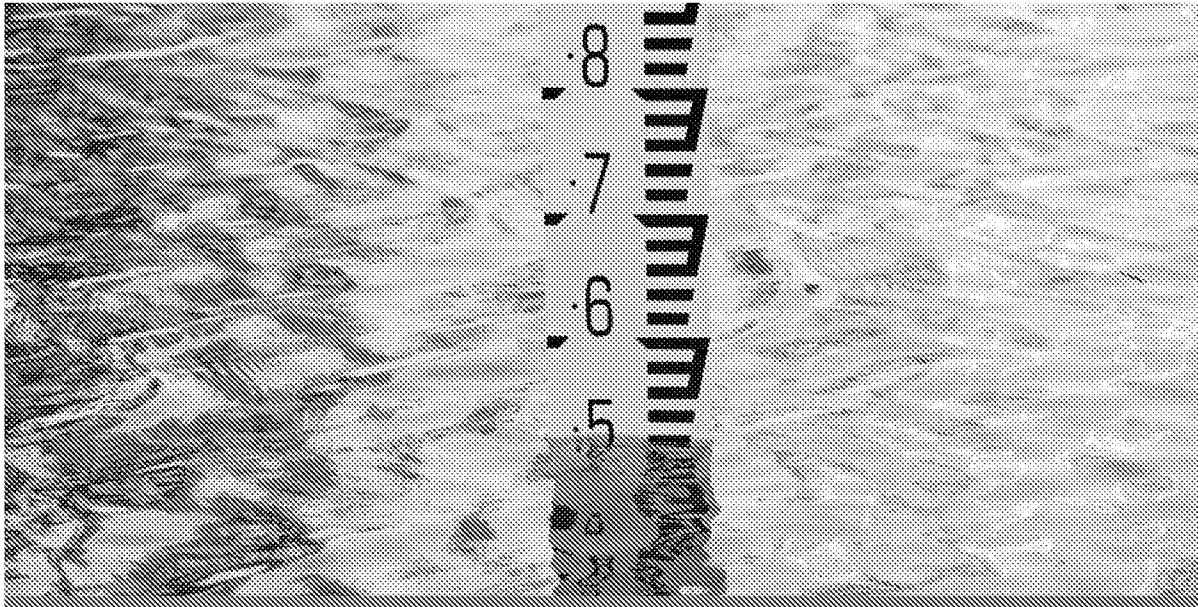




Flood Risk Assessment

Land South of Barnham Road, Eastergate, PO20 3RT

Client

Landacre (Eastergate) Ltd

Stockers Farm

Salthill Road,

Chichester

West Sussex, PO19 3PY

Ref: 10635

Date: November 2020

Consulting Engineers

GTA Civils & Transport Limited

Gloucester House

66a Church Walk

Burgess Hill

West Sussex, RH15 9AS

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B	Topographic Survey and Sewer Records
C	Environment Agency & SFRA Flood and Groundwater Maps
D	Proposed Scheme Drawings
E	Micro Drainage Calculations
F	Groundwater Monitoring Exercise & Borehole Records

Issue	Issue date	Compiled	Checked
Preliminary Issue	16 November 2020	JP	MR

1 Introduction

- 1.1 This report has been prepared for Landacre (Eastergate) Ltd in relation to land south of Barnham Road, Eastergate, PO20 3RT. No responsibility is accepted to any third party for all or part of this study in connection with this or any other development.
- 1.2 GTA Civils & Transport Limited was appointed by the client to provide a Flood Risk Assessment (FRA) as requested by the Environment Agency (EA) and Arun District Council in order to achieve Planning Approval at said property.
- 1.3 This report has been prepared in accordance with the 2019 National Planning Policy Framework (NPPF) and the current Planning Practice Guidance (PPG).

2 Existing Site and Current Flood Conditions

- 2.1 This greenfield application site lies in the area administered by Arun District Council (ADC), with a site area of 3.78ha. It is centred at 494970E, 105100N. Site location maps and an aerial view are shown in Appendix A.
- 2.2 Hydrology: The nearest Main River is the Arun, which is approximately 6km to the east. This site is in the catchment of the Lidsey Rife. There are a number of drains to the west and south, with a ditch along the south boundary, linking to the closest marked drain on the OS explorer map - to the southwest.
- 2.3 A topographical survey is contained in Appendix B. The survey shows the land as having a gentle slope from north to south, with ground levels to AOD ranging from +10.36m to +11.82m. There is a ditch watercourse on the south boundary that flows to the SE and onwards to the English Channel via the Ryebank Rife to the south.
- 2.4 Geology: the BGS's online map indicates the solid geology is London Clay Formation (clay, silt and sand), with River Terrace Deposits (drift sand, silt and clay) overlying.
- 2.5 A series of 3 windowless soil samples was taken and winter groundwater monitoring undertaken between 25/11/19 and 03/03/20. The highest level recorded level was in WS1, namely 0.34m bgl. Otherwise the recorded levels were, in the main over 1m bgl – or significantly greater. Refer to Appendix F for these graphs and borehole locations.
- 2.6 The EA's Online Flood Map for Planning (Rivers and Seas) (see Appendix C) shows the site lying in Flood Zone 1 (FZ1) – Low Risk. Inland sites in FZ1 have less than a 1 in 1000 annual probability (1 in 1000 years) of fluvial flooding. There is no risk of tidal/coastal flooding as the site is many kilometres from the coast.
- 2.7 Surface water flooding: The EA's online Surface Water Flood Depth Map for the 'Low Risk Scenario' (1 in 1000 years storm event) - in Appendix C - shows the site to be removed from this source of flooding.
- 2.8 Groundwater flooding: There are no records of groundwater flooding in this vicinity according to ADC's SFRA. Appendix C shows the SFRA's Indicative Risk of Groundwater Flooding Map (G1). The site is in the lowest risk area, namely 'Medium'.
- 2.9 Groundwater aquifers: The site overlies a Low Groundwater Vulnerability Zone and is removed

from all Source Protection Zones – refer to the EA online map excerpts in Appendix C.

- 2.10 Artificial flooding: The site is outside of any risk area associated with reservoir failure flooding (see the EA's Online 'Risk of Flooding from Reservoirs' Map in Appendix C). There are no docks or canals in this area.
- 2.11 Historical flooding: This site is removed from the nearest historically affected area.
- 2.12 In conclusion, the site's flood risk profile is Low. It is removed from *all* known sources of flooding.

3 Proposed Development & Drainage Strategy

- 3.1 The proposal is to build 44 new dwelling houses. The proposed site layout is included in Appendix D.
- 3.2 Vulnerability: Table 2 of the PPG for 'Flood risk and coastal change' indicates dwelling units are classed as 'More vulnerable'.
- 3.3 As concluded in Section 2.11, the flood risk of this site is Low. No flood mitigation is necessary or proposed as More Vulnerable uses are appropriate development in FZ1.
- 3.4 SuDS Hierarchy: Infiltration drainage potential was examined. Due to the shallow water table level (0.34m bgl as set out in section 2.5 above and Appendix F) .
- 3.5 In line with the SuDS hierarchy, development runoff will be managed by means of on-site attenuation with discharge to the ditch watercourse at the SE corner. The offsite discharge rate will be restricted to 1.6 l/s in the critical 1% + 40%CC event, this being the Qbar greenfield runoff rate – see the first calculation sheet in Appendix E. The proposed drainage strategy layout is in Appendix D.
- 3.6 A Micro Drainage Network calculation is included in Appendix E to demonstrate sufficient storage capacity is available for all events up to the '1 in 100 annual probability' with 40% allowance included for climate change. FEH Rainfall data was used in this calculation.
- 3.7 The last set of calculation sheets in Appendix E shows that the multiple areas of porous car parking, filter drain, pond and swale will hold the volume in the 1 in 100 years + 40% climate change storm.
- 3.8 Exceedance event: should the vortex device in the outfall control manhole get clogged/blocked for any reason, the resulting flow would be south – southwest, away from all buildings into the ditch on onwards into the Rife via the storm drain.
- 3.9 Ownership and maintenance responsibilities for the proposed drainage system will remain with the applicant. A Management and Maintenance Plan will be drawn up at the next stage. Each SuDS component (feature) will be listed with inspection periods and maintenance regime, in line with industry standards – compliant with CIRIA guidelines as set out in the SuDS Manual (C753).

