

192 Hawthorn Road  
Bognor Regis, West Sussex, PO21 2UX

**Flood Risk Assessment and Drainage  
Strategy**

For

Lamb Property Investments Ltd

## Document Control Sheet

192 Hawthorn Road

Bognor Regis, West Sussex, PO21 2UX

Lamb Property Investments Ltd

This document has been issued and amended as follows:

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## 1.0 Introduction

- 1.1 This Flood Risk Assessment (FRA) and Drainage Strategy has been produced by Motion on behalf of their client, Lamb Property Investments Ltd. It supports the planning application for the proposed development at 192 Hawthorn Road, Bognor Regis, West Sussex. A site location plan can be seen in [Appendix A](#).
- 1.2 The development proposes to demolish an existing detached accommodation unit to the rear of 192 Hawthorn Road and deliver a ground floor extension to 192 Hawthorn Road to provide an additional self-contained residential unit within the main property. It is also proposed to internally renovate an existing detached unit from a communal area to another residential dwelling. Plans and elevations of the proposed development, as well as the existing site layout, can be seen in [Appendix B](#).
- 1.3 This FRA and Drainage Strategy will assess flood risk to the property, from all sources. It will also ensure that where there are to be changes in the impermeable areas on the site that need to be positively drained, that the most sustainable drainage option is provided. This will be informed by the local geo-environmental and infrastructure constraints and will ensure that the proposed development will not increase surface water runoff and flood risk in the area and will also provide a net reduction in surface water runoff over the existing situation.
- 1.4 The drainage strategy will demonstrate how the development will manage and discharge surface water generated in all rainfall events up to and including the 1 in 100-year + 45% storm, as is required by the NPPF. This study will not consider the internal renovations to the existing detached unit within the drainage strategy. There is to be no external changes to this building and, as such, it falls outside of the NPPF's requirements to provide a drainage strategy.
- 1.5 The proposed development falls within the administrative boundary of Arun District Council (ADC) and West Sussex County Council (WSCC) and the FRA and Drainage Strategy follows the guidance set out in:
- ✦ ADC's Supplementary Requirements for Surface Water Drainage Proposals<sup>1</sup> and ADC's surface water drainage design checklists<sup>2</sup>.
  - ✦ National Planning Policy Framework (NPPF)
  - ✦ Planning Practice Guidance (PPG) to the National Planning Policy Framework
  - ✦ CIRIA SuDS Manual 2015 (C753)
  - ✦ Environment Agency Rainfall Runoff Management for Developments
  - ✦ Non-Statutory Technical Standards for SuDS (NSTSfS)
- 1.6 This FRA and drainage strategy report pertains only to the drainage strategy for the development. It does not provide details of how the site will be drained during the construction phase. This report is also not a drainage verification report, which can only be produced post-construction. This provision of this information should be secured by the LPA by condition.
- 1.7 Similarly, this report does not provide information on how the drainage infrastructure will be protected during the construction phase of the project. The provision of this information is the responsibility of the appointed contractor.

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<sup>1</sup> <https://www.arun.gov.uk/surfacewater/>

<sup>2</sup> <https://www.arun.gov.uk/download/full-surface-water-drainage-design-checklist-pcengd2-september-2024docx.docx?ver=27069&doc=docm93jjm4n21070.docx>

## 2.0 Site Description

Table 2.1 – Site Summary

<b>Site Name</b>	192 Hawthorn Road
<b>Location</b>	Bognor Regis, West Sussex, PO21 2UX
<b>Grid Reference(s)</b>	SZ925996
<b>Site Area</b>	1,273m <sup>3</sup> (0.127 ha)
<b>Development Type</b>	As described in Paragraph 1.2
<b>Flood Zone</b>	1
<b>Surface Water Flood Risk</b>	Very Low
<b>Local Water Authority</b>	Southern Water
<b>Local Planning Authority</b>	Arun District Council (ADC)
<b>Lead Local Flood Authority</b>	West Sussex County Council (WSSC)

### Site Location and Description

- 2.1 192 Hawthorn Road is situated within a residential area of Bognor Regis. It is bounded by dwellings and the gardens of other residential properties on its western, northern and eastern sides. On its southern boundary is Hawthorn Road and, beyond that, are the sports/recreation grounds associated with Bognor Regis Sports and Cricket Club.
- 2.2 The existing site contains the main dwelling of 192 Hawthorn Road in the centre of the site. Behind the main dwelling on its northeastern boundary is a single-storey accommodation (to be demolished) and in the northwestern corner of the site is another single-storey building. This is currently a communal area.
- 2.3 There is a large existing tarmacked parking area in the west of the site, which is accessed directly from Hawthorn Road.
- 2.4 In terms of the grounds and landscaping, other than the area covered by the tarmac parking area, the rest of the site is covered with mown grass gardens, and footpaths connecting the different units on the site.
- 2.5 Plans of the existing site layout can be seen in [Appendix B](#), and a satellite view of the site showing the ground covering can be seen in [Appendix C](#).

### Topography

- 2.6 A topographic survey of the site has not been carried out to date, but a topographic review of the site has been carried out using LiDAR data, and a contour plan has been produced that shows the site contours in 0.1m intervals. This can be seen in [Appendix D](#).
- 2.7 The LiDAR contour plan shows that most of the site is between 6.7 metres Above Ordnance Datum (mAOD) to 6.8 mAOD.
- 2.8 The northwestern part of the site is marginally lower at 6.5 mAOD to 6.6 mAOD, and the car park is at a similar elevation (6.4 mAOD to 6.6 mAOD)

- 2.9 Hawthorn Road is lower than the site at 6.0 mAOD to 6.1 mAOD.
- 2.10 The arrows on the LiDAR plan in Appendix D indicate where the natural flow paths of the site would be without positive drainage.

