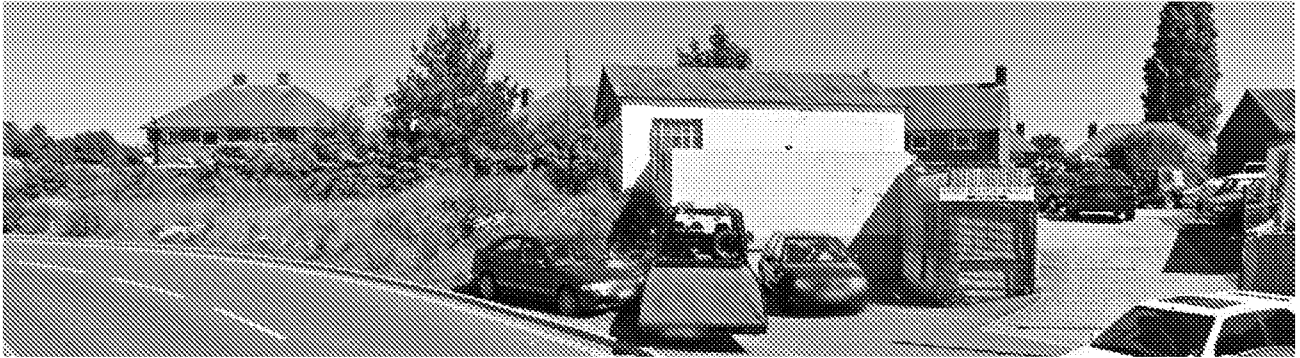




civils ltd - consulting engineers



FLOOD RISK ASSESSMENT

Fort Road Garage, Fort Road East,
Littlehampton West Sussex

CLIENT

Mr. T. Mills
Hunter Lodge
Lyminster Road
Littlehampton
West Sussex BN17 7PS

Ref: 4539/2.3F
Date: August 2012

CONSULTING ENGINEERS

GTA Civils Ltd
66a Church Walk
Burgess Hill
West Sussex
RH15 9AS

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- 2.0 Existing Site and Flood Conditions
- 3.0 Proposed Site and Drainage Strategy
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- B Topographical Survey & Proposed Scheme Drawings
- C Strategic Flood Risk Assessment Maps
- D Environment Agency Flood Data
- E Extract from “Improving the Flood Performance of New Buildings – Flood Resilient Construction”
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- G Micro Drainage Calculation

Issue	Date	Compiled	Checked
First Issue	19 May 2014	JP	MR

Report by: **John Pakenham BSc (Hons)**
Checked by: **Martin Roberts I Eng, ACIWEM, MCIHT**

1.0 INTRODUCTION

- 1.1 This report has been prepared for Mr. T. Mills in conjunction with a planning application at Fort Road Garage, Fort Road East, Littlehampton, West Sussex BN17 7QZ and 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 Ltd. was appointed by the client to provide a FRA as requested by the Environment Agency in order to achieve Planning Approval for developing this property.
- 1.3 This report will take the form of a formal Flood Risk Assessment in accordance with the 2014 Planning Practice Guidance, which has recently superseded the 2012 National Planning Policy Framework (NPPF) and the associated Technical Guidance document (TG).
- 1.4 The NPPF and TG are now contained within the Planning Practice Guidance, 2014 (PPG). Essentially, at this time, national flood risk policy is unchanged from the NPPF.

2.0 EXISTING SITE & FLOOD CONDITIONS

- 2.1 The site lies within the area administered by Arun District Council (ADC.) The site comprises a garage and a vacant area to the west. The site's area is approximately 1085m². Access on to the site is from Fort Road East. A site location plan and aerial view of the site are shown in Appendix A.
- 2.2 The site is approximately 360m north of the River Arun; it is 1.5km north of its estuary.
- 2.3 A topographic survey was carried out – see the drawing in Appendix B. This shows that the site's levels range between 5.1m AOD to the northwest and 3.1m AOD approximately near to the southeast corner. The unit's FFL is approximately 5.03m AOD. The total area of impermeable surfaces is approximately 240m².
- 2.4 According to the Environment Agency Flood data in Appendix D, the east half of the site is in tidal Flood Zone 3, which is land designated as having a high probability of flooding from the sea (greater than 1 in 200 or >0.5% annual chance of flooding). The west half of the site is in Flood Zone 2, ie at medium risk (greater than 1 in 1000 or >0.1% annual chance) of fluvial flooding.
- 2.5 The site benefits from defences, as denoted by the pink dashed lines along the Arun's banks. These crest heights provide protection only up to a '1 in 50-75 years' storm. For a coastal/tidal site to be formally 'defended' it must be protected up to the '200 years + climate change' level. It is understood (from a conversation with Ms. Keeley Mowatt, the EA's DFR Engineer for this area) that the coastal defences are being improved. These works are due to be finished soon. The EA has not re-modelled this, however, as yet.
- 2.6 The fluvial flood risk posed to the site (due to its location within the Arun's floodplain) is considerably less than the tidal risk.
- 2.7 The NPPF states that the predicted effects of climate change should be taken into account. Appendix D shows the EA's modelled levels for 5 nodes on and near to the site. These are identical to within 10mm. The '1 in 200 years + climate change' level is 4.88m AOD.

- 2.8 ADC commissioned a Strategic Flood Risk Assessment (SFRA.) The Map C1-T (see Appendix C) shows the '1 in 200 years plus climate change' flood extents. This confirms the EA's data in that the site falls within the year 2106 zone.
- 2.9 The site's solid geology, according to the BGS online map, is the Lewes Nodular Chalk Formation, with superficial deposits of Raised Beach Deposits (sand and gravel.) Both of these are renowned for their high permeability and so the infiltration rate is anticipated to be commensurately high.
- 2.10 There is no indication of this site flooding in the past. The EA's flood data in Appendix D confirms this. The SFRA's historical flood incidents map (H in Appendix C) shows this area being clear.
- 2.11 The SFRA shows this site falls within a Groundwater Emergence Zone – see the excerpt from the 'Indicative Risk of Groundwater Flooding' Map (G1) in Appendix C. Although this looks serious at first glance it should be borne in mind that actual incidents of groundwater flooding in this area are extremely rare. Such flooding is understood to occur in (low-lying) aquifers when the water table rises after *multiple* periods of high rainfall.
- 2.12 The Groundwater Emergence Zone map was published by DEFRA. This was a national modelling exercise using winter hydrographs akin to 2000/1. The zones where groundwater was showing within 2m of the ground's surface were thus defined. Therefore it is not certain where the emergence points typically occur and it is unclear whether this hydrology is definitive. The only point to take forward with regard to groundwater flood risk is that there is a significant risk of such flooding in this vicinity: this can be checked by a site-specific soil investigation measuring groundwater depths.

3.0 PROPOSED SITE AND MITIGATION

- 3.1 The application is to erect 4 no. light industrial units – see the proposed scheme drawings in Appendix C. One unit will be located at the west corner (no' 4) and the others (no's 1-3) will be incorporated into one large building adjacent to the east boundary. The total roofed area is 390m². There will be a new access created for Unit 4 at the far west end of the site.
- 3.2 The ground floor FFLs of Units 1, 2 and 3 will be set at 4.70m AOD. This is lower than the necessary 0.3m above the '200 years + climate change' level of 4.88m AOD, as per the NPPF. The reason for this is due to the limited gradient between the access to the site and the vehicle doors in unit 1.
- 3.3 The ground floor FFL of Unit 4 will be set at 4.9m AOD. This is also due to a limit of gradient but the distance to the entrance is greater making it possible for a higher FFL.
- 3.4 Vulnerability and the Sequential Test: Table 2 of the NPPF's TG classes light industrial buildings as 'Less Vulnerable'. Table 3 of the TG states that such uses are 'appropriate development' in Flood Zone 3A. This is the same classification as the garage unit and so the vulnerability will be unaffected.
- 3.5 The residual flood risk due to the 180mm flood depth, ie between 4.7m and 4.88m AOD, is to be mitigated by 2 means: resilient materials and techniques – and a Flood Warning and Evacuation Plan.
- 3.6 Resilient techniques shall be incorporated into the design of the new builds up to a minimum of 0.47m above 4.70m AOD FFL, which equates to **5.18m AOD**. Industrial buildings are typically resilient and these units are to include solid concrete floors and blockwork walls up to 2.1m in height.
- 3.7 The document "Improving the Flood Performance of New Buildings - Flood Resilient Construction" published by DEFRA/Environment Agency is a good source of information on resilient techniques.

Examples of such construction include: placing boilers and meter cupboards on the first floor, water-resistant plaster/tiles on the walls of the ground floor, solid stone or concrete floors and non-return valves on new plumbing works – refer to Appendix F.

- 3.8 Access to safety: the predicted flood depth at the site's main entrance is approximately $4.88 - 3.5 = 1.38\text{m}$, which is clearly hazardous to all users. This means that there is no safe access to dry land - whether or not this development goes ahead. In order to mitigate this situation it is proposed that a Flood Warning and Evacuation Plan is incorporated into each unit. Appendix E shows this plan.
- 3.9 It is contended that the duration of the flooding will be limited, due to the tidal nature. The waters will rise and fall on a 12-hourly cycle with only the peak hours affecting the streets near to the site.
- 3.10 Flood Warning and Evacuation: due to the risk of flooding from the River Arun, it is recommended that each of the 4 businesses registers with the free flood warning service provided by the Environment Agency (called 'Floodline'), in order to facilitate evacuation of the premises prior to floodwater approaching the site from Fort Road East.
- 3.11 The manager (or a designated member of staff) should monitor any other developments as regards broadcast information. The TV news channels and local radio stations will augment the EA's warnings in their bulletins. There *may* be Local Authority Emergency Planning Department vehicles fitted with public address systems (loud hailers) issuing directions from the street.
- 3.12 Each business must monitor and review the Plan in Appendix G. This is a 'live' document, meaning that it should be adapted to suit each business's needs and the flood risk conditions as they evolve. This may have to be adapted early on if there are occupants of the unit with special requirements. It should be regularly, no less often than 5 years. From the time of first occupancy of the unit each business should carry out the first review within 18 months.
- 3.13 By providing a Flood Warning and Evacuation Plan and flood resilience within the building the risk of groundwater flooding will also be sufficiently mitigated.

4.0 DRAINAGE STRATEGY

- 4.1 The total impermeable area on the site will be 787m^2 . This comprises 390m^2 of roofs and 397m^2 of concrete yard.
- 4.2 Surface Water drainage strategy: depending on the result of a soil soakage test (to BRE Digest 365) that will be carried out prior to finalising the design, it is proposed to discharge the roofs and yard to a soakaway under each unit's yard. A Micro Drainage calculation is shown in Appendix G: this assumes a soil infiltration rate of $8 \times 10^{-5}\text{m/s}$ and the soakaways being linked together so that the soil with the best infiltration rate will discharge the most water.
- 4.3 The 4 soakaways are to hold the excess volume of the '1 in 100 years + 20% climate change' event. The calculation in Appendix G shows that each soakaway will comprise a cellular crate whose dimensions are $5\text{m} \times 3\text{m} \times 0.4\text{m}$ deep. This calculation must be re-worked with the actual soil infiltration rate, prior to the scheme's design being finalised.
- 4.4 SUDS: the discharging of rain water from the roof to ground via soakaways is sustainable as it does not add any extra load on to the sewerage network.