- 3.10 The outfall headwall will be subject to Ordinary Watercourse consent from the LLFA.
- 3.11 Lidsey Foul Water Environmental Assessment: the strategy layout in Appendix D illustrates the proposed foul layout with connection shown to the existing public sewer at MH ref 9202. This new connection will be subject to a Section 106 Agreement with Southern Water.
- 3.12 The Arun Strategic Surface Water Management Study (2015) states that there was insufficient capacity at Lidsey Wastewater Treatment Works (WWTW) at that time and it was not viable to increase loads into the WWTW. Southern Water stated their determination to use their AMP 7 funding to increase this WWTW's capacity during 2020 and 2025. As there will be a lag between now and the development's completion, it would be unwise to propose installing a bespoke sewage treatment plant on this site, if additional capacity is only a few months away.
- 3.13 The fall back (alternative) option to routing the development's foul effluent to the WWTW, is to install an underground sewage treatment plant near to the south boundary. This will be subject to the EA's Standard Environmental Permit as the daily volume will exceed 5m³. Any STP will conform to BS/EN 12566 pt3 with the treated water routed into the watercourse. The outfall headwall will be subject to Ordinary Watercourse consent from the LLFA.

- End of Report -

4 Conclusions

- 4.1 The application site lies within FZ1 and the site's overall flood risk profile is Low.
- 4.2 A SuDS strategy for the development has been prepared which will manage surface runoff up to the 1 in 100 annual probability events plus 40%. The surface water offsite flow rate will be restricted to 1.6l/s, this being the Qbar greenfield runoff rate for the same contributing area.
- 4.3 The first option for the development's foul effluent is to route it to the local Lidsey Wastewater Treatment Works, whose capacity is due to be enlarged, certainly prior to 2015, according to the 2015 Arun Strategic Surface Water Management Study.
- 4.4 If this is not viable the alternative is to install an underground sewage treatment plant near to the south boundary.
- 4.5 The proposed development complies with the NPPF/PPG in terms of flood risk and drainage.

- End of Report -

Appendix A

Site Location Maps & Aerial Photo







Appendix B

Topographic Survey and Sewer Records

Year	Score	Team	Score	Team	Score	Team	Score	Team	Score	Team
1975	100	USA	97	USA	95	USA	92	USA	90	USA
1976	100	USA	98	USA	96	USA	93	USA	91	USA
1977	100	USA	99	USA	97	USA	94	USA	92	USA
1978	100	USA	100	USA	98	USA	95	USA	93	USA
1979	100	USA	100	USA	99	USA	96	USA	94	USA
1980	100	USA	100	USA	100	USA	97	USA	95	USA
1981	100	USA	100	USA	100	USA	98	USA	96	USA
1982	100	USA	100	USA	100	USA	99	USA	97	USA
1983	100	USA	100	USA	100	USA	100	USA	98	USA
1984	100	USA	100	USA	100	USA	100	USA	99	USA
1985	100	USA	100	USA	100	USA	100	USA	100	USA
1986	100	USA	100	USA	100	USA	100	USA	100	USA
1987	100	USA	100	USA	100	USA	100	USA	100	USA
1988	100	USA	100	USA	100	USA	100	USA	100	USA
1989	100	USA	100	USA	100	USA	100	USA	100	USA
1990	100	USA	100	USA	100	USA	100	USA	100	USA
1991	100	USA	100	USA	100	USA	100	USA	100	USA
1992	100	USA	100	USA	100	USA	100	USA	100	USA
1993	100	USA	100	USA	100	USA	100	USA	100	USA
1994	100	USA	100	USA	100	USA	100	USA	100	USA
1995	100	USA	100	USA	100	USA	100	USA	100	USA
1996	100	USA	100	USA	100	USA	100	USA	100	USA
1997	100	USA	100	USA	100	USA	100	USA	100	USA
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2009	100	USA	100	USA	100	USA	100	USA	100	USA
2010	100	USA	100	USA	100	USA	100	USA	100	USA
2011	100	USA	100	USA	100	USA	100	USA	100	USA
2012	100	USA	100	USA	100	USA	100	USA	100	USA
2013	100	USA	100	USA	100	USA	100	USA	100	USA
2014	100	USA	100	USA	100	USA	100	USA	100	USA
2015	100	USA	100	USA	100	USA	100	USA	100	USA
2016	100	USA	100	USA	100	USA	100	USA	100	USA
2017	100	USA	100	USA	100	USA	100	USA	100	USA
2018	100	USA	100	USA	100	USA	100	USA	100	USA
2019	100	USA	100	USA	100	USA	100	USA	100	USA
2020	100	USA	100	USA	100	USA	100	USA	100	USA
2021	100	USA	100	USA	100	USA	100	USA	100	USA
2022	100	USA	100	USA						

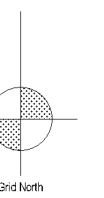
[illegible][illegible]

Diagram illustrating a multi-directional tree canopy structure. The canopy is shown as a series of overlapping, irregular shapes representing tree crowns. Labels include:

- Fireescapes
- Kerb
- Walls
- Stairs
- Change of Surface
- Footpath
- Bank Top
- Bank Bottom
- Building
- Building Overhead
- Roof heights
- Flower Bed
- Overhead Cable
- Road Edge
- Hedge Row
- Canopy
- Edge of vegetation
- Multi directional tree canopy
- Transit position at ground level
- No. 38
- Multi-ride
- Tree number
- Edge of canopy

Tree species should be confirmed by a arboricultural consultant if critical
Trunk sizes are measured at 1.5m above ground level

Eaves heights (where shown) are taken at the end of the tile / top of guttering
Ridge heights are taken at the top of the ridge tile
Service covers indicated where visible at time of survey



J. Brotherton & Partners
Land Surveyors & Engineers

Fieldway 113 Frogmore Lane
Waterdoville, Hampshire PO8 9RD

Tel: 023 9259 1979
Email: enquiries@jbsurveys.co.uk
Web: www.jbsurveys.co.uk

Client	Landacre (Eastergate) Ltd
Drawing Title	Topographic Land Survey

Location
Barnham Road, Eastleigh, Chichester, West Sussex, PO20 3RT

The grid and datum for this survey is based on the Ordnance Survey grid OSGB36, site centered on

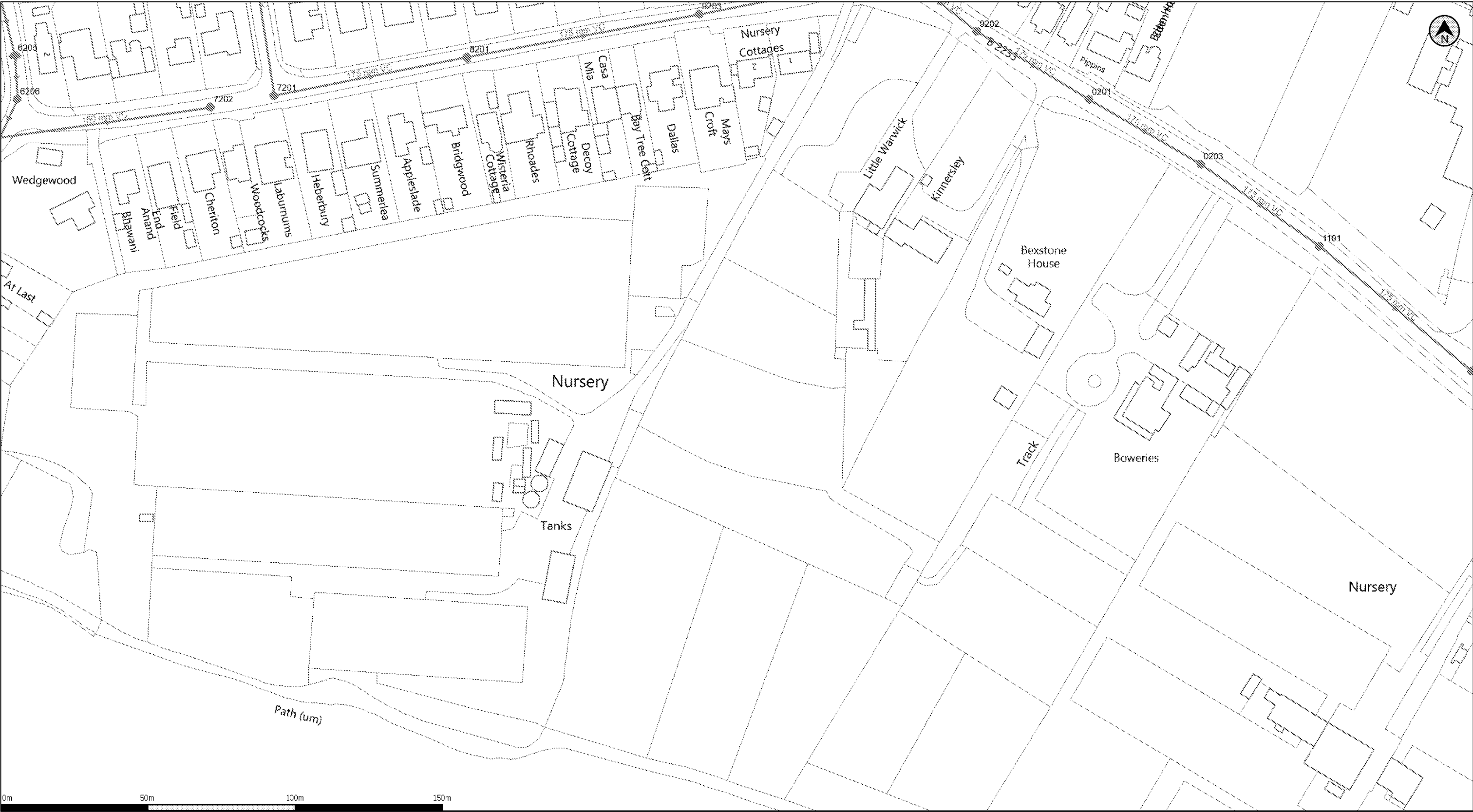
control station GPS1 with a scale factor of 1.00			
LEVELS BASED ON	CGG336	Surveyor- SR	Assistant- TC