### Geology

- 2.11 The British Geological Survey (BGS) online 1:50,000 Geindex maps show that the site is in an area with London Clay bedrock geology (Clay, Silt and Sand) and River Terrace Deposits as superficial geology (Sand, Silt and Clay). Please see Appendix E.
- 2.12 No intrusive investigations have been carried out on site to date, so to gain further understanding of the site's geology, local BGS boreholes were reviewed.
- 2.13 The nearest BGS borehole to the site is SZ99NW44, which is from a location just 250m to the north on Gravits Lane. This BGS borehole is within an area shown as being of the same geology as the site, and is at 7.2 mAOD, so is also at a similar elevation.
- 2.14 Borehole SZ99NW44 can be seen in Appendix F and describes the following geological horizons and depths in Table 2.2.

Table 2.2 – Geological Horizons and Depths from SZ99NW44

Geology	Depth (metres)	Total Depth (metres)
Tarmac and Made Ground	0.76	0.76
Firm to Stiff brown-grey sandy silty CLAY	2.13	2.89
Stiff ref MARL	0.76	3.65
Loose brown sandy GRAVEL	0.91 (to end of borehole)	4.56

- 2.15 Therefore, the River Terrace Gravels in this area of Bognor Regis are characterised by CLAY and MARL to approximately 3.66 metres Below Ground Level (mBGL).
- 2.16 This geology, along with groundwater considerations (discussed below), is prohibitive to infiltration.

### Hydrogeology and Groundwater

- 2.17 Groundwater Source Protection Zones (SPZ's) are defined around groundwater abstraction sources such as wells, boreholes and springs that are used for public drinking water supply.
- 2.18 SPZ's show the risk of contamination to groundwater from any activities that might cause pollution in the area. The closer the activity to the source of abstraction, the greater the risk. The maps show three main zones; inner – Zone 1; outer – Zone 2 and; total catchment – Zone 3.
- 2.19 Defra's Magic Map was reviewed, and none of the sites are within in any SPZ's.
- 2.20 The River Terrace Gravels are described as being a 'Secondary A' Aquifer, which means that it comprises permeable layers that can support local water supplies, and may form an important source of base flow to rivers. However, noting the geology described in Table 2.2, it is unlikely that the CLAY and MARL that is present within the superficial geological layers in the area of the site would support groundwater throughflow and water supplied.
- 2.21 Groundwater levels have not been measured on site. Bognor Regis, however, is known for having shallow groundwater levels below the surface.
- 2.22 To investigate this, local recent developments within this part of Bognor Regis and their geo-environmental site investigations were reviewed.

- 2.23 Condition Discharge Application reference BR/188/20/DOC relates to the erection of 3no. dwellings and 1no. detached garage on land to the rear of 41 – 47 Pevensey Road. The land to the Rear of 41 – 47 Pevensey Road is only 358 meters northwest of 192 Hawthorn Road.
- 2.24 As part of the drainage strategy’s investigation into the viability of infiltration as a means of surface water discharge, both infiltration testing (discussed below) and winter groundwater monitoring were carried out.
- 2.25 The results of the groundwater monitoring at land to the rear of 41 – 47 Pevensey Road can be seen in [Appendix G](#). Two windowless sampling boreholes were sunk to a depth of 3mBGL and yielded the following groundwater levels in [Table 2.3](#)

*Table 2.3 – Groundwater Levels at 41 – 47 Pevensey Road.*

Sample Borehole	17/02/2020	21/02/2020	28/02/2020
WS1	0.75mBGL	0.17mBGL	0.06mBGL
WS2	0.92mBGL	0.42mBGL	0.25mBGL

- 2.26 As can be seen, groundwater was recorded almost immediately below surface in both windowless samples.
- 2.27 The land to the rear of 41 – 47 Pevensey Road is at approximately 6.4mAOD, so a similar elevation to 192 Hawthorn Road, and the groundwater levels encountered are transferable to the current development. The shallow depth of groundwater below ground level means that infiltration would be precluded as it would not be possible to install infiltration structures and maintain a clear one metre to the annual average highest ground water levels, as per ADC’s policy requirements. If the shallowest groundwater level of 6.34mAOD (6.4mAOD minus 0.06m) is transferred to 192 Hawthorn Road, it means that groundwater levels will be only 0.36m below the average ground level of 6.7mAOD.

*Infiltration Potential*

- 2.28 Condition Discharge Application reference BR/188/20/DOC also submitted infiltration testing information. The infiltration rate that was recorded and taken forward to hydraulic modelling was  $1.4 \times 10^{-6}$  metres/sec. This is close to the minimum that can be used for infiltration-based solutions ( $1.0 \times 10^{-6}$  metres/sec). The infiltration rate of  $1.4 \times 10^{-6}$  metres/sec was used to size a soakaway, and this resulted in a design that failed the half-drain time requirement of 24 hours (the half drain time was 36 hours). This, in combination with the groundwater levels that prohibit infiltration, meant that infiltration was eschewed as a means of surface water discharge. The infiltration testing information and the subsequent failed infiltration calculations can be seen in [Appendix H](#).
- 2.29 The geology in the area, as demonstrated by the BGS borehole log in [Appendix F](#), is of CLAY and MARL down to depths of approximately 3.66mBGL. Firstly, clay geology is not generally conducive to infiltration and literature values for infiltration in clay soils supports this. BS 7533-13:2009 states that clay soils have infiltration rates in the order of  $1 \times 10^{-8}$  to  $1 \times 10^{-10}$ . Table 25.1 of CIRIA C753 supports this by suggesting infiltration rates of less than  $3 \times 10^{-8}$  are possible.
- 2.30 Because surface water drainage designs now have incorporate CV values of one, a MADD Factor of zero, and 45% for climate change, it is now the case that sites with an infiltration coefficient of  $1.0 \times 10^{-6}$  m/s are not appropriate for infiltration-based drainage strategies. This is because the additional surface water inputs that current regulations and LLFA advice prescribes means that half-drain times of 24 hours can’t be achieved in the 1 in 100-year and 1 in 30-year storms, and attenuation structures are prohibitively large, especially when additional design requirements like 300mm freeboard and 1-in-4 side slopes for SuDS basins are considered.