5.0 SUMMARY & CONCLUSIONS

- 5.1 The site comprises a garage premises (Fort Road Garage) and vacant area to the west, which lies within the area administered by Arun District Council. The proposal is to erect 4 no light industrial units with a total roofed area of 390m².
- 5.2 The site's proximity to the coast and River Arun makes the main source of flood risk tidal, as opposed to fluvial.
- 5.3 There is no record from the EA or within the SFRA of any flooding from tidal or other sources to this vicinity.
- 5.4 The EA's modelled flood '1 in 200 years + climate change' level is **4.88m AOD**.
- 5.5 Due to the very steep gradients between the site's entrance and Unit 1 it is possible to set Units 1, 2 and 3's FFL at 4.70m AOD. Unit 4's FFL will be set at 4.90m AOD, making it clear of the predicted flood level.
- 5.6 There is no safe route to dry land (as the depth at the entrance is over 1.3m).
- 5.7 The flood risk of the units will be mitigated by providing flood resilient materials and techniques within each unit – and providing a Flood Warning and Evacuation Plan for each unit's manager.
- 5.8 A Flood Warning and Evacuation Plan, as outlined in sections 3.10 – 3.12 and Appendix F, is proposed for each of the 4 businesses.
- 5.9 As the geology is chalk overlain by sand/gravel deposits it is proposed to discharge the impermeable areas' surface water to ground via a soakaway under each unit's yard. Assuming a nominal rate of 8×10^{-5} m/s each soakaway will hold the excess volume in the critical '100 years plus 20% climate change' storm. Appendix G shows the supporting calculation for this design. This must be re-worked once the soil's infiltration is known, ie following a BRE 365 soil soakage test.
- 5.10 It is therefore considered that this development complies with the 2012 NPPF and PPG.

– End of Report –

APPENDIX A

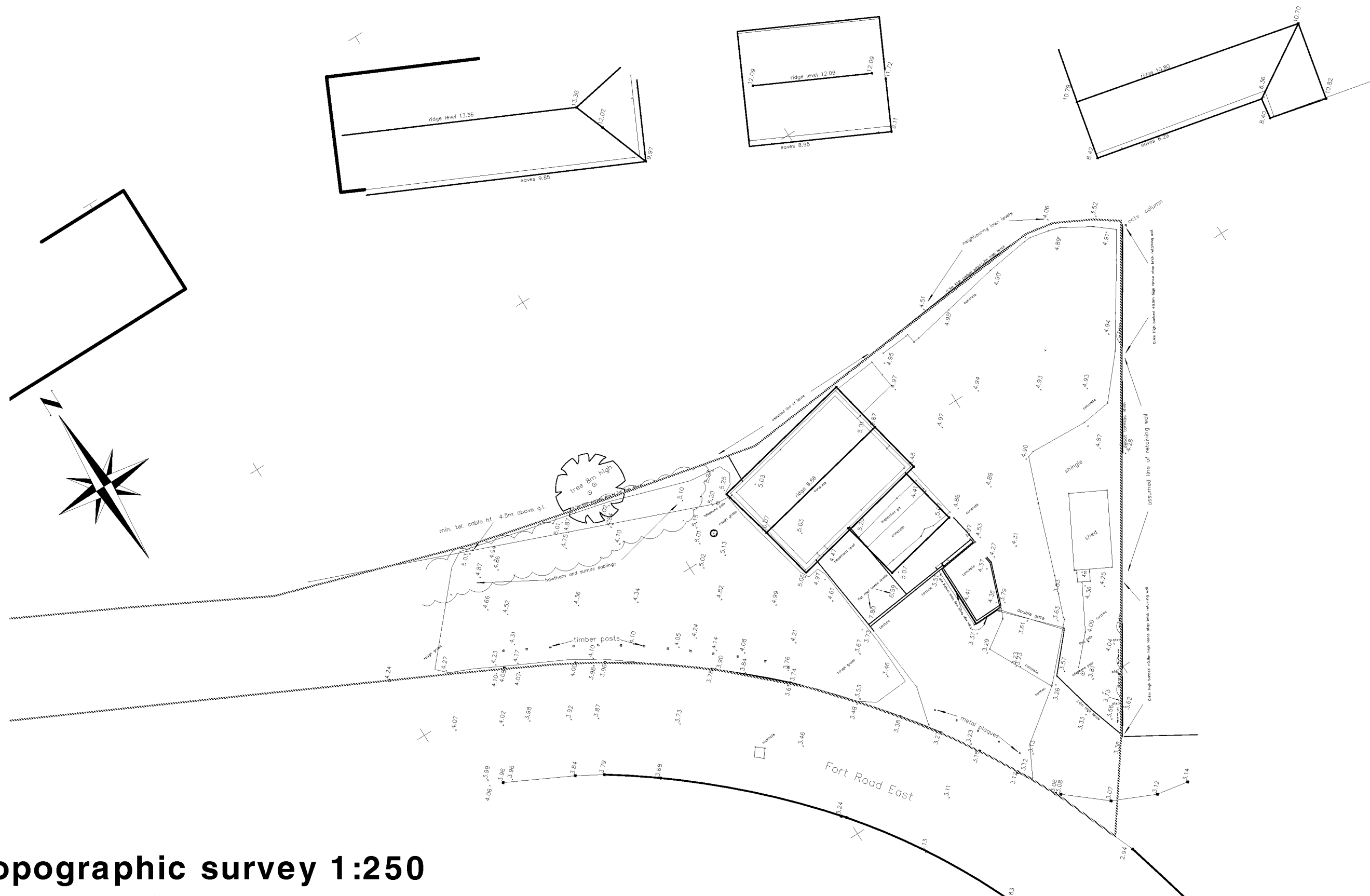
Site Location Map and Aerial View





APPENDIX B

Topographical Survey & Proposed Scheme Drawings



Topographic survey 1:250

steve hunting bathonsarch...diblarch
architectural and graphic designer

8 Somerset gardens, Bognor Regis, West Sussex, PO21 2AA Tel: 01243 822796 email: steve.sharch@googlemail.com

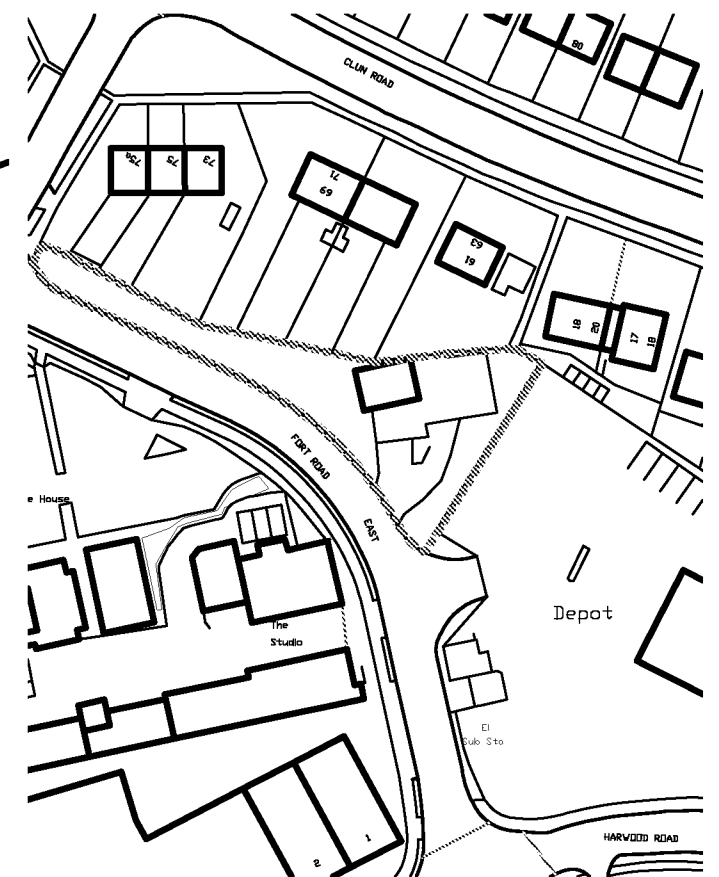
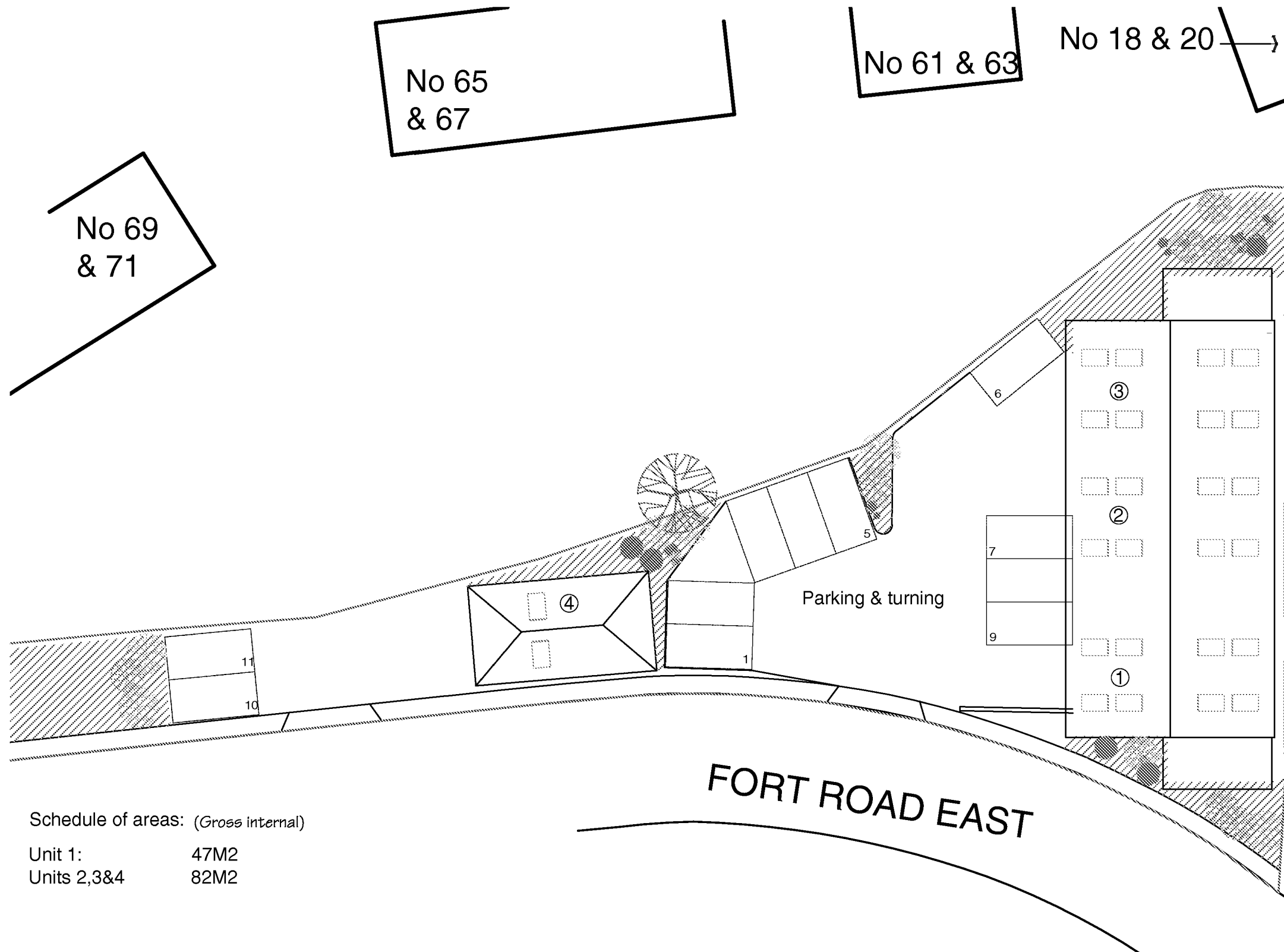
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East, Littlehampton.
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CLIENT: Mr T. Mills