GRID BASED ON	OSQ836	Drawn By- SB	Checked by- JB
Drawing & CAD Ref.		REVISIONS	

20346		
SCALE (when printed)	Date	DEPOSIT OF

Removal of this block also removes all warranties.
This division has been created for use at a scale of 1:500.

All critical dimensions, positions and levels to be checked on site



(c) Crown copyright and database rights 2020 Ordnance Survey 100031673 Date: 04/05/20 Scale: 1:1250 Map Centre: 494917,105140 Data updated: 01/04/20 Our Ref: 386029 - 1 Wastewater Plan A3

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 2020 Ordnance Survey 100031673. 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.

duncan@cornerstoneprojects.co.uk	
U06-20	





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Data updated: 15/06/20

Scale: 1:1250
Map Centre: 494930,105168

Date: 19/06/20
Our Ref: 408144 - 1

Wastewater Plan A3
Powered by digdat

duncan@cornerstoneprojects.co.uk
U206/20



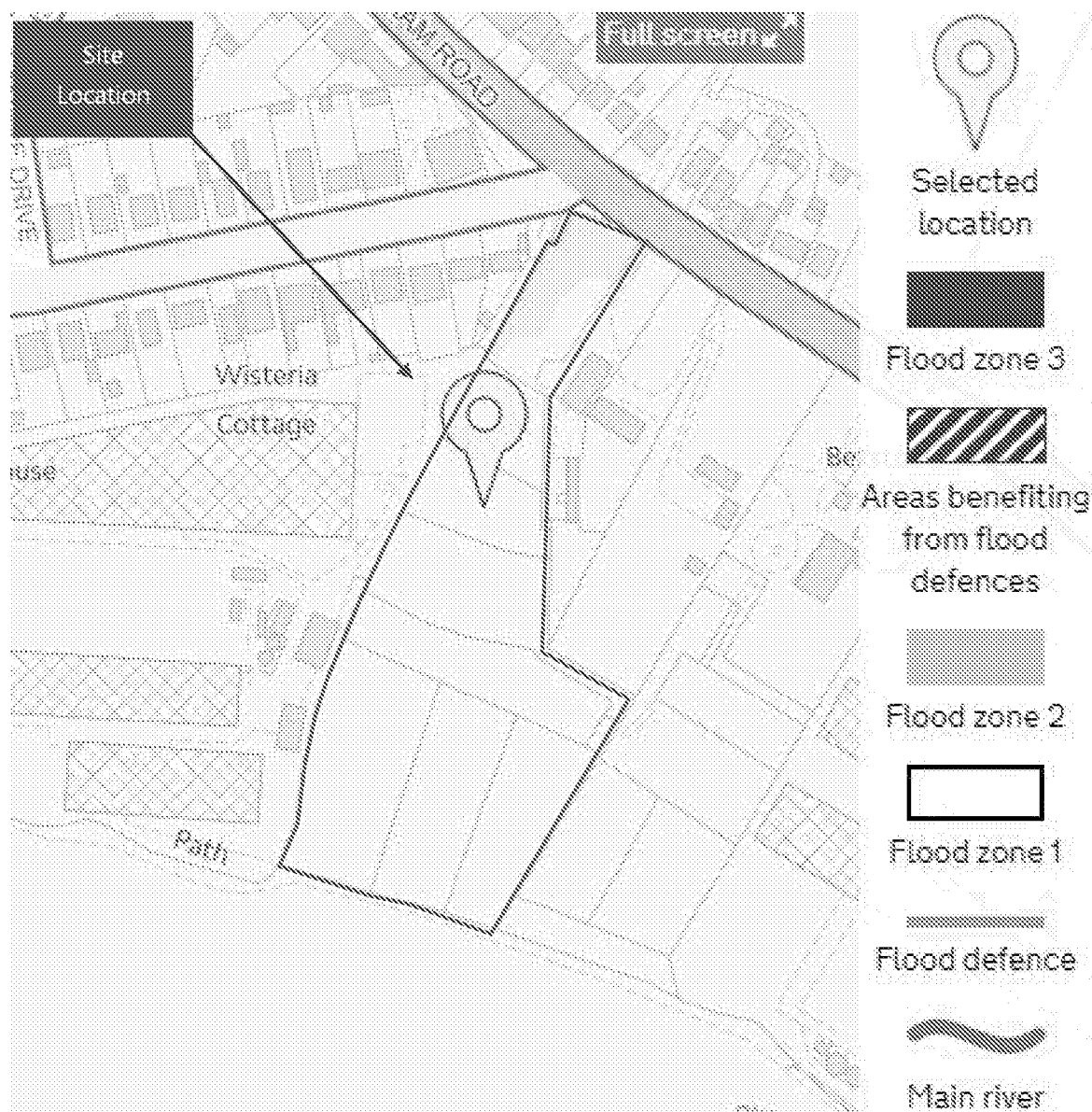
The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2020 Ordnance Survey 100031673. 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 C

Environment Agency & SFRA Flood and Groundwater Maps

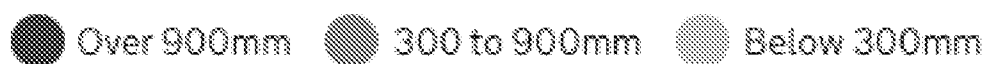


EA's Online Flood Map for Planning (Rivers and Seas)

The site falls within Flood Zone 1 (FZ1)



Surface water flood risk: water depth in a low risk scenario
Flood depth (millimetres)

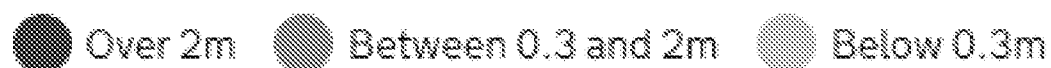


EA's Online Surface Water Flood Depth Map in the 'Low Risk Scenario'
(1 in 1000 years storm event)