- 2.31 These issues are drawn into sharper focus on brownfield sites where constrained site dimensions, the need to offset infiltration structures at least five metres from all structures and boundaries, existing infrastructure, and made ground dictate that certain SuDS solutions are unavailable.
- 2.32 Therefore, because of the CLAY and MARL geology to depth that is present in the area of Bognor Regis that the site is within, the shallow groundwater below surface, and the brownfield status of the site, there is a robust argument that infiltration is unviable and unsuitable at 192 Hawthorn Road. On that basis, the drainage strategy at 192 Hawthorn Road will use alternative means of surface water discharge.
- 2.33 We expect that the LLFA will accept the basis for this approach, but if they wish for the results of BRE365 soakage testing to complete their records, a condition in this regard will be accepted.
- 2.34 Southern Water's Asset Location Plans, which are discussed below, show large surface water sewers serve the Hawthorn Road area. This is also suggestive that infiltration is not available to discharge surface water and, without local watercourses being present, the public sewer system is the only means by which surface water can be removed.

#### Existing Drainage Regime

- 2.35 The existing drainage on- and off-site has been investigated to understand how the existing buildings/site drains surface and foul water. This has been achieved through an on-site CCTV sewer survey and the obtention of Southern Water's Asset Location Plans. The nature of the on- and off-site sewers are discussed, below.

#### On-Site Drainage

- 2.36 The CCTV sewer survey, the outputs of which can be seen in [Appendix 1](#), has provided information on the condition and layout of the existing private drainage at 192 Hawthorn Road.
- 2.37 The private drainage layout plan in [Appendix 1](#) indicates that most of the site's drainage, both foul and surface water, currently drains to the rear of the site. Rainwater pipes and gullies from all buildings feed into the same private below-ground drainage as foul waste.
- 2.38 This suggests that the site's drainage is a compound system that has been added to over the years as new buildings have been erected on site or extensions have been installed. This has resulted in the connection of surface water into the foul drainage system, which drains off-site to the northeast, away from Hawthorn Road.
- 2.39 The onsite drainage also shows no attenuation features, thus all surface water discharges into the public sewerage network or to ground without restriction.
- 2.40 This is something that the proposed drainage strategy can go some way into correcting. Where the extension is to be located, and where the existing detached accommodated is to be demolished, it allows the removal of some of the surface water connections from the foul system and for them to be re-directed to surface water sewers via an attenuated system. Therefore, the proposed drainage strategy will offer multiple benefits and improvements over the existing situation.

#### Off-Site Drainage

- 2.41 Southern Water's Asset Location Plans for the area can be reviewed in [Appendix 3](#).
- 2.42 The combined foul and surface water sewerage from 192 Hawthorn Road connects to a manhole in the grounds of 190 Hawthorn Road to the northeast. The pipe issuing from this manhole to the northeast towards manhole node 5602 is shown as a public foul sewer. However, as we know, this is also taking some surface water from 192 Hawthorn Road, as well as perhaps other properties in the area that are of similar age.

2.43 There are 2no. large public surface water pipes/culverts running west-east in Hawthorn Road. Both surface water pipes are 600mm in diameter. They are relatively shallow within Hawthorn Road; which is evidenced from the nearest manhole nodes to the site. Manhole node 5551 on the first surface water pipe has an invert level (IL) of 4.03 mAOD, and manhole nide 5655, which is on the second pipe, has an IL of 5.08 mAOD.

*Existing Runoff Rates*

2.44 The site’s existing surface water runoff rates have been calculated so that they can be compared with the proposed drainage strategy. This shows ‘betterment’ that the drainage strategy will provide.

2.45 The extension to 192 Hawthorn Road requires the demolition of the existing detached accommodation unit, whose surface water load currently discharges to the foul system. Therefore, the existing surface water runoff rate from this building should be included.

2.46 The area that will be occupied by the extension partly overlaps with the detached accommodation unit that is to be demolished. The remaining footprint of the proposed extension is on land that is primarily mown lawn, with some footpaths. To simplify how the existing runoff rate should be calculated for this area, it will all be considered as greenfield.

2.47 The areas final areas that must be assessed for existing runoff are the roof areas that currently drain to side of the main dwelling that will be occupied by the extension. Surface water that runs off from these roof areas, and which currently connects to the foul sewer system, must be re-routed and disconnected from the foul sewer system. Therefore, their existing surface water discharge rates must be considered.

2.48 The areas that are occupied by the above components of the existing site are as follows in Table 2.4:

*Table 2.4 – Areas of the site that are subject to change (with regards to surface water runoff)*

<b>Site Component</b>	<b>Area</b>
The detached accommodation area	76.92 m <sup>2</sup>
Main dwelling roof area (to be rerouted)	56.73 m <sup>2</sup>
The proposed extension area (47.53m <sup>2</sup> ), excluding that which overlaps with the detached accommodation (5.02m <sup>2</sup> )	42.51 m <sup>2</sup>

2.49 These areas have been illustrated and annotated by the plans in Appendix K.

2.50 It is these areas whose surface water loads will undergo change in terms of being added, re-routed or changed, thus will inform the existing runoff rates. As the detached accommodation and main dwelling’s roof area are impermeable, their existing (brownfield) runoff rate will be calculated using the Modified Rational Method, with rainfall intensities for different return periods extracted from Table 1(a) of the Transport and Road Research Laboratory Report – Estimated Rainfall for Drainage Calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young.