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DRAWN BY: SH
DATE: JAN 14

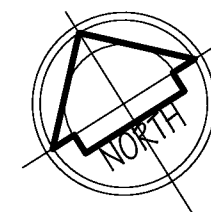
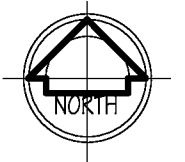
PROJECT No
1322
REVISIONS
A

01



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**Site location
plan 1:1250**



Schedule of areas: (Gross internal)

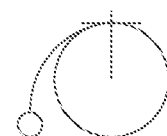
Unit 1: 47M2
Units 2,3&4 82M2

Block plan 1:250

A 10.05.14 PLANNING APPLICATION

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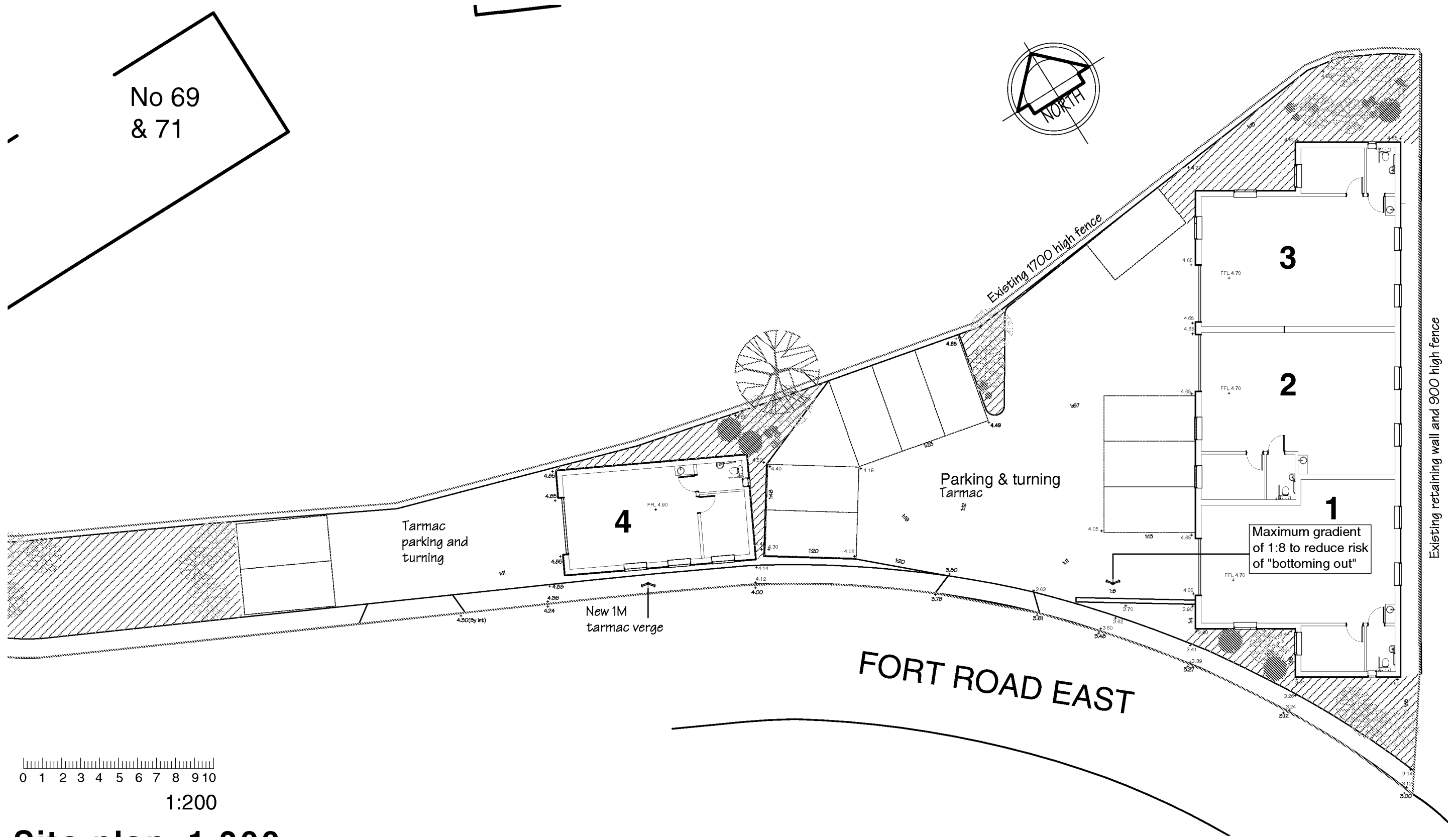


PROJECT: Proposed Light industrial development at: Fort Road East, Littlehampton.
DRWG TITLE: PLANNING Site location and Block plans
CLIENT: Mr T. Mills

SCALE
1:250 @ A3
DRAWN BY: SH
DATE: JAN 14

PROJECT No
1322
REVISIONS
A

02



Site plan 1:200

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A 10.05.14 PLANNING APPLICATION

PROJECT: Proposed Light industrial development at: Fort Road East, Littlehampton.
DRWG TITLE: PLANNING Site plan
CLIENT: Mr T. Mills

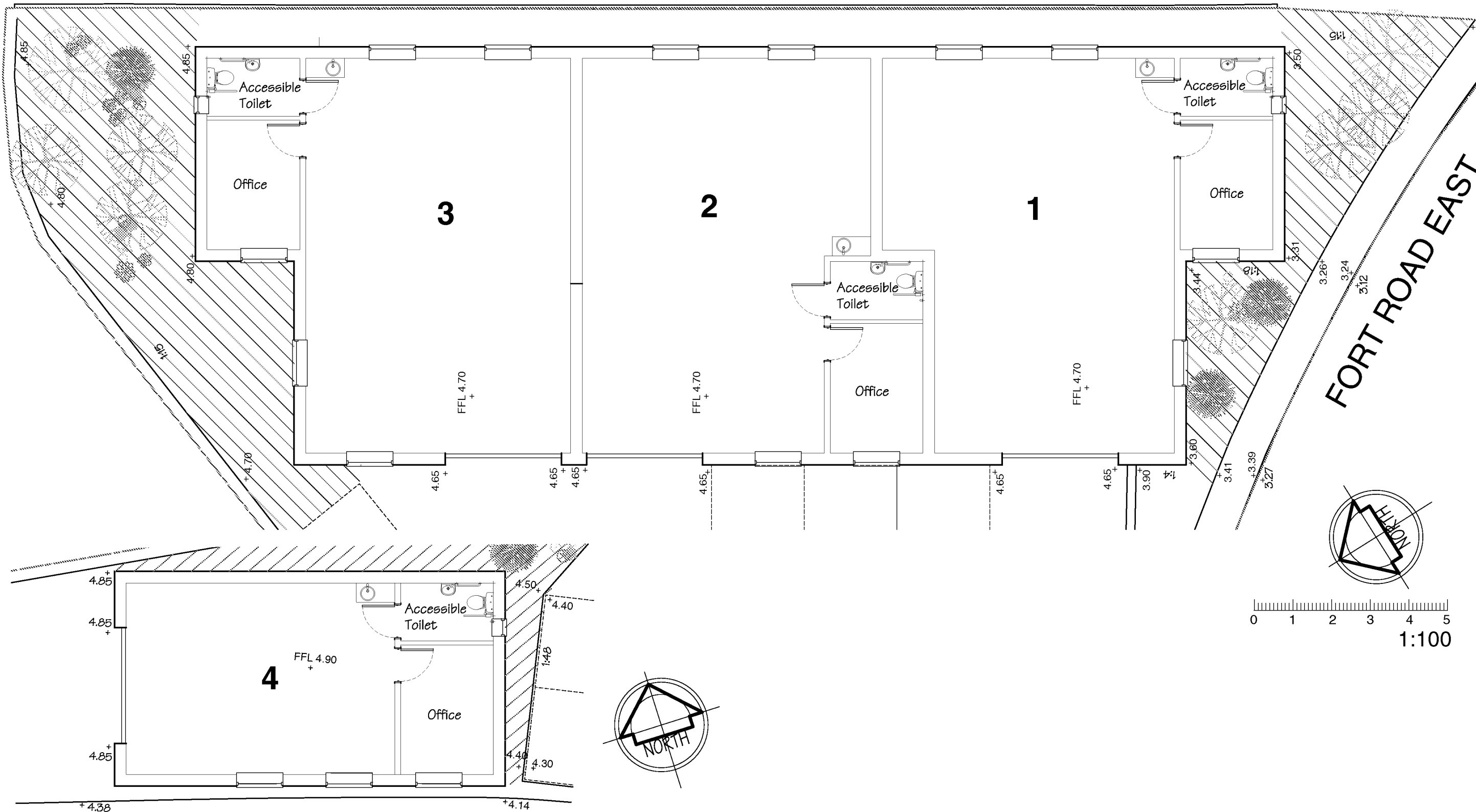
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PROJECT No
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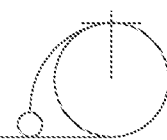
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SH JAN 14