The site is removed from this source of flooding



Reservoir flood risk: flood water depth



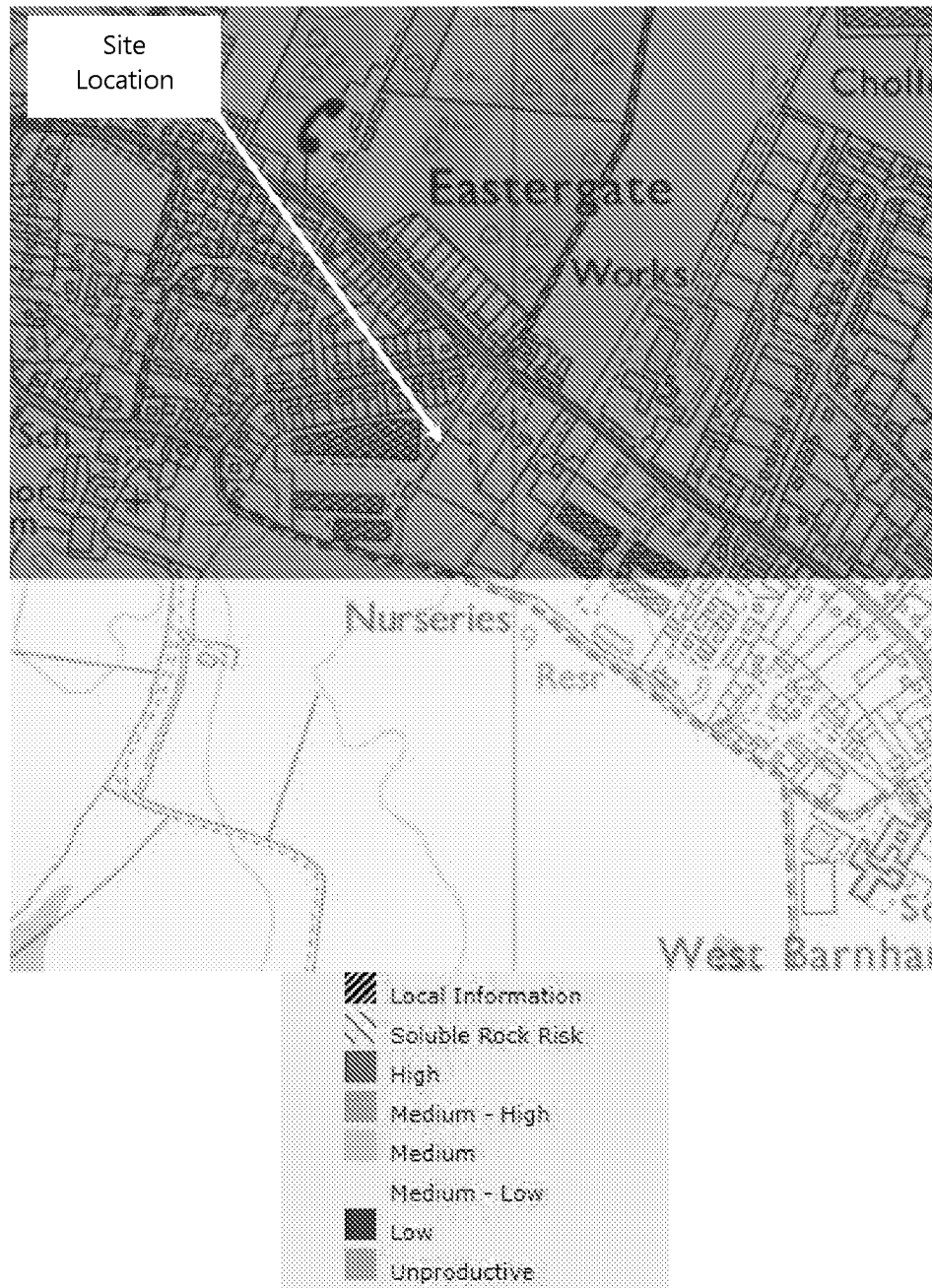
EA's Online 'Risk of Flooding from Reservoirs' Map