2.51 The Modified Rational Method Equation is:

$$Q_n = 2.78CiA$$

Where:

**C** = Runoff Coefficient (which is assumed to be ‘1’ in this case to represent impermeable areas)

**i<sub>n</sub>** = Rainfall intensity for a **n** return period (mm/hr) as prescribed by Table 1(a) of TRRL LR 595

**A** = Impermeable Area

**Q<sub>n</sub>** = Runoff for **n** return period

The rainfall intensities for different return periods extracted from Table 1(a) of TRRL Report LR 595 are:

**i<sub>1</sub>** = 50.8 mm/hr

**i<sub>30</sub>** = 113.02 mm/hr

**i<sub>100</sub>** = 143.9 mm/hr

2.52 Using the above calculation and the areas provided in Table 2.4, the brownfield runoff rate for the existing detached accommodation and the main dwelling's roof area is as follows in Table 2.5.

*Table 2.5 – Brownfield Runoff Rate From Existing Impermeable Areas*

Site Component	Area	Return Period		
		1 in 1	1 in 30	1 in 100
The existing detached accommodation	76.92 m <sup>2</sup>	1.09 l/s	2.42 l/s	3.08 l/s
Main dwelling roof area to be rerouted	56.73 m <sup>2</sup>	0.80 l/s	1.78 l/s	2.27 l/s
<b>TOTAL:</b>	<b>133.65m<sup>2</sup></b>	<b>1.89 l/s</b>	<b>4.2 l/s</b>	<b>5.35 l/s</b>

2.53 It should be emphasised that this current surface water load is being discharged to the foul sewer. Although this is an existing connection, it does not accord with Southern Water's current guidance, which is that surface water cannot connect to foul or combined sewers under any circumstance. Therefore, because the proposed development will remove the surface water load from the detached accommodation from the foul sewer, and reroutes some of the surface water from the main dwelling away from the foul sewer and to a dedicated surface water system, there are multiple benefits to the development's drainage strategy that should not be overlooked by the LPA/LLFA or Southern Water.

2.54 The greenfield runoff rate for the area that is to be occupied by the extension has been calculated using FEH2022 QMED values in MicroDrainage using the catchment descriptors methodology, which includes the following input variables:

- ✦ Site Location
- ✦ SAAR – Standard Average Annual Rainfall 1961 – 1990 (mm)
- ✦ SPR Host - Standard percentage runoff derived from HOST soils data
- ✦ URBEXT - The extent of urban and suburban cover
- ✦ BFIHOST - Baseflow index derived from Hydrology of Soil Types (HOST) soils data
- ✦ FARL - Index of flood attenuation due to reservoirs and lakes
- ✦ Catchment Area - Hectares

2.55 The QMED calculation sheet from MicroDrainage can be seen in [Appendix L](#) and is expressed as a runoff rate per hectare. This is summarised in Table 2.6, below.

Table 2.6 – QMED Runoff Rate

QMED Rural (l/s/ha)	QMED Urban (l/s/ha)
2.7	5.4

- 2.56 The calculated QMED Rural value of 2.7 l/s/ha is equivalent to a rate of 0.011 l/s over the 42.51m<sup>2</sup> area of the proposed extension (minus where it overlaps with the location of the existing detached accommodation). This is so low as to be considered negligible, thus the existing runoff rates that will be compared to the proposed drainage strategy will only include those summarised in Table 2.5.
- 2.57 The drainage strategy for the proposed extension and the existing roof areas of the main dwelling that will need to be rerouted are discussed in Section 7 of this report following the discussion of current and future flood risk.

### 3.0 Flood Risk Legislative and Policy Framework

3.1 As of April 2015, the LLFA became a statutory consultee on all major planning applications. The LLFA is required to assess planning applications in respect of surface water drainage and sustainable drainage systems. WSCC is the LLFA for the Bognor Regis area and will preside over major applications. However, for minor applications such as this, ADC has devolved powers and drainage engineers who will review matters pertaining to local sources of flood risk.

3.2 LLFA's including WSCC and ADC have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from local sources, such as surface water run-off, groundwater and ordinary watercourses (i.e. non main rivers). The EA plays a role in managing the watercourses designated as 'main rivers'.

#### The Environment Agency Flood Map for Planning

3.3 The Environment Agency's Flood Map for Planning gives an indicative prediction of areas at risk of fluvial and tidal flooding. The mapping is an amalgamation of modelled flood levels and historical flood event outlines.

3.4 The Flood Map is split into 'Flood Zones', which demarcate the extent of flooding from rivers or the sea for different return periods. The Flood Map for Planning shows the extent of the natural floodplain if there were no defences or other man-made structures. They do not provide a definitive picture of where flooding would occur; rather, they provide an indicative prediction of areas at risk.

3.5 Table 3.1, below, lists the flood zone categories and explains the flood risk probabilities they represent.

Table 3.1 – Flood Zone Categories

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of tidal flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of tidal flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood, which is typically the 1 in 30-year flood event or greater. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map, but may be distinguished in Product 4 information, for example)

#### The National Planning Policy Framework

3.6 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The Planning Practice Guidance (PPG) to the NPPF provides further information on the policies set out in the NPPF. It encourages development to take place in areas of lower flood risk wherever possible and stresses the importance of preventing increases in flood risk off-site to the wider catchment area. This includes ensuring that flood risk is considered at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest.