REVISIONS
A



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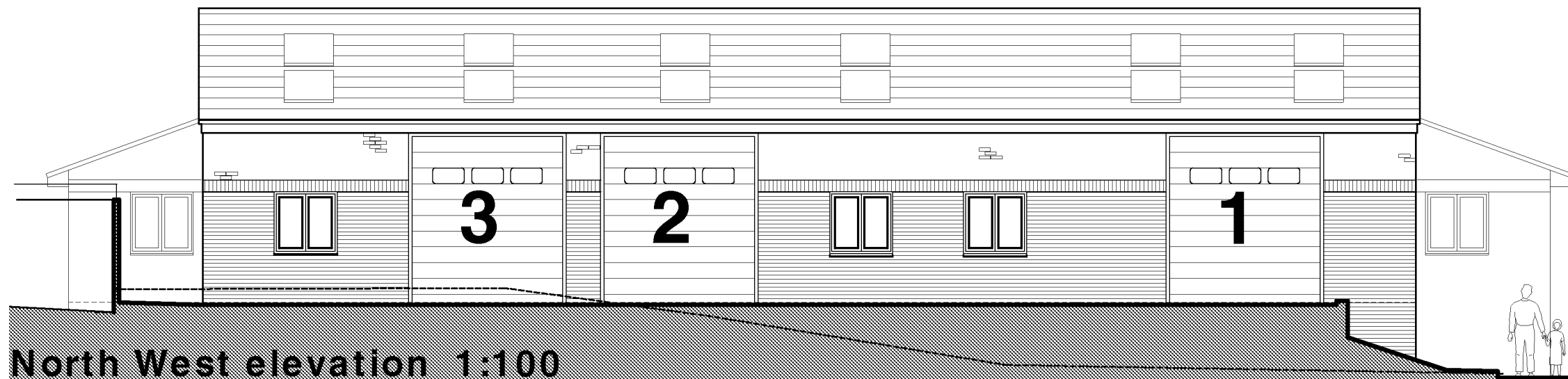
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East, Littlehampton.
DRWG TITLE: PLANNING Floor plans
CLIENT: Mr T. Mills

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DRAWN BY: SH
DATE: JAN 14

PROJECT No
1322
REVISIONS
A

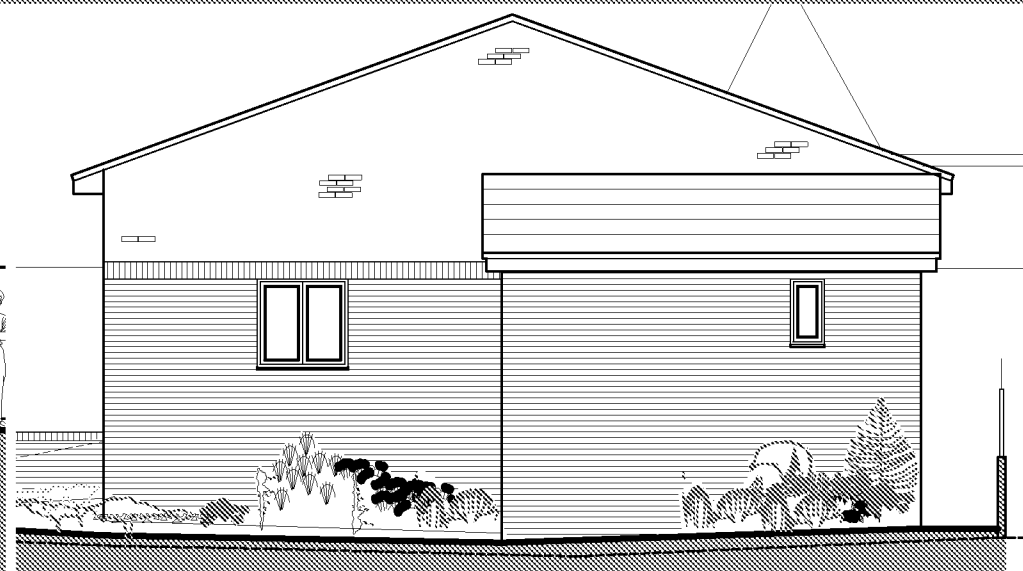
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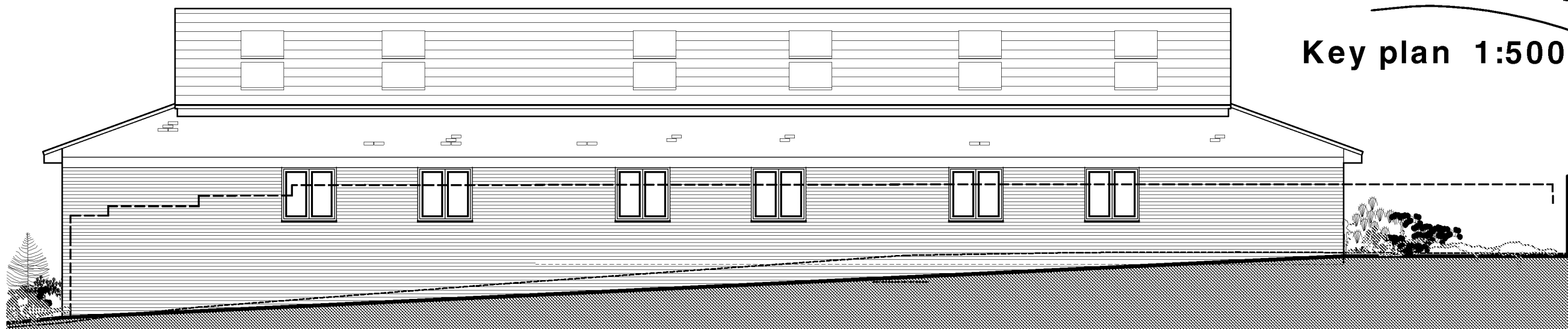
North West elevation 1:100



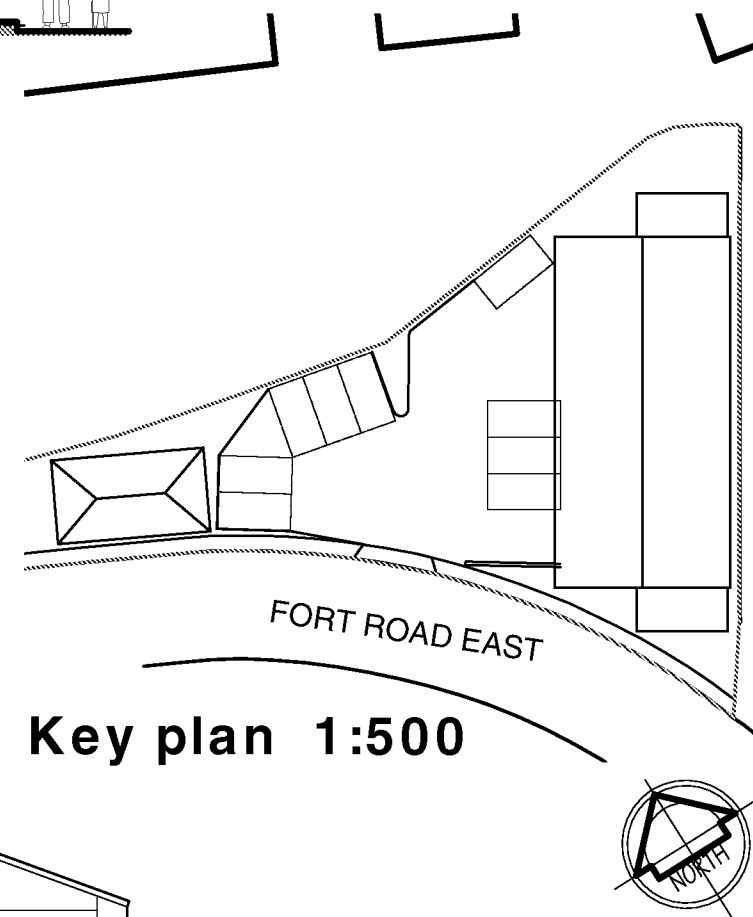
North East elevation 1:100



South West elevation 1:100



South East elevation 1:100



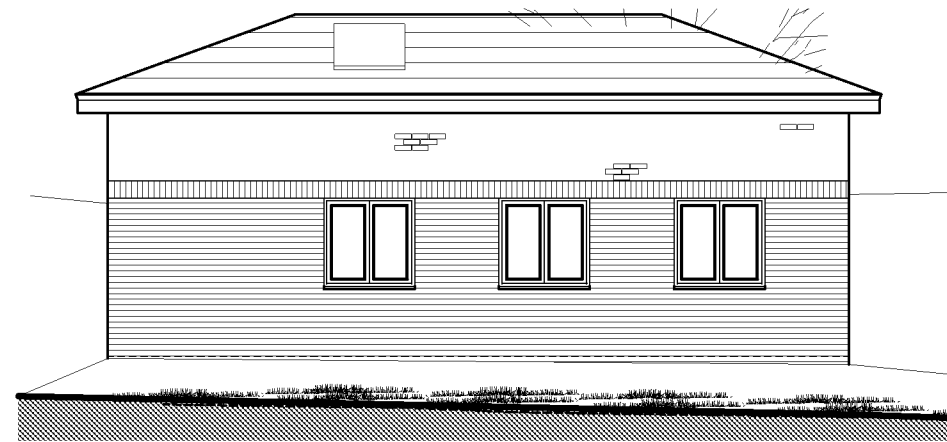
Key plan 1:500

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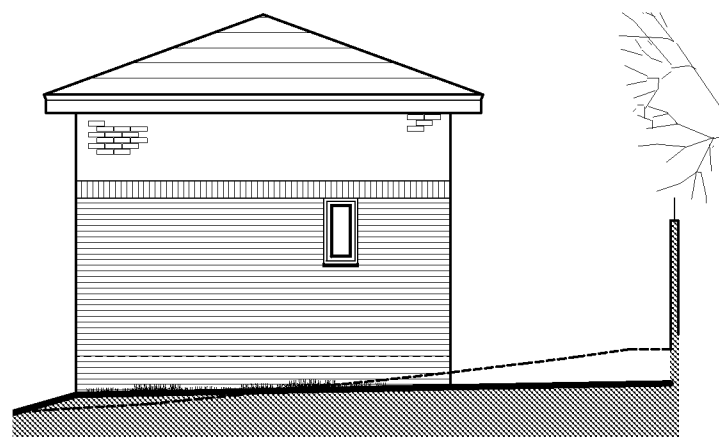


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DRWG TITLE:	PLANNING Elevations Units 1,2&3	PROJECT No 1322
CLIENT:	Mr T. Mills	DRAWN BY SH
		DATE JAN 14
		REVISIONS A