The site is removed from this source of flooding



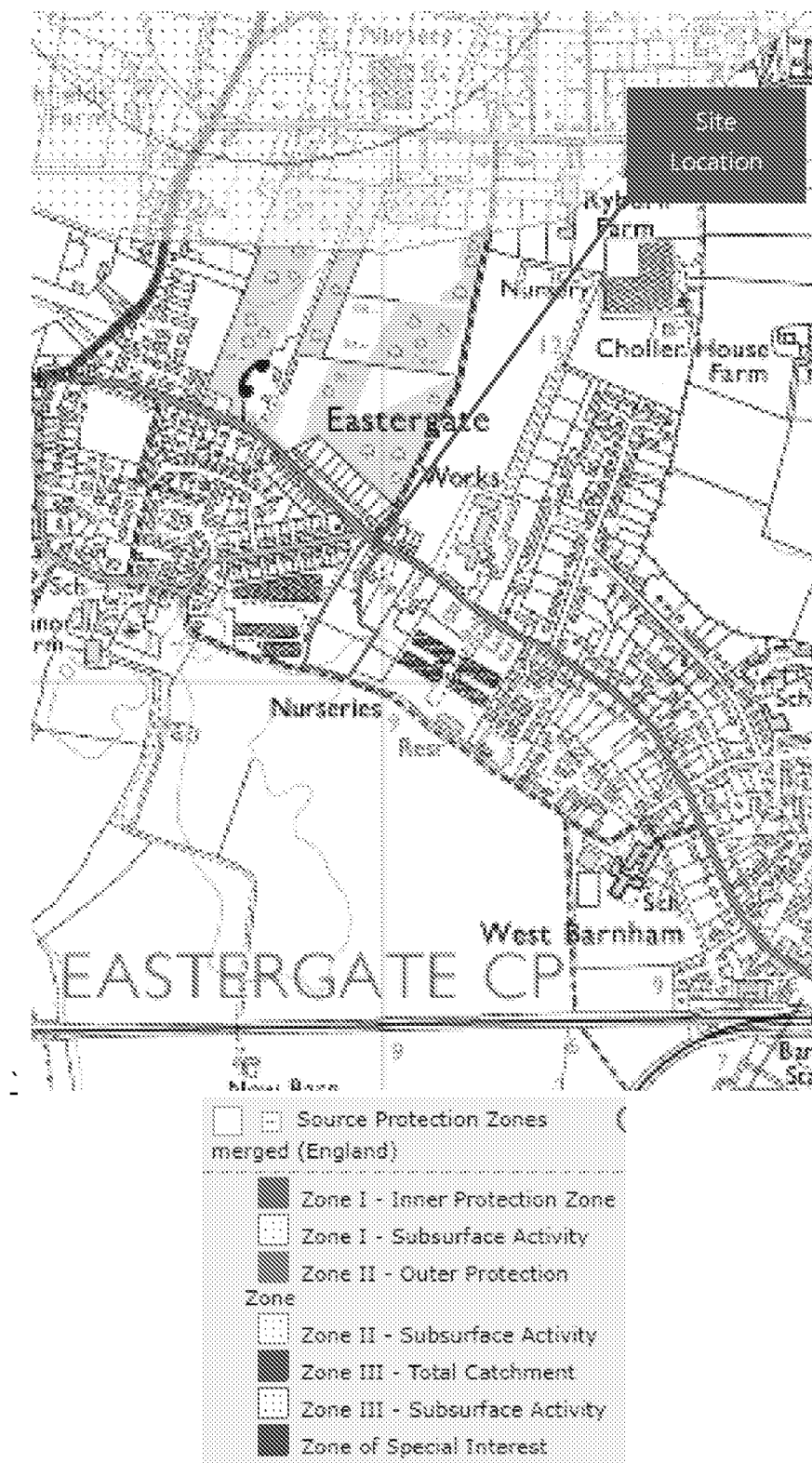
EA's Historic Flood Map

This site is removed from the nearest affected area



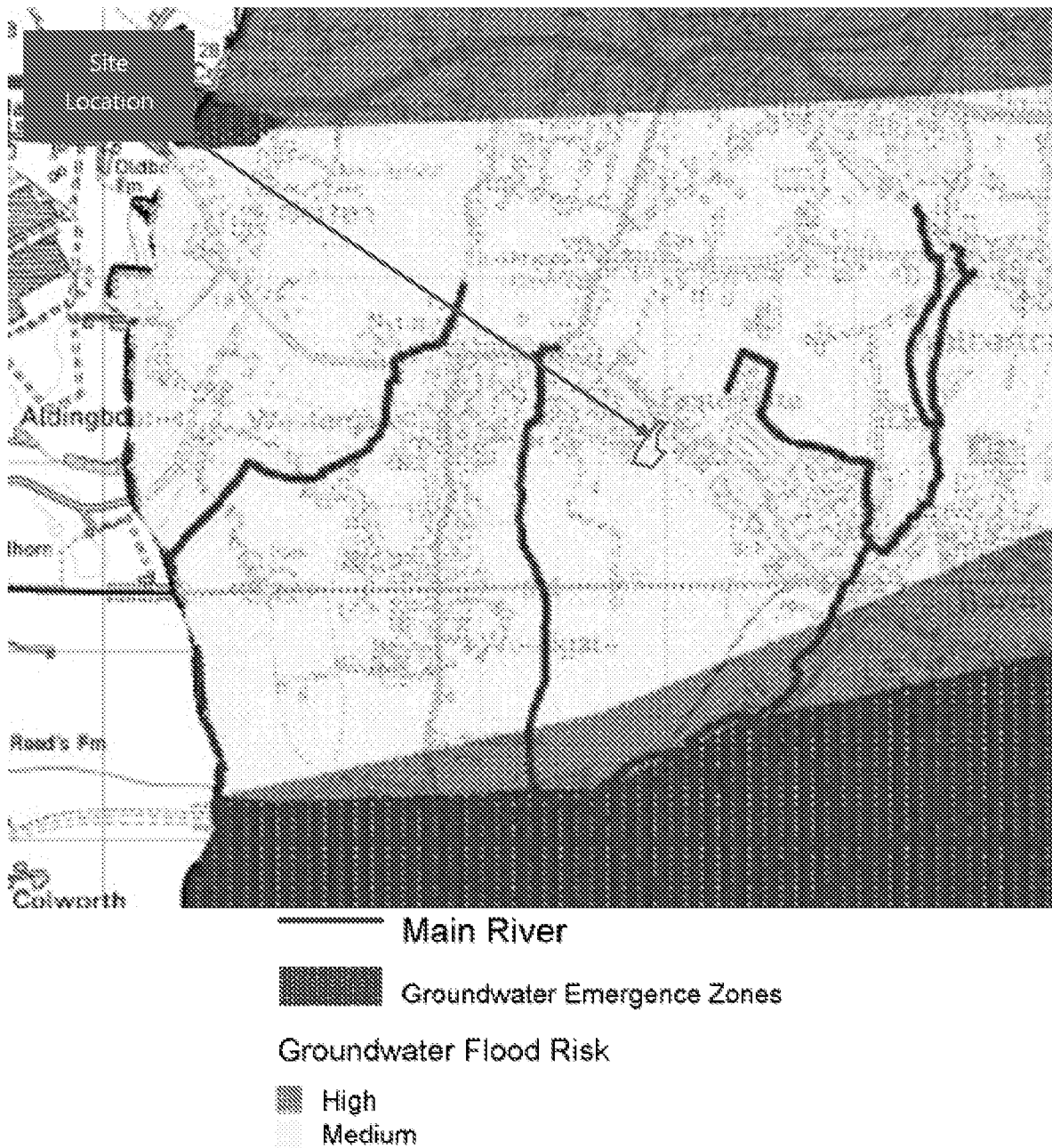
EA's Groundwater Vulnerability Map

This site overlies a "Low" GWV Zone



EA's Source Protection Zone Map

The site is removed from the nearest Source Protection Zone



Excerpt from SFRA's "Map G1: Indicative Risk of Groundwater Flooding"

The site is in the Medium risk zone – the lowest risk area

Appendix D

Proposed Scheme Drawings



ACCOMMODATION SCHEDULE

Affordable Provision 13 Dwellings

Affordable Rent

2no. 1-Bed Flats
2no. 2-Bed Flats
2no. 2-Bed Flats Part M4(3)
1no. 3-Bed Houses

Shared Ownership

3no. 2-Bed Houses 80sqm
3no. 3-Bed Houses 92sqm

Open Market Provision 31 Dwellings

6no. 2-Bed Houses
13no. 3-Bed Houses
2no. 3-Bed Townhouses
10no. 4-Bed Houses

Total: 44 Dwellings [1.72 Ha - 25.6 Dw/Ha]

Car Parking: 2 spaces per 1, 2 & 3-Bed dwellings
2/3 spaces per 4 bed dwelling
14 visitor spaces within lay-bys (0.31 per dwelling)

Cycle Parking: 2 spaces per dwelling within garden sheds

Refuse Storage: Within rear gardens to be brought to property fronts on collection days only

Public Open Space

Arun Requirement 44 dwellings = 3630sqm

Provision

Frontage Open Space 315sqm
Central / Incidental Open Spaces 1270sqm
Southern Open Space 2235sqm
Total 3820sqm Open Space
(includes existing ditches, hedges and trees)

B	03.11.20	Drainage basin and swale updated	PB	KE
A	10.09.20	Amended To Comments	JW	SLG
Rev	Date	Revision Details	Dr	Ch



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T 0117 315 8557 E bristol@ecearchitecture.com
ECE Architecture
www.ecearchitecture.com

Client's Name
Landacre (Eastergate) Ltd.

Job Title
Warwick Nursery, Barnham Road,
Eastergate, PO20 3RT

Drawing Title
Proposed Site Layout

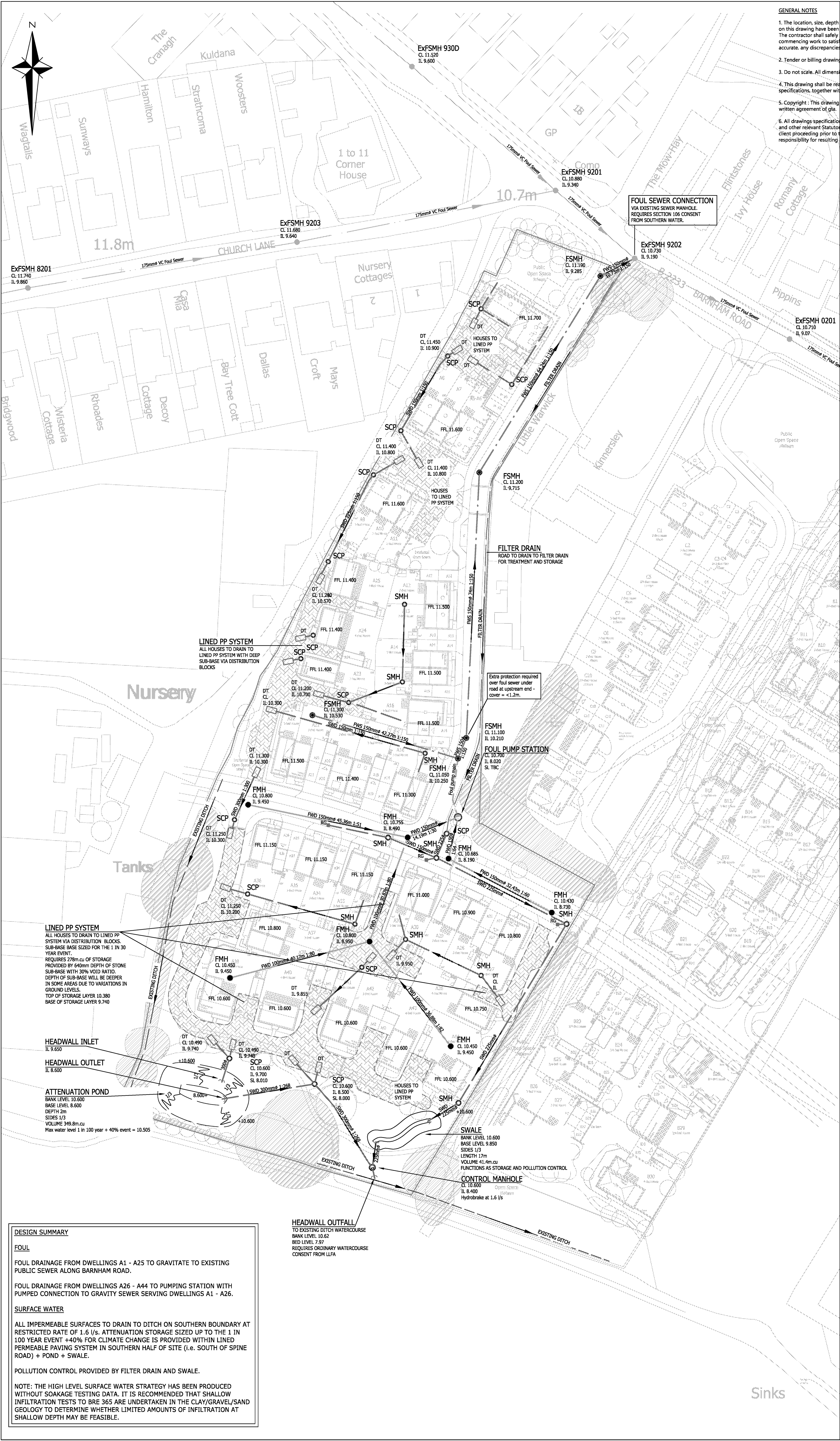
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Drawn KE
Checked KE
Date 28.08.20

Job No 6710
Drawing No PL-005
Rev B

Status
APPROVAL



- 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
 5. Copyright : This drawing must not be copied, amended nor reproduced without the prior written agreement of gta.
 6. All drawings specifications and recommendations made by gta are subject to Local Authority and other relevant Statutory Authorities approval. Any works or services made abortive due to the client proceeding prior to these approvals is considered wholly at the Clients risk. gta hold no responsibility for resulting abortive works or costs.