- 3.7 The process of directing development away from those areas where risks are highest is the sequential test. It covers all forms of flooding, and this is covered in Paragraphs 23 and 24 of the NPPF. Following the December 2024 update to the NPPF, Paragraph 175 was added that states that development can be appropriate on sites with flood risk *“in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future”*. This essentially means that if a sequential approach is applied within the site boundary, and areas of flood risk now and in the future are avoided, that flood risk should not prevent the development coming forward.
- 3.8 A site-specific FRA is required for proposals of 1ha or greater in Flood Zone 1, all proposals for development in Flood Zones 2 and 3, or in an area within Flood Zone 1 that has critical drainage problems (as notified to the local planning authority by the EA). There are areas of surface water flood risk near to the site, and because Bognor Regis is known for high groundwater levels, flood risk will be reviewed for the completeness of the application.
- 3.9 A FRA should identify and assess the risks of all forms of flooding and demonstrate how these flood risks will be managed so that a development remains safe throughout its lifetime, taking climate change into account.
- 3.10 Within each Flood Zone, a key factor in determining planning applications for development is the flood risk vulnerability of a development. Table 2 of the PPG to the NPPF categorises different development types according to their vulnerability to flooding. These categories are:
- ✦ Essential infrastructure;
  - ✦ Highly vulnerable development;
  - ✦ More vulnerable development;
  - ✦ Less vulnerable development, and;
  - ✦ Water-compatible development.
- 3.11 Within the different Flood Zones each of the above development categories are considered appropriate or not permissible. The Technical Guidance to the NPPF lists these as:
- Flood Zone 1:**
- ✦ All the development categories listed above are appropriate.
- Flood Zone 2:**
- ✦ Water-compatible, less vulnerable development, more vulnerable development and essential infrastructure is appropriate in this zone.
- Flood Zone 3a:**
- ✦ Water-compatible and less vulnerable development is appropriate in this zone. Highly vulnerable development should not be permitted in this zone.
- Flood Zone 3b:**
- ✦ Only water-compatible development and essential infrastructure that must be there should be permitted in this zone.
- 3.12 The above information sets out the basis by which developments must be assessed in terms of flood risk.
- 3.13 Each of the development sites will be reviewed against the Flood Zone in which they are locate and an assessment will be made of the appropriateness of the proposed development, as per the advice within

the PPG to the NPPF, and taking account of the proposed site layouts for the development shown in Appendix B.

## 4.0 Current Flood Risk

4.1 Flooding can arise from a variety or combination of sources. These may be natural or artificial and may be affected by climate change. These are discussed, below, in the following two sections and summarised in Table 6.1. The probability of any likely impacts is also assessed, where necessary.

### Flooding from Rivers and the Sea

4.2 The Environment Agency's Flood Map for Planning (Appendix M) for 192 Hawthorn Road shows that it is within Flood Zone 1. Consequently, it can be summarised that the proposed development is not within a fluvial or tidal flood risk area, now or in the future, and the residual flood risk to the site is zero.

### Fluvial Flood Risk and the Appropriateness of the Development in this Location

4.3 The proposed residential development is 'more vulnerable' according to the classifications in the NPPF.

4.4 Table 3 of the PPG to the NPPF (see below) states that 'more vulnerable' developments are appropriate in Flood Zone 1, thus the proposed development is appropriate in this location with the current and future level of flood risk.

Table 3 of the NPPF - Flood Risk Vulnerability and Flood Zone Compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

### Surface Water Flooding

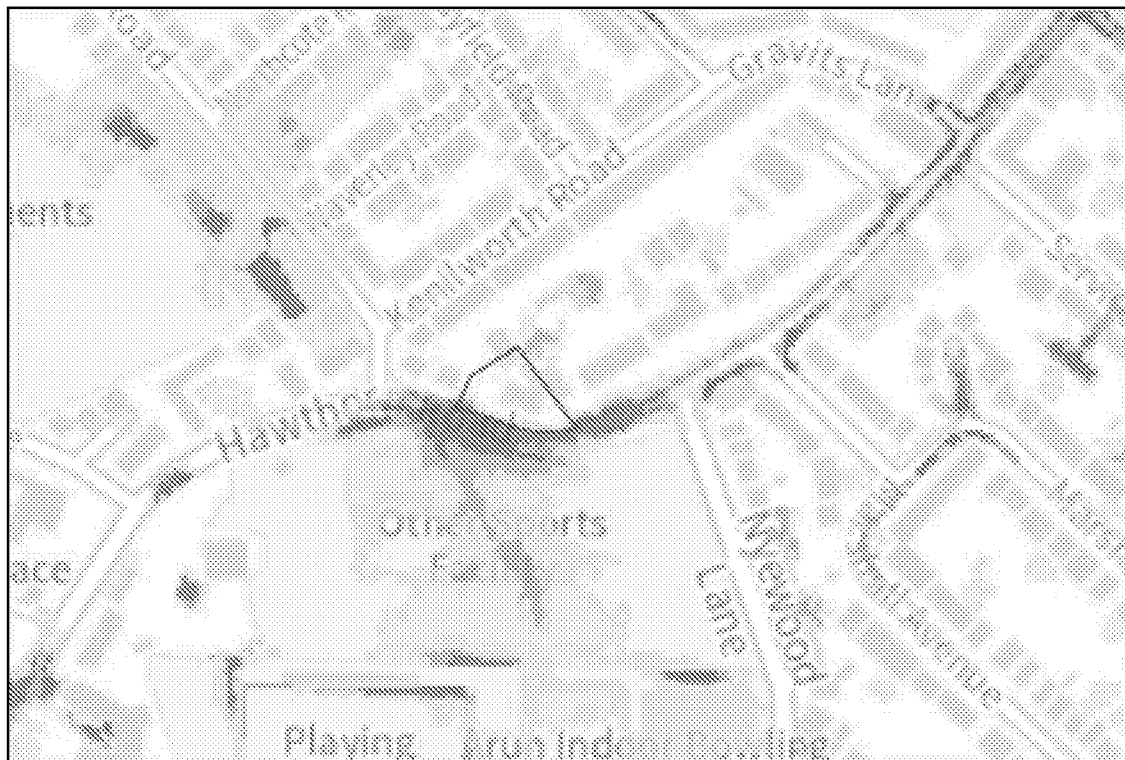
4.5 Surface water, or pluvial flooding, results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