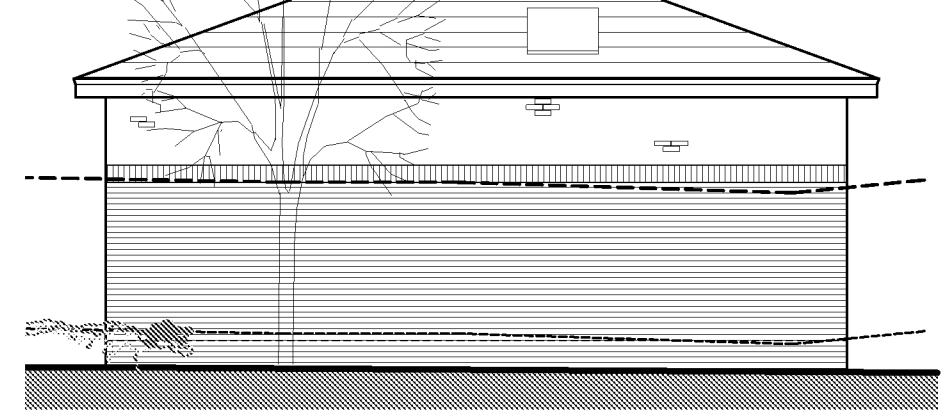
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South West elevation 1:100



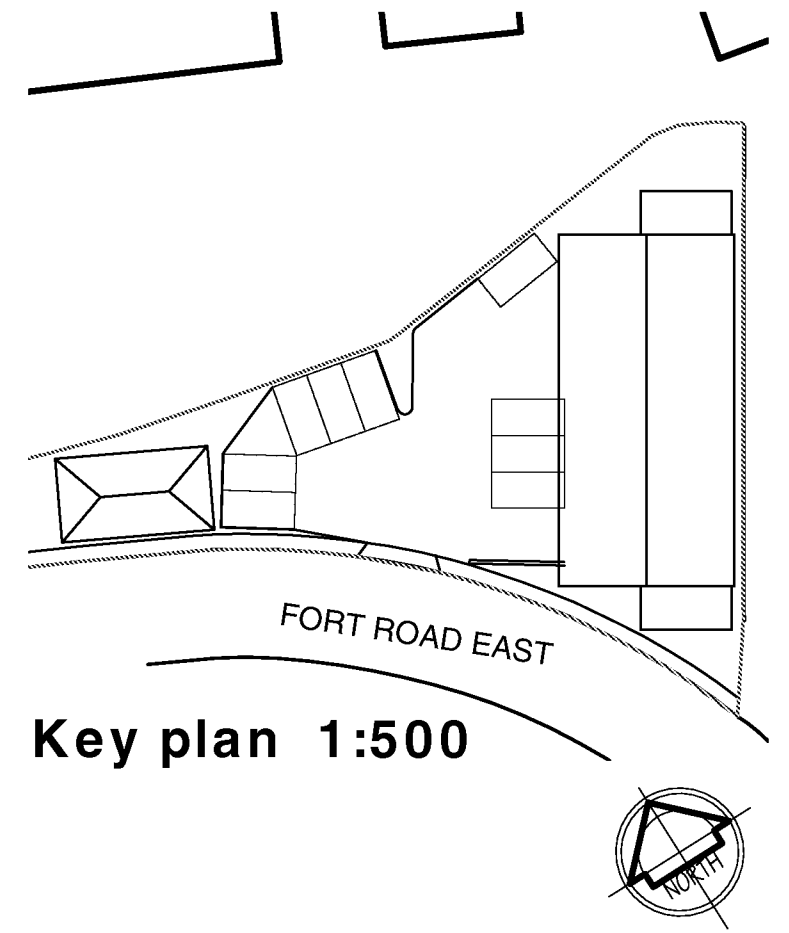
South East elevation 1:100



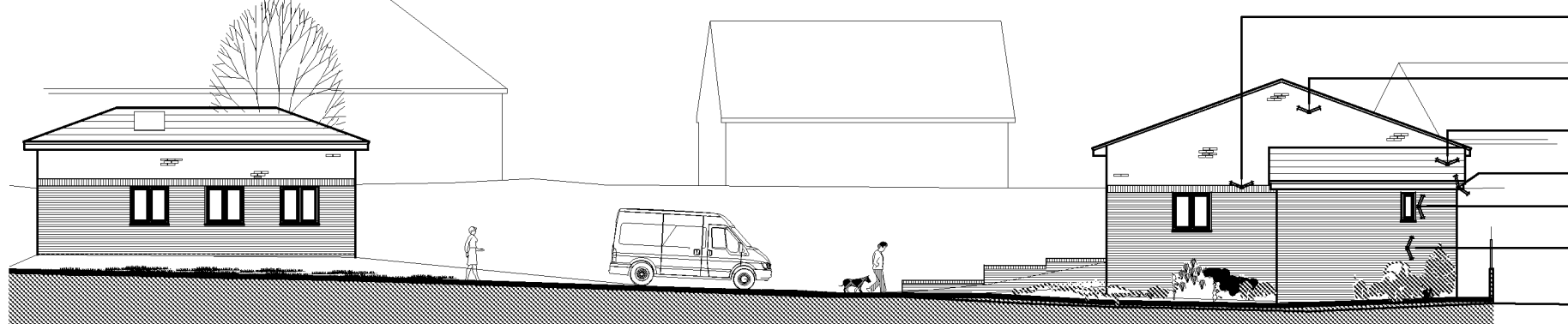
North East elevation 1:100



North West elevation 1:100

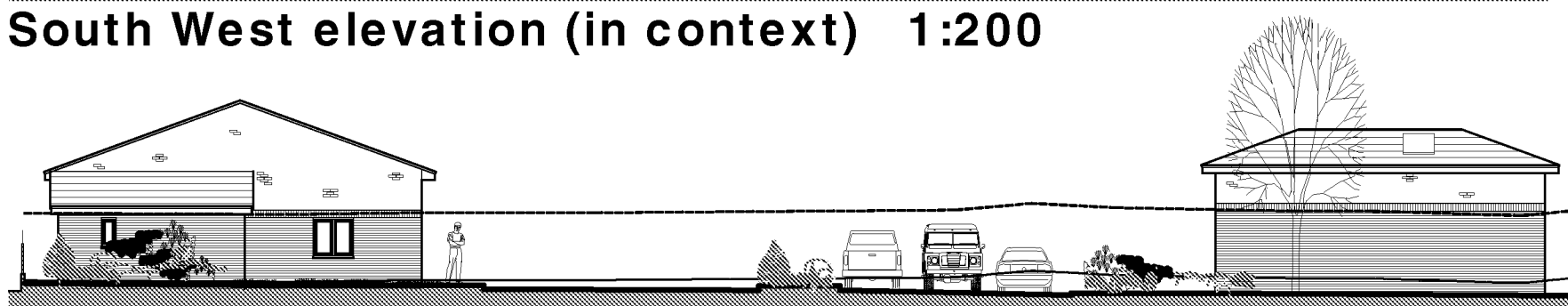
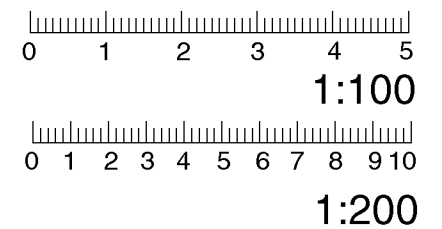


Key plan 1:500



South West elevation (in context) 1:200

- Red multi stock soldier course
- Buff multi stock facing brick at higher level
- Concrete slate roof tile
- Black upvc fascia
- White upvc double glazed windows
- Red multi stock facing brick at lower level.



North East elevation (in context) 1:200

A 10.05.14 PLANNING APPLICATION

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PROJECT: Proposed Light industrial development at: Fort Road East, Littlehampton.
DRWG TITLE: PLANNING Elevations Unit 4 & In context
CLIENT: Mr T. Mills