- KEY**
- Existing Foul Sewer
 - Private surface water drain
 - Private foul drain
 - Private foul sewer
 - Private foul pump main
 - Private filter drain
 - Existing ditch
 - ExFSMH Existing foul sewer manhole
 - FSMH Proposed foul sewer manhole
 - FMH Proposed private foul manhole
 - SMH Proposed surface water manhole
 - RG Road gully
 - DT Distribution block

- PERMEABLE PAVING**
PERMEABLE PAVING LINED SYSTEM WITH SUB-BASE STORAGE
- LINED PERMEABLE PAVING SYSTEM USED FOR ATTENUATION STORAGE**
1 IN 100 YEAR +40%

- ABBREVIATIONS**
- CL COVER LEVEL
 - DT DISTRIBUTION BLOCK
 - ExFSMH EXISTING FOUL SEWER MANHOLE
 - FSMH FOUL SEWER MANHOLE
 - FWD FOUL DRAIN
 - FWS FOUL SEWER
 - IL INVERT LEVEL
 - PP PERMEABLE PAVING
 - RG ROAD GULLY
 - SL SUMP LEVEL
 - SMH SURFACE WATER MANHOLE
 - SWD SURFACE WATER DRAIN

P8	PROPOSED TREE PLAN ADDED		11/11/2020	JR	MR
P7	REVISED TO CLIENT'S COMMENTS 28/10		02/11/2020	JR	MR
P6	SUDS AMENDED TO MISS EXISTING TREES		01/09/2020	JR	
P5	REVISED TO LATEST SITE LAYOUT		17/08/2020	JR	MR
P4	REVISED TO LATEST SITE LAYOUT. MORE DETAIL ADDED TO STORM SYSTEM INCLUDING STORAGE SIZING.		11/08/2020	JR	
P3	REVERSION BACK TO POND AND SWALE WITH PP SYSTEMS RETAINED		10/07/2020	JR	MR
P2	POND REPLACED BY TANK SWALE REPLACED BY TRENCH PP SYSTEMS SHOWN LINED		10/07/2020	JR	MR
P1	INITIAL ISSUE		09/07/2020	JR	MR
Rev	Amendments		Date	Dsn	Chk
Status					
Client					
LANDACRE (EASTERGATE) LTD.					
Architect					
ECE ARCHITECTURE					
Project					
WARWICK NURSERY EASTERGATE					
Title					
DRAINAGE STRATEGY					
Date		JULY 2020		Scale @ A1	
				1 : 500	
Clients Ref.				Project Ref.	
				10635	
gtacivils & transport Gloucester House, 66a Church Walk, Burgess Hill, West Sussex, RH15 9AS Tel:01444 871444 Web: www.gtacivils.co.uk					
Drawing Number				Rev.	
10635/1101				P8	

DESIGN SUMMARY

FOUL

FOUL DRAINAGE FROM DWELLINGS A1 - A25 TO GRAVITATE TO EXISTING PUBLIC SEWER ALONG BARNHAM ROAD.

FOUL DRAINAGE FROM DWELLINGS A26 - A44 TO PUMPING STATION WITH PUMPED CONNECTION TO GRAVITY SEWER SERVING DWELLINGS A1 - A26.

SURFACE WATER

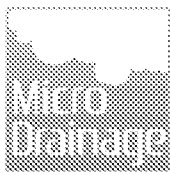
ALL IMPERMEABLE SURFACES TO DRAIN TO DITCH ON SOUTHERN BOUNDARY AT RESTRICTED RATE OF 1.6 l/s. ATTENUATION STORAGE SIZED UP TO THE 1 IN 100 YEAR EVENT +40% FOR CLIMATE CHANGE IS PROVIDED WITHIN LINED PERMEABLE PAVING SYSTEM IN SOUTHERN HALF OF SITE (i.e. SOUTH OF SPINE ROAD) + POND + SWALE.

POLLUTION CONTROL PROVIDED BY FILTER DRAIN AND SWALE.

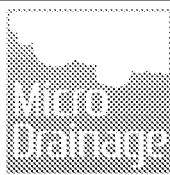
NOTE: THE HIGH LEVEL SURFACE WATER STRATEGY HAS BEEN PRODUCED WITHOUT SOAKAGE TESTING DATA. IT IS RECOMMENDED THAT SHALLOW INFILTRATION TESTS TO BRE 365 ARE UNDERTAKEN IN THE CLAY/GRAVEL/SAND GEOLOGY TO DETERMINE WHETHER LIMITED AMOUNTS OF INFILTRATION AT SHALLOW DEPTH MAY BE FEASIBLE.

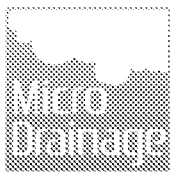
Appendix E

Micro Drainage Calculations

GTA Civils Ltd		Page 1
66a Church Walk	Barnham Road	
Burgess Hill	Greenfield Runoff	
West Sussex RH15 9AS	Developed area only	
Date 14/08/2020	Designed by JR	
File	Checked by	
Micro Drainage		Source Control 2018.1
<u>ICP SUDS Mean Annual Flood</u> Input Return Period (years) 100 Soil 0.300 Area (ha) 0.796 Urban 0.000 SAAR (mm) 778 Region Number Region 7 Results l/s QBAR Rural 1.6 QBAR Urban 1.6 Q100 years 5.2 Q1 year 1.4 Q30 years 3.7 Q100 years 5.2		
©1982-2018 Innovyze		