4.6 In these conditions surface water can build up where the topography allows it to converge or pond. Where it gathers it will travel down prevailing gradients. Pluvial flooding then occurs at locations where significant surface water flow paths converge, at localised low points and/or due to overland obstructions. In urban areas pluvial flooding often occurs where the built environment channels overland flow routes (down roads that are bounded by kerbs, for example) or where there are obstacles to the natural overland

flow routes. Boundary walls and buildings are often the main causes and, hence, the likelihood of pluvial flooding to impact property and gardens.

- 4.7 Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).
- 4.8 The EA's Risk of Flooding from Surface Water (RoFSW) map was updated and refined in January 2025. The map uses improvements in data, technology and modelling and includes information and input from LLFAs, where this is available. This New National Model (NNM) for surface water represents a significant improvement over previous national-scale models with more targeted risk areas that tie in better with local land features and overall topography.
- 4.9 The updated RoFSW mapping includes a present-day risk prediction as well as one for the 2040 – 2060 scenario, i.e., with an inclusion for climate change. This allows current and future surface water flood risk to be fully considered.
- 4.10 Only the 2040 – 2060 scenario maps are included in Figure 4.1, below, so that the maximum, future surface water flood risk in the area is considered. The scale of the map is the best available.

*Figure 4.1 – Surface Water in 2040 – 2060 Scenario*



- 4.11 Figure 4.1 shows that there is an area of surface water flood risk that is fed from Hawthorn Road to the east and the sports ground to the south. This converges in the highway on the southern frontage of 192 Hawthorn Road. This area of low (1 in 1,000-year), medium (1 in 100-year) and high (1 in 30-year) surface water flood risk does not extend into the boundary of 192 Hawthorn Road and certainly is not within the area of the proposed extension.
- 4.12 This will be because, as discussed in Section 2, the Hawthorn Road is in the range 6.0 mAOD to 6.1 mAOD and the site levels are approximately 600mm higher at 6.7 mAOD to 6.8 mAOD.

- 4.13 On that basis, surface water is not an impediment to the proposed extension. The extension is in an area of very low risk of surface water flooding, now and in the future, and the proposed drainage strategy will reduce surface water runoff to Hawthorn Road, which will reduce surface water runoff locally.

*Groundwater Susceptibility*

- 4.14 There are no flood risk maps for groundwater, as stated by the Environment Agency in their 2011 guidance note 'flooding from groundwater'. Mapping products currently available only show areas where the geological and hydrogeological conditions *may* combine to cause groundwater flooding, but they should not be considered as groundwater flood risk maps. They only show *susceptibility* to groundwater flooding.

- 4.15 There are several mapping products that depict areas that may be susceptible to groundwater flooding, but they are not comparable in detail to the risk maps developed for fluvial, tidal and surface water, such as those scrutinised above and used to support planning decisions. The mapping does not show the likelihood of groundwater flooding occurring and can only be considered as a hazard, but not a risk-based dataset.

- 4.16 As such, the mapping products can be viewed as indicative at best and should only be used as a prompt to review site-based information to determine whether groundwater is a risk factor that should be considered. Indeed, the Environment Agency state that:

*"The susceptibility data should not be used on its own to make planning decisions at any scale and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding."*

- 4.17 To investigate groundwater flooding susceptibility, this FRA will review groundwater flooding susceptibility mapping, which can be seen in Appendix N. There are three different forms of groundwater susceptibility mapping, which are discussed in turn, below.

*BGS Geological Indicators of Flooding*

- 4.18 The BGS Geological Indicators of Flooding map shows that 192 Hawthorn Road is not within an area considered to have any geological indicators of groundwater flooding.

*BGS Groundwater Flooding Susceptibility*

- 4.19 Conversely, the BGS Groundwater Flooding Susceptibility map shows that the site is within an area with potential for groundwater flooding at the surface. This perhaps reflects the local groundwater data that was discussed in Section 2 where groundwater levels are shallow below the surface.

*Geosmart Information Groundwater Flood Map*

- 4.20 The Geosmart Information Groundwater Flood Map places the site in an area of 'low' risk.

*Groundwater Flooding Susceptibility Summary*

- 4.21 There is a mixed overall picture of groundwater flooding susceptibility by the three mapping products. The proposed development is unlikely to be at risk of groundwater flooding, but it should be aware of the shallow groundwater levels (as discussed in Section 2) and any below-ground structures should be lined to ensure that there can be no groundwater ingress.