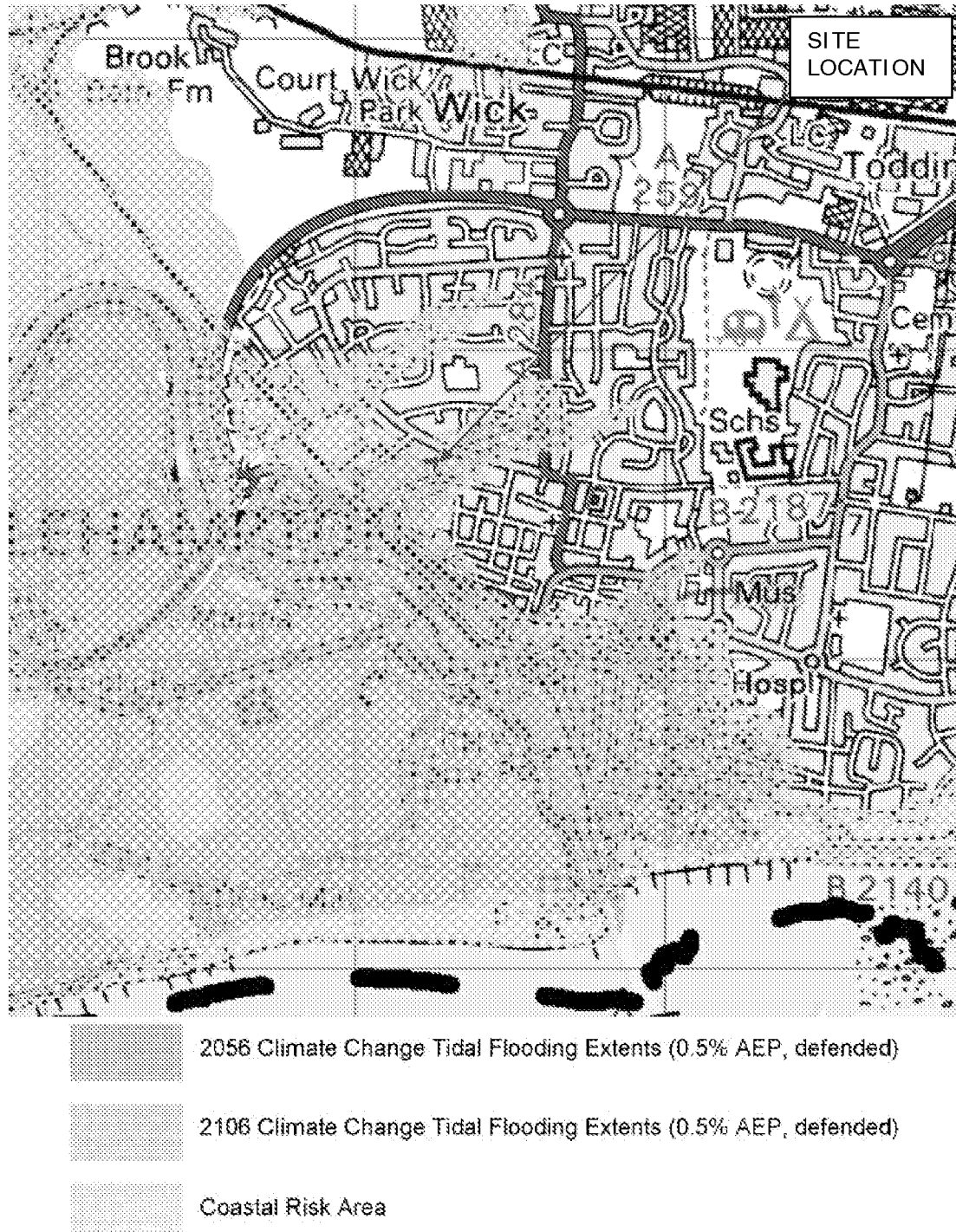
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PROJECT No
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REVISIONS
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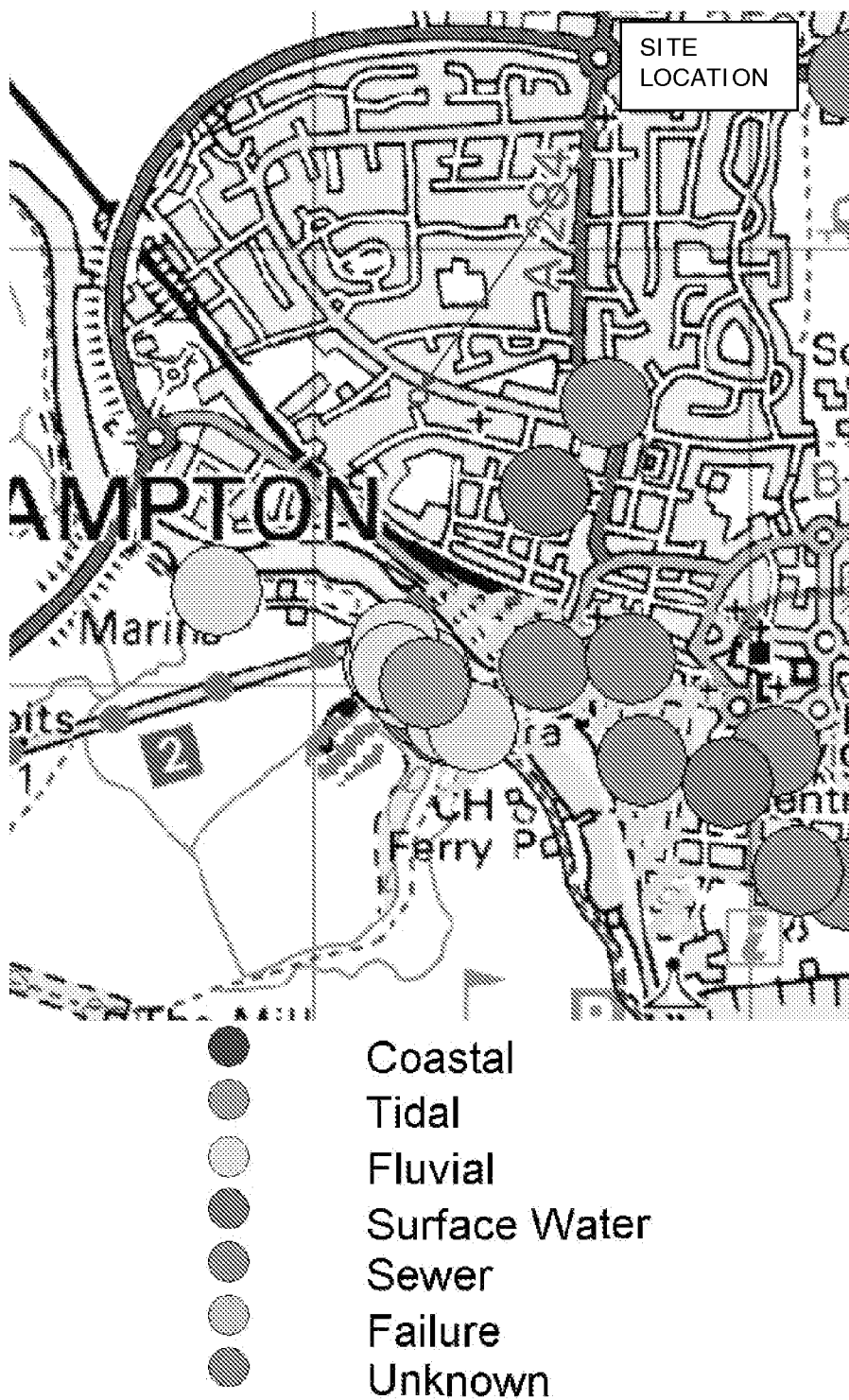
APPENDIX C

Strategic Flood Risk Assessment Maps



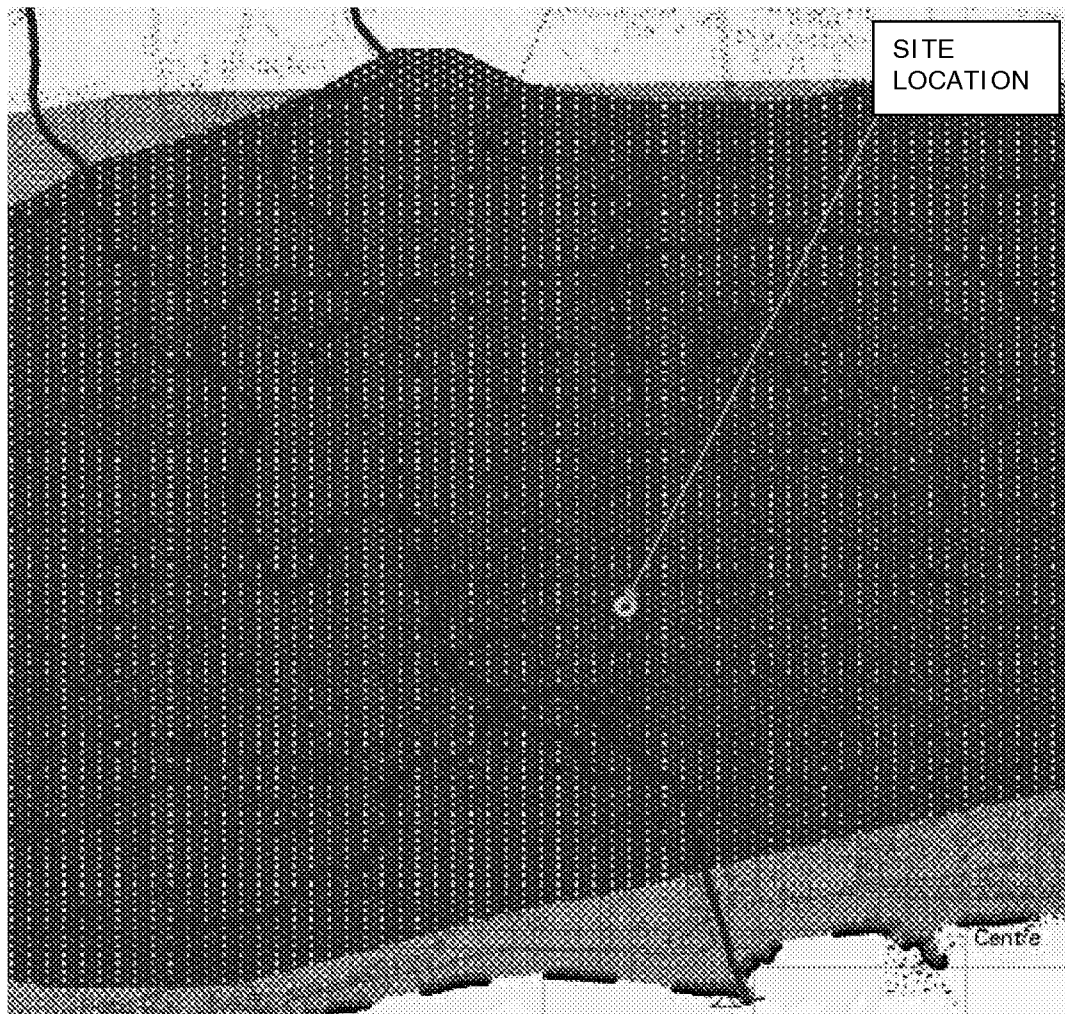
Enlarged Extract of the '1 in 200 years + Climate Change' Tidal Flood Map (C1-T)

This shows that, once climate change is taken into consideration the site falls within FZ3



Enlarged Extract of the Historical Flood Events Map (H)

This shows that there are no records of this site flooding from any sources



Groundwater Emergence Zones

Groundwater Flood Risk



High



Medium

Enlarged Extract of the 'Indicative Risk of Groundwater Flooding' Map (G1)

This shows the site falling within the Groundwater Emergence Zone

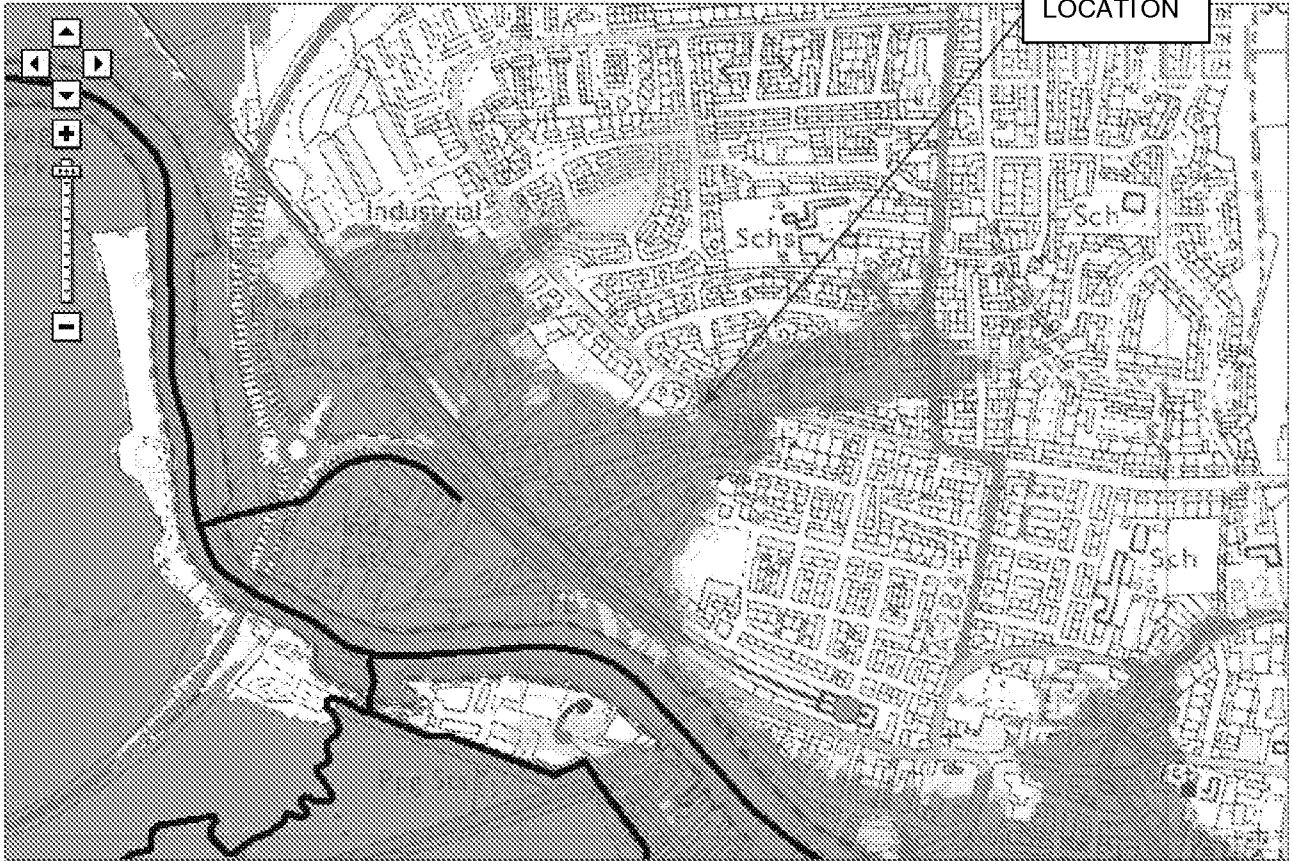
APPENDIX D

Environment Agency Flood Data

Map of BN17 7QZ at scale 1:10,000

Data search

SITE
LOCATION



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John Pakenham
GTA Civils
Gloucester House
66a Church Walk
Burgess Hill
RH15 9AS

Our ref: SSD/3830/KW
Your ref:

Date: 02/05/2014

Dear Mr Pakenham

Provision of Product 4 for Fort Road East, Littlehampton BN17 7QZ

Thank you for your request to use Environment Agency data. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments / Flood Consequence Assessments.