GTA Civils Ltd							Page 1
66a Church Walk			Barnham Road				
Burgess Hill			1 in 100 year + 40%				
West Sussex RH15 9AS			Porous car park, swale, pond				
Date 10/11/2020			Designed by JR				
File complex storage			Checked by				
Micro Drainage			Source Control 2020.1				
<u>Summary of Results for 100 year Return Period (+40%)</u>							
Half Drain Time : 3817 minutes.							
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.867	1.267	0.0	1.4	1.4	213.7	O K
30 min Summer	9.975	1.375	0.0	1.4	1.4	288.8	O K
60 min Summer	10.089	1.489	0.0	1.5	1.5	371.6	O K
120 min Summer	10.180	1.580	0.0	1.5	1.5	440.5	O K
180 min Summer	10.234	1.634	0.0	1.5	1.5	482.5	O K
240 min Summer	10.271	1.671	0.0	1.6	1.6	511.5	O K
360 min Summer	10.316	1.716	0.0	1.6	1.6	548.0	O K
480 min Summer	10.343	1.743	0.0	1.6	1.6	569.9	O K
600 min Summer	10.361	1.761	0.0	1.6	1.6	584.4	O K
720 min Summer	10.373	1.773	0.0	1.6	1.6	594.3	O K
960 min Summer	10.387	1.787	0.0	1.6	1.6	606.0	O K
1440 min Summer	10.397	1.797	0.0	1.6	1.6	613.9	O K
2160 min Summer	10.392	1.792	0.0	1.6	1.6	610.2	O K
2880 min Summer	10.379	1.779	0.0	1.6	1.6	599.1	O K
4320 min Summer	10.360	1.760	0.0	1.6	1.6	583.3	O K
5760 min Summer	10.346	1.746	0.0	1.6	1.6	572.1	O K
7200 min Summer	10.342	1.742	0.0	1.6	1.6	569.1	O K
8640 min Summer	10.343	1.743	0.0	1.6	1.6	569.8	O K
10080 min Summer	10.347	1.747	0.0	1.6	1.6	572.6	O K
15 min Winter	9.906	1.306	0.0	1.4	1.4	240.3	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)			
15 min Summer	140.714	0.0	115.6	23			
30 min Summer	94.437	0.0	120.2	38			
60 min Summer	60.674	0.0	242.8	68			
120 min Summer	36.152	0.0	249.0	128			
180 min Summer	26.572	0.0	252.3	188			
240 min Summer	21.265	0.0	254.2	246			
360 min Summer	15.394	0.0	256.1	366			
480 min Summer	12.172	0.0	256.6	486			
600 min Summer	10.122	0.0	256.4	606			
720 min Summer	8.696	0.0	255.8	726			
960 min Summer	6.832	0.0	253.8	964			
1440 min Summer	4.865	0.0	248.1	1444			
2160 min Summer	3.484	0.0	496.8	2160			
2880 min Summer	2.767	0.0	489.0	2796			
4320 min Summer	2.029	0.0	469.1	3456			
5760 min Summer	1.648	0.0	929.6	4216			
7200 min Summer	1.417	0.0	921.8	5048			
8640 min Summer	1.261	0.0	900.2	5880			
10080 min Summer	1.147	0.0	872.6	6760			
15 min Winter	140.714	0.0	117.8	23			
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GTA Civils Ltd							Page 2	
66a Church Walk Burgess Hill West Sussex RH15 9AS			Barnham Road 1 in 100 year + 40% Porous car park, swale, pond					
Date 10/11/2020 File complex storage			Designed by JR Checked by					
Micro Drainage			Source Control 2020.1					
<u>Summary of Results for 100 year Return Period (+40%)</u>								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status	
30 min Winter	10.025	1.425	0.0	1.5	1.5	324.6	O K	
60 min Winter	10.150	1.550	0.0	1.5	1.5	417.6	O K	
120 min Winter	10.251	1.651	0.0	1.5	1.5	495.4	O K	
180 min Winter	10.310	1.710	0.0	1.6	1.6	543.1	O K	
240 min Winter	10.351	1.751	0.0	1.6	1.6	576.2	O K	
360 min Winter	10.402	1.802	0.0	1.6	1.6	618.2	O K	
480 min Winter	10.432	1.832	0.0	1.6	1.6	643.8	O K	
600 min Winter	10.453	1.853	0.0	1.6	1.6	661.2	O K	
720 min Winter	10.468	1.868	0.0	1.6	1.6	673.6	O K	
960 min Winter	10.486	1.886	0.0	1.6	1.6	689.1	O K	
1440 min Winter	10.502	1.902	0.0	1.6	1.6	702.8	O K	
2160 min Winter	10.505	1.905	0.0	1.6	1.6	706.0	O K	
2880 min Winter	10.500	1.900	0.0	1.6	1.6	701.3	O K	
4320 min Winter	10.481	1.881	0.0	1.6	1.6	685.1	O K	
5760 min Winter	10.468	1.868	0.0	1.6	1.6	674.2	O K	
7200 min Winter	10.460	1.860	0.0	1.6	1.6	667.4	O K	
8640 min Winter	10.452	1.852	0.0	1.6	1.6	660.6	O K	
10080 min Winter	10.449	1.849	0.0	1.6	1.6	657.5	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)				
30 min Winter	94.437	0.0	122.1	38				
60 min Winter	60.674	0.0	247.4	68				
120 min Winter	36.152	0.0	253.8	126				
180 min Winter	26.572	0.0	257.4	184				
240 min Winter	21.265	0.0	259.4	244				
360 min Winter	15.394	0.0	261.4	362				
480 min Winter	12.172	0.0	261.9	480				
600 min Winter	10.122	0.0	261.7	598				
720 min Winter	8.696	0.0	261.1	716				
960 min Winter	6.832	0.0	259.0	950				
1440 min Winter	4.865	0.0	253.0	1414				
2160 min Winter	3.484	0.0	508.7	2160				
2880 min Winter	2.767	0.0	500.7	2768				
4320 min Winter	2.029	0.0	479.8	3980				
5760 min Winter	1.648	0.0	965.4	4504				
7200 min Winter	1.417	0.0	953.8	5472				
8640 min Winter	1.261	0.0	937.7	6400				
10080 min Winter	1.147	0.0	914.0	7360				
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66a Church Walk Burgess Hill West Sussex RH15 9AS	Barnham Road 1 in 100 year + 40% Porous car park, swale, pond	
Date 10/11/2020	Designed by JR	
File complex storage	Checked by	
Micro Drainage		Source Control 2020.1

Rainfall Details

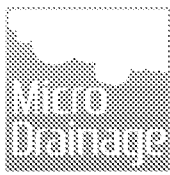
Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 494911 105112 SU 94911 05112
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

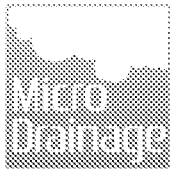
Time Area Diagram

Total Area (ha) 0.844

Time (mins)	Area		Time (mins)	Area	
From:	To:	(ha)	From:	To:	(ha)
0	4	0.422	4	8	0.422

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66a Church Walk Burgess Hill West Sussex RH15 9AS	Barnham Road 1 in 100 year + 40% Porous car park, swale, pond																																																																																																																																					
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<u>Model Details</u> Storage is Online Cover Level (m) 10.600 <u>Complex Structure</u> <u>Tank or Pond</u> Invert Level (m) 8.600 <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> </tr> </thead> <tbody> <tr><td>0.000</td><td>48.5</td><td>1.400</td><td>236.4</td><td>2.800</td><td>0.0</td><td>4.200</td><td>0.0</td></tr> <tr><td>0.200</td><td>68.5</td><td>1.600</td><td>272.4</td><td>3.000</td><td>0.0</td><td>4.400</td><td>0.0</td></tr> <tr><td>0.400</td><td>90.8</td><td>1.800</td><td>310.6</td><td>3.200</td><td>0.0</td><td>4.600</td><td>0.0</td></tr> <tr><td>0.600</td><td>115.3</td><td>2.000</td><td>351.0</td><td>3.400</td><td>0.0</td><td>4.800</td><td>0.0</td></tr> <tr><td>0.800</td><td>142.2</td><td>2.200</td><td>0.0</td><td>3.600</td><td>0.0</td><td>5.000</td><td>0.0</td></tr> <tr><td>1.000</td><td>171.4</td><td>2.400</td><td>0.0</td><td>3.800</td><td>0.0</td><td></td><td></td></tr> <tr><td>1.200</td><td>202.8</td><td>2.600</td><td>0.0</td><td>4.000</td><td>0.0</td><td></td><td></td></tr> </tbody> </table> <u>Porous Car Park</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00000</td> <td>Width (m)</td> <td>4.8</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>314.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>418.7</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>9.740</td> <td>Membrane Depth (m)</td> <td>0</td> </tr> </table> <u>Swale</u> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.00000</td> <td>Length (m)</td> <td>17.0</td> </tr> <tr> <td>Infiltration Coefficient Side (m/hr)</td> <td>0.00000</td> <td>Side Slope (1:X)</td> <td>3.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Slope (1:X)</td> <td>300.0</td> </tr> <tr> <td>Porosity</td> <td>1.00</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Invert Level (m)</td> <td>9.850</td> <td>Cap Infiltration Depth (m)</td> <td>0.000</td> </tr> <tr> <td>Base Width (m)</td> <td>1.0</td> <td></td> <td></td> </tr> </table> <u>Hydro-Brake® Optimum Outflow Control</u> <table> <tr> <td>Unit Reference</td> <td>MD-SHE-0051-1600-2000-1600</td> </tr> <tr> <td>Design Head (m)</td> <td>2.000</td> </tr> <tr> <td>Design Flow (l/s)</td> <td>1.6</td> </tr> <tr> <td>Flush-Flo™</td> <td>Calculated</td> </tr> <tr> <td>Objective</td> <td>Minimise upstream storage</td> </tr> <tr> <td>Application</td> <td>Surface</td> </tr> <tr> <td>Sump Available</td> <td>Yes</td> </tr> <tr> <td>Diameter (mm)</td> <td>51</td> </tr> <tr> <td>Invert Level (m)</td> <td>8.400</td> </tr> <tr> <td>Minimum Outlet Pipe Diameter (mm)</td> <td>75</td> </tr> </table>			Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	0.000	48.5	1.400	236.4	2.800	0.0	4.200	0.0	0.200	68.5	1.600	272.4	3.000	0.0	4.400	0.0	0.400	90.8	1.800	310.6	3.200	0.0	4.600	0.0	0.600	115.3	2.000	351.0	3.400	0.0	4.800	0.0	0.800	142.2	2.200	0.0	3.600	0.0	5.000	0.0	1.000	171.4	2.400	0.0	3.800	0.0			1.200	202.8	2.600	0.0	4.000	0.0			Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8	Membrane Percolation (mm/hr)	1000	Length (m)	314.0	Max Percolation (l/s)	418.7	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	9.740	Membrane Depth (m)	0	Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	17.0	Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0	Safety Factor	2.0	Slope (1:X)	300.0	Porosity	1.00	Cap Volume Depth (m)	0.000	Invert Level (m)	9.850	Cap Infiltration Depth (m)	0.000	Base Width (m)	1.0			Unit Reference	MD-SHE-0051-1600-2000-1600	Design Head (m)	2.000	Design Flow (l/s)	1.6	Flush-Flo™	Calculated	Objective	Minimise upstream storage	Application	Surface	Sump Available	Yes	Diameter (mm)	51	Invert Level (m)	8.400	Minimum Outlet Pipe Diameter (mm)	75
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File complex storage	Checked by	
Micro Drainage		Source Control 2020.1