*Flooding from Infrastructure Failure*

- 4.22 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or because of a reduction in capacity due to collapse, siltation, blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

- 4.23 Typically, sewer systems are constructed to accommodate rainstorms with a 30-year return period or less, depending on their age. Consequently, rainstorm events greater than 1 in 30-years would be expected to result in surcharging of some parts of the sewer system. In fact, due to most gullies being poorly maintained and often partially blocked with silt, leaves and other debris, their capacity is often estimated to be closer to the 1 in 10-year storm.
- 4.24 The CCTV survey and the subsequent report of the existing site drainage ([Appendix I](#)) has made full recommendations with regards to what needs attention, enabling the site owners to remediate any issues with the existing drainage infrastructure.
- 4.25 The areas of the site that are to be redeveloped and new drainage infrastructure will be installed will be designed to attenuate the 1 in 100-year + 45% rainfall event. This means that the new drainage will be at very low risk of flooding from infrastructure failure.
- 4.26 Moreover, a drainage management and maintenance plan will also be provided for the site's new drainage infrastructure. Aspects of this will also apply to the site's existing drainage infrastructure (advice relating to pipes and manholes, and inspection frequencies and practices, for example). This will contribute to the onsite drainage infrastructure working at its optimum capacity. This will ensure that residual flood risks to the site from its internal drainage systems will be minimised.
- 4.27 The drainage management and maintenance plan is discussed later in this report.

#### *Flooding from Artificial sources*

- 4.28 The EA provides a map showing the maximum potential flood extent should all reservoirs with a capacity of greater than 25,000 cubic metres fail and release the water they hold.
- 4.29 The map shows that 192 Hawthorn Road would not experience flooding in this scenario.
- 4.30 There are no canals in the local area to create flood risk either.

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## 5.0 Future Flood Risk & Climate Change

- 5.1 The NPPF and the supporting Planning Practice Guidance document sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.

### Peak River Flows

- 5.2 The site is within Flood Zone 1 and there are no significant watercourses within or on the site boundary. Therefore, the site will continue to be at low risk of fluvial flooding in the future and peak river flows do not need to be discussed any further.

### Peak Rainfall Intensity and Climate Change

- 5.1 With climate change, peak rainfall intensities are expected to increase, which would result in increased surface water flows and, potentially, flooding.
- 5.2 The discussion of surface water flooding in this report referred to the future surface water flood risk scenarios and the data in the updated RoFSW mapping shows that surface water flood risk on the site is not expected to increase. Therefore, future peak rainfall intensity has already been addressed in terms of surface water flood risk.
- 5.3 The drainage strategy for the proposed extension will also be designed to fully account for future peak rainfall intensities. A climate change increase for the 1 in 10-year, 1 in 30-year and 1 in 100-year rainfall events will be applied to the hydraulic model and drainage design, to ensure that all surface water loads, for the lifetime of the development, are fully considered.
- 5.4 This approach ensures that the development will not be at risk of flooding from surface water now or in the future.

## 6.0 Summary of Flood Risk

6.1 Table 6.1, below, summarises the level of flood risk to the three site.

Table 6.1: Summary of Flood Risk

Flood Source	Risk Level				Comment
	High	Medium	Low	Very Low	
Fluvial				X	Flood Zone 1 (present day and in the future)
Tidal				X	Not within a tidal flood risk area
Groundwater		X			Groundwater shallow below surface
Surface Water			X		Sites at very low risk of flooding, but higher flood risk areas in Hawthorn Road.
Canals				X	There are no canals in the vicinity
Reservoirs				X	The Reservoir Flood Risk Map places the site well outside a maximum extent of flooding
Infrastructure Failure				X	The site's infrastructure will be properly managed and maintained, as per the prescription in the drainage management and maintenance plan, which will minimise the risk of flooding due to infrastructure failure.
Increase due to Climate Change				X	Future fluvial flood risk has been discussed, and the drainage strategy will accommodate surface water generated in the 1 in 100 + 45% rainfall event.

## 7.0 Surface Water Drainage Strategy

### Sustainable Drainage Overview

- 7.1 Current planning policy and Environment Agency guidance requires developments to employ SuDS (Sustainable Drainage Systems) techniques wherever feasible. Careful design of SuDS features can ensure that a development's surface water drainage closely reflects the natural hydrology of the pre-developed site.
- 7.2 SuDS will attenuate and treat surface water run-off quantities at the source (source control) in line with current guidance and best practice.
- 7.3 Source control systems treat surface water close to the point of origin, in features such as soakaways, permeable paving and swales, to name a few.
- 7.4 The key benefits of SuDS are as follows:
- Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g., roads);
  - Improving amenity through the provision of open green space;
  - Improving biodiversity through increased areas for wildlife habitat; and
  - Enabling a natural drainage regime that recharges groundwater (where possible).
- 7.5 SuDS provide a flexible approach to drainage, with a wide range of components from soakaways to large-scale basins or ponds. The individual techniques should be used where possible in a management train that mimics the natural pre-developed pattern of drainage.

### Target Runoff Rate for the Development

- 7.6 As discussed in Paragraphs 2.44 to 2.52, it is only the area of the proposed extension and the areas of roof drainage that will need to be redirected due to the proposed extension that need to be considered in the drainage strategy. The areas to be included for surface water runoff and attenuation in the drainage strategy differ from those assessed for the existing site runoff rate in Table 2.5. This is because the full area of the extension should be included, not just that which does not overlap with the area of the detached accommodation.
- 7.7 The areas that are included in the drainage strategy are listed in Table 7.1, below, and are shown in the impermeable area plan in Appendix O.