Supporting Information

This information is provided subject to the enclosed notice, which you should read.

Modelled Flood Levels

The attached flood levels have been taken from the 2011 Arun to Adur Flood Modelling study. These levels represent current defended and undefended tidal flood risk.

Guildbourne House, Chatsworth Road, Worthing, West Sussex BN11 1LD
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

Flood Defences

The estimated Standard of Protection for defences offering protection to this area vary from 1in50yr to 1in200yr, with crest levels varying from 4.14 to 3.57 mAOD. The Littlehampton Arun East Bank Tidal Walls Flood Defence Scheme will make improvements to the flood defences on the East Bank of the River Arun in the town of Littlehampton to reduce the risk of flooding to 0.33% (1in300yr) up to the year 2110. Further details available at <http://www.environment-agency.gov.uk/homeandleisure/floods/114650.aspx>

Flood History

We do not have any records of previous flood events affecting this location. However, I would suggest contacting Arun District Council for a more comprehensive flood history check.

If you have any queries or would like to discuss the content of this letter further please don't hesitate to contact me.

Yours faithfully

Jon Denman
FCRM Officer
Partnership and Strategic Overview Team – West Sussex



Enc. Detailed FRA/FCA Map, Modelled Extents, Modelled Levels
[Standard Notice]

Flood Map for Planning Centered on Fort Road East, Littlehampton BN17 7QZ - Created 02/05/2014 [Ref: SSD/3830/KW]



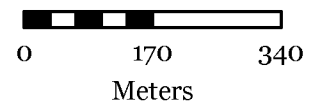
Environment
Agency

Legend

-  Main River
-  Flood Zone 3
-  Flood Zone 2

1:10,000 *

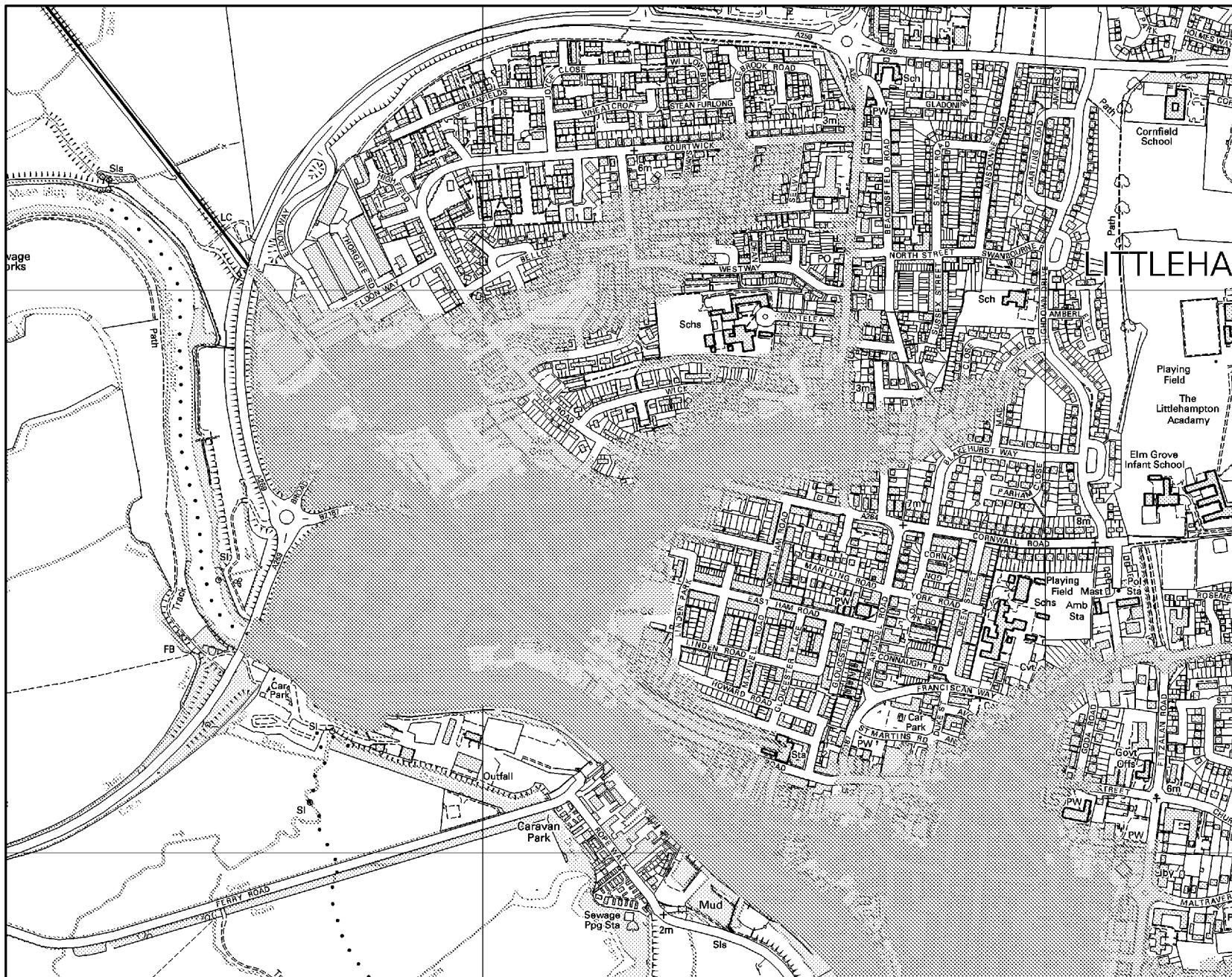
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Contact Us: National Customer Contact Centre, PO BOX 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

**2011 Arun to Adur UNDEFENDED Outlines Centered on Fort Road East, Littlehampton BN17 7QZ -
Created 02/05/2014 [Ref: SSD/3830/KW]**



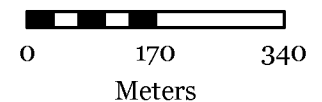
Environment
Agency

Legend

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-  0.5% AEP [1in200] Undefended

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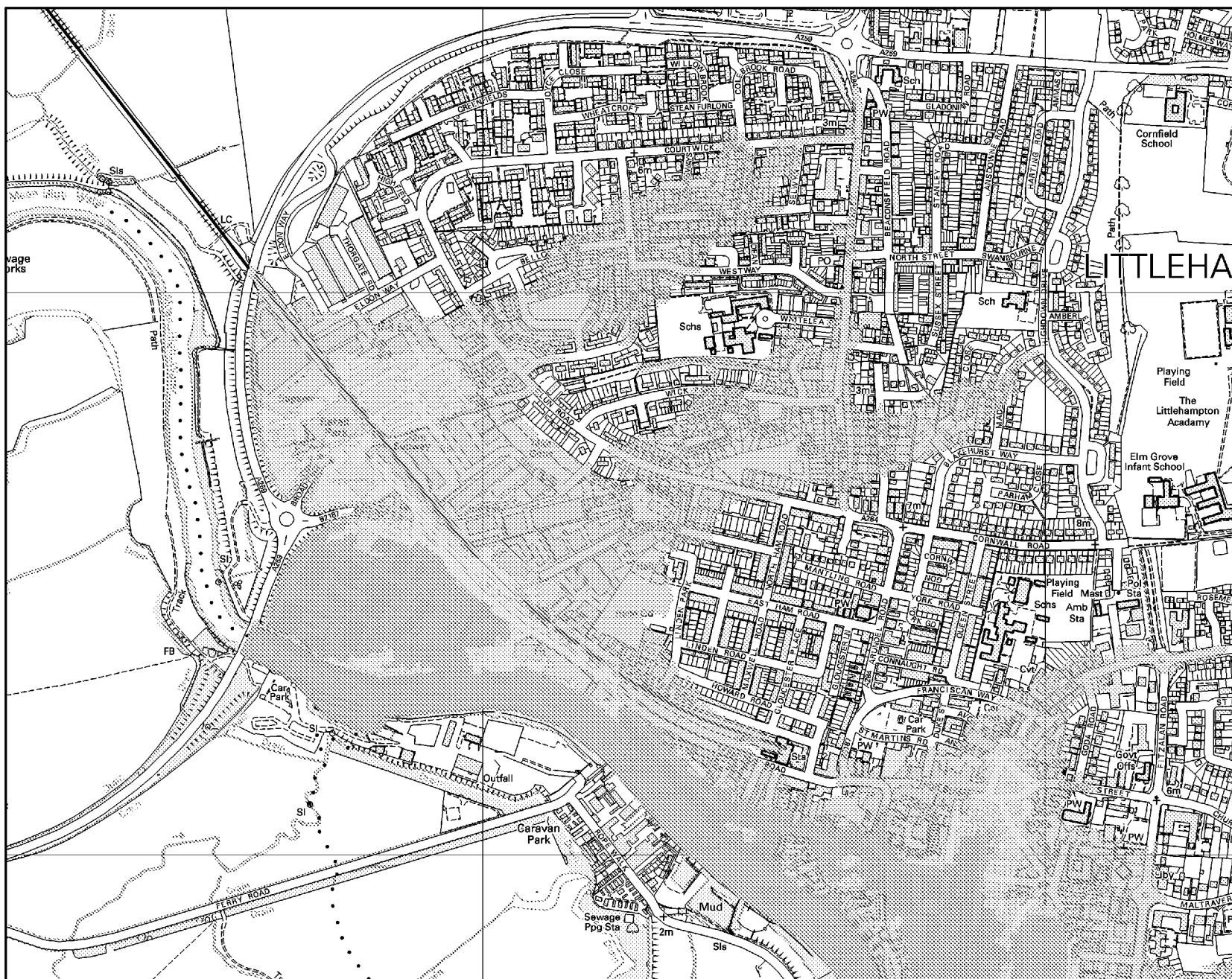
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**2011 Arun to Adur DEFENDED Outlines Centered on Fort Road East, Littlehampton BN17 7QZ -
Created 02/05/2014 [Ref: SSD/3830/KW]**



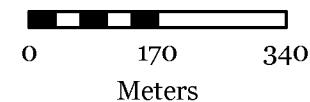
Environment
Agency

Legend

-  0.5% AEP [1in200] Def +CC [2115]
-  0.1% AEP [1in1000] Defended
-  0.5% AEP [1in200] Defended

1:10,000 *

*when printed at A4.