Hydro-Brake® Optimum Outflow Control

Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	1.6	Kick-Flo®	0.454	0.8
Flush-Flo™	0.225	1.0	Mean Flow over Head Range	-	1.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	1.200	1.3	3.000	1.9	7.000	2.9
0.200	1.0	1.400	1.4	3.500	2.1	7.500	2.9
0.300	1.0	1.600	1.4	4.000	2.2	8.000	3.0
0.400	0.9	1.800	1.5	4.500	2.3	8.500	3.1
0.500	0.9	2.000	1.6	5.000	2.4	9.000	3.2
0.600	0.9	2.200	1.7	5.500	2.5	9.500	3.3
0.800	1.1	2.400	1.7	6.000	2.7		
1.000	1.2	2.600	1.8	6.500	2.8		

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Appendix F

Groundwater Monitoring Exercise & Borehole Records

Warwick Nursery, Eastergate Water Monitoring - LandAcre

REFER TO SITE PLAN FOR WS LOCATIONS

	Drilling Date							
Visit	1	2	3	4	5	6	7	8
	25/11/2019	09/12/2019	23/12/2019	06/01/2020	20/01/2020	06/02/2020	20/02/2020	03/03/2020
WS1								
Water level (mbgl)	1.34	1.18	0.42	1.16	1.04	1.06	1.03	0.94
Depth (mbgl)	3.40	2.39	2.58	2.19	2.20	2.23	2.23	2.21
WS2								
Water level (mbgl)	2.80	2.56	2.03	1.97	1.90	No Access	1.88	1.70
Depth (mbgl)	4.00	3.44	3.40	3.34	3.35	No Access	3.36	3.29
WS3								
Water level (mbgl)	1.62	1.89	1.35	1.86	1.81	1.81	1.81	1.72
Depth (mbgl)	3.00	2.68	2.68	2.68	2.69	2.68	2.68	2.66



Offington Land Surveys

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15 Cherry Tree Close
Worthing
West Sussex, BN13 3QJ
Tel/fax 01903 267883
surveyors@offington.com

Job Land South of Bannham Road
Eastergate
PO20 3RT

Drawing No. 16201818 Site Plan

Plot Scale: 1:1250
Sheet Size: A3 Portrait
Publication Date: 24/08/2018
Version: 1.0

Ordnance Survey data included under licence number
100022432

Ordnance Survey © Crown Copyright 2018. All rights
reserved.

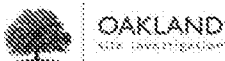
--- Ordnance Survey
--- Land Registry

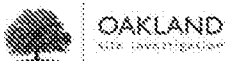


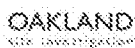
OS Map - Scale 1:1,250

0m 25m 50m



		Windowless Sample Log										Location No WS1			
Project:		Warwick Nursery, Eastergate										Date			
Project No:		4755										25.11.2019			
Location:		WS1										Logged By			
Client:		Land Acre										RS			
In Situ Testing												Hand Pen		Depth (m)	Stratum Description
Depth (m)	Type	Seating		Main Drive				"N"	Depth (m)	(kg/cm2)					
		1	2	1	2	3	4								
												0	Soft brown slightly sandy topsoil with frequent rootlets. Occasional fine to medium subrounded gravel. Occasional fine to medium frgaments of brick.		
												0.20	TOPSOIL		
												0.20	Soft brown sandy clay with occasional angular to subrounded gravel. Fine to medium fragments of brick. Frequent rootlets. Sand is fine.		
												0.60	MADE GROUND		
												0.60	Soft orangish brown sandy CLAY with angular to subrounded fine to medium gravel. Sand is fine.		
												0.90	CLAY		
												0.90	Firm brown slightly sandy, gravelly CLAY. Gravel is fine to medium angular to subrounded. Sand is fine.		
												3.10	CLAY		
												3.10	Fine brown silty SAND.		
												4.00	SAND		
													End of borehole		
Notes															
Water strike at 1.50m Install at 3.40m (0.40m Plain / 3m Slotted pipe) Water Depth 1.34m upon departure															

		Windowless Sample Log										Location No WS2			
Project:		Warwick Nursery, Eastergate										Date			
Project No:		4755										25.11.2019			
Location:		WS2										Logged By			
Client:		Land Acre										RS			
In Situ Testing												Hand Pen		Depth (m)	Stratum Description
Depth (m)	Type	Seating		Main Drive				"N"	Depth (m)	(kg/cm2)					
		1	2	1	2	3	4								
												0	Soft brown slightly sandy topsoil with frequent rootlets. Occasional fine to medium subrounded gravel. Occasional fine to medium frgaments of brick.		
												0.20	TOPSOIL		
												0.20	Soft brown sandy clay with occasional angular to subrounded gravel. Fine to medium fragments of brick. Frequent rootlets. Sand is fine.		
												0.40	MADE GROUND		
												0.40	Soft orangish brown sandy CLAY with angular to subrounded fine to medium gravel. Sand is fine.		
												1.05	CLAY		
												1.05	Firm brown slightly sandy, gravelly CLAY. Gravel is fine to medium angular to subrounded. Sand is fine.		
												3.50	CLAY		
												3.50	Fine brown silty SAND.		
												4.00	SAND		
													End of borehole		
Notes															
Water strike at 3.50m Install at 4.00m (1m Plain / 3m Slotted pipe) Water Depth 2.80m upon departure															



Windowless Sample Log

Location No

WS3

Project:	Warwick Nursery, Eastergate
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Date _____

Project No:	4755
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25.11.2019

Location:	WS3
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Logged By

Client:	Land Acre
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RS

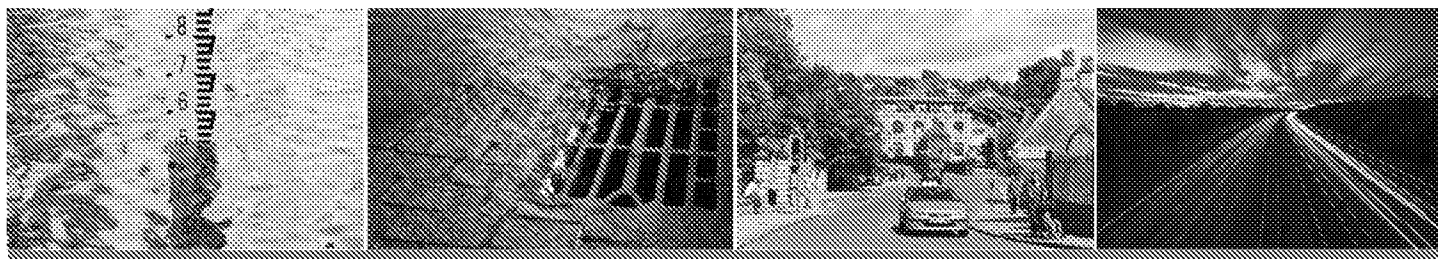
In Situ Testing									Hand Pen		Depth (m)	Stratum Description	
Depth (m)	Type	Seating		Main Drive				"N"					
		1	2	1	2	3	4		Depth (m)	(kg/cm2)			
											0	Soft brown slightly sandy topsoil with frequent rootlets. Occasional fine to medium subrounded gravel. Occasional fine to medium fragments of brick.	
											0.20	TOPSOIL	
											0.20	Soft brown sandy clay with occasional angular to subrounded gravel. Fine to medium fragments of brick. Frequent rootlets. Sand is fine.	
											0.80	MADE GROUND	
											0.80	Fine to coarse angular to subrounded clayey, sandy GRAVEL. Clay is soft. Sand is fine.	
Sampling											3.00	GRAVEL	
Depth (m)		Type		Soil Type								3.00	Fine brown silty SAND.
0.10		ES		TOPSOIL								4.00	SAND
0.60		ES		MADE GROUND									
0.50		D		MADE GROUND								End of borehole	
1.00		D		GRAVEL									
1.50		D		GRAVEL									
2.00		D		GRAVEL									
2.50		D		GRAVEL									
3.00		D		SAND									
3.50		D		SAND									
4.00		D		SAND									

Notes

Water strike at 2.00m

Install at 3.00m (1m Plain / 2m Slotted pipe)

Water Depth 1.62m upon departure



Civil Engineering - Transport Planning - Flood Risk

GTA Civils & Transport, Gloucester House, 66a Church Walk, Burgess Hill, West Sussex, RH15 9AS