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2011 Arun to Adur Modelled Outputs Centered on Fort Road East, Littlehampton BN17 7QZ -

Created 02/05/2014 [Ref: SSD/3830/KW]



Environment
Agency

Legend

Node Point
1



Node Point	Easting	Northing	TIDAL Depths taken from 2011 TUFLOW model [m]					
			DEFENDED			UNDEFENDED		
			0.5% AEP [1in200yr]	0.5% AEP [1in200yr] +CC [2115]	0.1% AEP [1in1000yr]	0.5% AEP [1in200yr]	0.5% AEP [1in200yr] +CC [2115]	0.1% AEP [1in1000yr]
1	520450	106081	Null	1.69	Null	0.57	1.73	0.82
2	520559	106083	Null	1.18	Null	0.13	1.21	0.31
3	520436	105833	Null	0.94	Null	0.05	0.97	0.15

Node Point	Easting	Northing	TIDAL Levels taken from 2011 TUFLOW model [mAOD]					
			DEFENDED			UNDEFENDED		
			0.5% AEP [1in200yr]	0.5% AEP [1in200yr] +CC [2115]	0.1% AEP [1in1000yr]	0.5% AEP [1in200yr]	0.5% AEP [1in200yr] +CC [2115]	0.1% AEP [1in1000yr]
1	520450	106081	Null	4.84	Null	3.72	4.88	3.97
2	520559	106083	Null	4.84	Null	3.72	4.88	3.97
3	520436	105833	Null	4.84	Null	3.70	4.88	3.97

1:1,500
*when printed at A4.

0 25 50
Meters



APPENDIX E

Extract from “Improving the Flood Performance of New Buildings – Flood Resilient Construction”

Aim of the Guidance

This document aims to provide guidance to developers and designers on how to improve the resilience of new properties in low or residual flood risk areas by the use of suitable materials and construction details. These approaches are appropriate for areas where the probability of flooding is low (e.g. flood zone 1 as defined by PPS 25) or areas where flood risk management or mitigation measures have been put in place. The guidance will also be useful to planners, building control officers and loss adjusters.

Specifically this guidance document provides:

- practical and easy-to-use guidance on the design and specification of new buildings (primarily housing) in low or residual flood risk areas in order to reduce the impacts of flooding
- recommendations for the construction of flood resistant and resilient buildings.

Services

General advice for resilient design

Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed cell material).

Pipework: Closed cell insulation should be used for pipes which are below the predicted flood level.

Drainage services: Non-return valves are recommended in the drainage system to prevent back flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness.

Water, electricity and gas meters: should be located above predicted flood level.

Electrical services: electrical sockets should be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation (see Figure 6.13. Note a dado rail which provides a limit for replacement of any wall covering). Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches.

Heating systems: boiler units and ancillary devices should be installed above predicted flood level and preferably on the first floor of two-storey properties. Underfloor heating should be avoided on ground floors and controls such as thermostats should be placed above flood level. Conventional heating systems, e.g. hot water pipes are unlikely to be significantly affected by flood water unless it contains a large amount of salts. The less common, hot air duct heating would remain effective provided it is installed above the design flood level.

Communications wiring: wiring for telephone, TV, internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage. Any proposed design solution for flood insulation on all potentially vulnerable wiring should be discussed with the relevant service providers.

The full document can be downloaded from:

http://www.planningportal.gov.uk/uploads/br/flood_performance.pdf

APPENDIX F

Flood Warning and Evacuation Plan

1. This building is most at risk of flooding from the River Arun.
2. The probable maximum depth at the entrance from Fort Road East is 1.4m.
3. The Manager (or appointed Duty Manager) shall sign up to the Environment Agency's (free) flood warning system, 'Floodline Warnings Direct'. This is explained on the EA's website:
<http://www.environment-agency.gov.uk/homeandleisure/floods/38289.aspx>
4. This plan shall be part of the Manager's operational documents and should be managed in a similar way to other risks that may affect the business's operations.
5. The building should only be evacuated if the warnings given clearly indicate that this action is necessary. It is possible that a lesser storm occurs that adversely affects only streets nearer to the river, thereby leaving other areas unaffected: so undue panic should be avoided. That said, if it is clear from any broadcast warnings that the site is liable to flood then the following evacuation procedure must be carried out as quickly as practically possible.
6. Common sense should prevail: if it is clear that the warning is for the next day (or on Monday on a Friday) the Manager should tell staff that the premises will be closed that day. He or she should also work out how to alert all staff (and visitors due to arrive on site) to stay away and safe if need be during out-of-office hours. This can be by email or any other agreed method for the staff and visitors must be called unless they send a confirmation email in reply.
7. All members of staff shall be told what is expected of them in a flood situation in their induction. It must be clearly explained and understood by them. They should be told the contents of this Plan (or given a copy of it if preferred) so that they have a better understanding of the flood risk in this building. Any staff acting temporarily as Duty Manager must be involved during the testing and review of this Plan and assume the responsibilities, albeit temporarily, as if they were the Manager whilst on duty.
8. The Manager should be able to assess from the EA's and Local Authority Emergency Services' warnings the likely flood warning time, ie how long there is before the factory is likely to be inundated. This is likely to be well in excess of 4 hours but this depends on the storm's intensity. Once this is known it will be clear how quickly the evacuation must be carried out.
9. Once the decision has been made to evacuate, the Manager will shut and lock up the premises, once he/she is satisfied that any members of staff and visitors at that time are able to reach dry land.
10. A car (or other motor vehicle) that is capable of transporting wheel-chair bound people, shall be available to ferry up to 4 people to dry land. Note that this 'target site' must be identified in advance by the Manager. This is to be added to this Plan and thereby included into the review process.
11. This is a live document and should be monitored and reviewed regularly, no less often than every 5 years.

APPENDIX G

Micro Drainage Calculation

GTA Civils Ltd			Page 1																																																																																																																																																																																																																													
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Summary of Results for 100 year Return Period (+20%) Half Drain Time : 63 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>3.093</td><td>0.243</td><td>0.8</td><td>3.5</td><td>O K</td></tr><tr><td>30 min Summer</td><td>3.152</td><td>0.302</td><td>0.8</td><td>4.3</td><td>O K</td></tr><tr><td>60 min Summer</td><td>3.186</td><td>0.336</td><td>0.8</td><td>4.8</td><td>O K</td></tr><tr><td>120 min Summer</td><td>3.190</td><td>0.340</td><td>0.8</td><td>4.8</td><td>O K</td></tr><tr><td>180 min Summer</td><td>3.175</td><td>0.325</td><td>0.8</td><td>4.6</td><td>O K</td></tr><tr><td>240 min Summer</td><td>3.154</td><td>0.304</td><td>0.8</td><td>4.3</td><td>O K</td></tr><tr><td>360 min Summer</td><td>3.112</td><td>0.262</td><td>0.8</td><td>3.7</td><td>O K</td></tr><tr><td>480 min 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GTA Civils Ltd			Page 2		
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Date 15-05-14		Designed by JNP			
File soakaway1405.srcx		Checked by			
Micro Drainage		Source Control 2013.1			
Summary of Results for 100 year Return Period (+20%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
60 min Winter	3.238	0.388	0.8	5.5	O K
120 min Winter	3.239	0.389	0.8	5.5	O K
180 min Winter	3.214	0.364	0.8	5.2	O K
240 min Winter	3.181	0.331	0.8	4.7	O K
360 min Winter	3.118	0.268	0.8	3.8	O K
480 min Winter	3.061	0.211	0.7	3.0	O K
600 min Winter	3.013	0.163	0.7	2.3	O K
720 min Winter	2.972	0.122	0.7	1.7	O K
960 min Winter	2.914	0.064	0.6	0.9	O K
1440 min Winter	2.890	0.040	0.5	0.6	O K
2160 min Winter	2.880	0.030	0.4	0.4	O K
2880 min Winter	2.874	0.024	0.3	0.3	O K
4320 min Winter	2.867	0.017	0.2	0.2	O K
5760 min Winter	2.864	0.014	0.2	0.2	O K
7200 min Winter	2.862	0.012	0.1	0.2	O K
8640 min Winter	2.860	0.010	0.1	0.1	O K
10080 min Winter	2.859	0.009	0.1	0.1	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
60 min Winter	46.096	0.0	58		
120 min Winter	28.574	0.0	92		
180 min Winter	21.285	0.0	130		
240 min Winter	17.148	0.0	168		
360 min Winter	12.605	0.0	236		
480 min Winter	10.130	0.0	304		
600 min Winter	8.542	0.0	366		
720 min Winter	7.427	0.0	426		
960 min Winter	5.951	0.0	528		
1440 min Winter	4.347	0.0	736		
2160 min Winter	3.168	0.0	1092		
2880 min Winter	2.528	0.0	1452		
4320 min Winter	1.836	0.0	2180		
5760 min Winter	1.461	0.0	2880		
7200 min Winter	1.223	0.0	3744		
8640 min Winter	1.059	0.0	4312		
10080 min Winter	0.937	0.0	4888		
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Gloucester House 66a Church Walk Burgess Hill RH15 9AS	Fort Road East Worthing Industrial Units	
Date 15-05-14 File soakaway1405.srcx	Designed by JNP Checked by	
Micro Drainage Source Control 2013.1		

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.020

Time (mins)	Area
From:	To: (ha)
0	4 0.020

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GTA Civils Ltd		Page 4																		
Gloucester House 66a Church Walk Burgess Hill RH15 9AS	Fort Road East Worthing Industrial Units																			
Date 15-05-14 File soakaway1405.srcx	Designed by JNP Checked by																			
Micro Drainage Source Control 2013.1																				
<u>Model Details</u> Storage is Online Cover Level (m) 3.900 <u>Cellular Storage Structure</u> Invert Level (m) 2.850 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.28800 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.28800 <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>15.0</td> <td>15.0</td> <td>0.500</td> <td>0.0</td> <td>21.4</td> </tr> <tr> <td>0.400</td> <td>15.0</td> <td>21.4</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	15.0	15.0	0.500	0.0	21.4	0.400	15.0	21.4			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)															
0.000	15.0	15.0	0.500	0.0	21.4															
0.400	15.0	21.4																		
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