*Table 7.1 – Impermeable areas to be included in the drainage strategy*

Site Area	Area
The proposed extension	47.53m <sup>2</sup>
The main dwelling roof area to be rerouted	56.73 m <sup>2</sup>
<b>TOTAL:</b>	<b>104.26m<sup>2</sup></b>

- 7.8 The greenfield runoff is calculated using the QMED runoff rate, which has already been discussed and presented in Appendix L and Table 2.6 of this report.
- 7.9 The calculated QMED Rural value of 2.7 l/s/ha is equivalent to a rate of 0.0028 l/s over the 104.26m<sup>2</sup> of areas that need to be positively drained as part of the development. This greenfield runoff rate is

extremely low – far too low to be achieved because no flow control structures exist that can control surface water runoff to such infinitesimally small rates. With this in mind, and because infiltration is not an option for the proposed development, **this drainage strategy will not prescribe any flow control device for surface water runoff with individual discharge rates of less than 1 l/s in order to reduce blockage risk and to reduce future flood risk.**

#### Drainage Strategy Overview

- 7.10 The proposed development is small scale. In reflection of this, the drainage strategy for the areas of site that will be changed and must be positively drained will utilise a simple but effective SuDS strategy that offers all four SuDS pillars. This discussion of the drainage strategy should be read in conjunction with a review of the drainage strategy details in [Appendix P](#).
- 7.11 Firstly, it is recommended that 100 litre water butts are fitted to the downpipes of the extension and the rerouted roof water from the main dwelling. While water butts cannot be considered attenuation, they reduce the reliance on potable water supplies during external water use activities such as gardening and car washing. Water butts can also provide small amounts of storage for surface water and can often assist in achieving zero discharge for rainfall depths up to 5mm, which covers 50% of annual rainfall events (according to the EA's Rainfall Runoff Management for Developments report – SC030219).
- 7.12 It is proposed that the 104.26m<sup>2</sup> of new and rerouted roof drainage will be directed to a rainwater garden located in the existing garden/greenspace within the site. Rainwater will initially pass through a catchpit to remove silts and gross solids, prior to discharging into the permeable subbase of the rainwater garden, which will attenuate and filter surface water.
- 7.13 Flow from the rainwater garden will be restricted by a hydrobrake with a maximum discharge rate of 1.0 l/s. As stated earlier in this report, the surface water drainage will outfall to a dedicated surface water system, rather than the foul system as it currently does. This system is the public surface water sewerage in Hawthorn Road.
- 7.14 The details of the rainwater garden are as follows and can also be seen in the drainage details in [Appendix P](#).
- ✦ Cover Level: 6.7 mAOD (ground level)
  - ✦ Invert Level: 5.5 mAOD
  - ✦ Length: 5m
  - ✦ Width: 1.5m
  - ✦ Crushed Stone Depth: 0.8m (5.5 mAOD – 6.3 mAOD)
  - ✦ Crushed Stone Porosity: 30%
  - ✦ Crushed Stone volume: 1.8m<sup>3</sup>
  - ✦ Inflow via Polypipe Linflex Filter Drain
  - ✦ Outflow via separate Polypipe Linflex Filter Drain to ensure clean flow towards hydrobrake
  - ✦ Geomembrane surround on sides and base to resist groundwater ingress
  - ✦ Geotextile layer above crushed stone and below soil/shingle layer
- 7.15 The use of rainwater gardens is a SuDS strategy that fits seamlessly within the garden and landscaping of the property. It also provides all SuDS pillars; it reduces water quantity through attenuation, improves water quality through the removal of pollutants and silts, provides amenity and aesthetic value and, finally, provides a biodiversity benefit through the replacement of lawn grass with a mixture of planting within the rainwater garden. A comprehensive guide to rainwater gardens is included in [Appendix Q](#), which also includes suggested plant species for use within the rainwater garden.

- 7.16 Another factor that has been stated earlier in this report and that should not be overlooked is that the surface water from the parts of the site to be developed are currently going to the foul sewer. The proposed drainage strategy will correct this and provide an outfall to the surface water sewer via a SuDS feature.
- 7.17 The drainage strategy for the development has been modelled in MicroDrainage’s Network hydraulic modelling module to ensure that it can provide the requisite attenuation up to and including the 1 in 100-year rainfall event, with a 45% inclusion for climate change. The outputs of the MicroDrainage hydraulic modelling, as well as a comparison of the existing and proposed surface water discharges from the site, is presented later in this report.

#### Design Criteria

- 7.18 The drainage strategy has been designed in accordance with the design criteria outlined in ADC’s Supplementary Requirements for Surface Water Drainage Proposals<sup>3</sup> and ADC’s surface water drainage design checklists<sup>4</sup>, where they are applicable to this site.
- 7.19 This ensures that the drainage strategies accord with local policy requirements (as well as those of the NPPF). In brief, this includes:
- ✦ Using FEH 2022 data rather than FSR data. It should be noted that the dropdown menu in MicroDrainage’s Network module only allows the choice of 1999 data and 2013 data but allows the upload of any data – including FEH 2022. Therefore, the user can use FEH 2022 data but is forced to do it under the label of 2013 data. As such, the MicroDrainage results included with this report state that FEH 2013 data has been used, but we would like to assure that LLFA that FEH 2022 has been used. To this end, the full FEH 2022 data, including Catchment Descriptors and Catchment Rainfall has been presented in Appendix R.
  - ✦ Using a runoff coefficient (CV) value of 1.0 in all hydraulic modelling (for both summer and winter storms)
  - ✦ Reducing the MADD Factor (which assumes 10m<sup>3</sup> of pipe storage per hectare) to zero.
  - ✦ Urban Creep has been considered, but it is not applicable to the site as it is a block of flats and urban creep is not applicable to flats/apartments.
  - ✦ The full suite of rainfall events has been used (up to the 5,760-minute storm, which is maximum allowable when using FEH data).
  - ✦ The maximum rainfall intensity has been raised to 550mm/hr to ensure that the full hydrograph is included in the hydraulic calculations.
  - ✦ The maximum half-drain times for the drainage strategy does not exceed the 1,440-minute (24-hour) requirement for this metric for the 1 in 100-year + 45% storm. The maximum half drain time is 52 minutes.
  - ✦ Buoyancy of the rainwater garden in this area of high groundwater is not an issue because the mass of the crushed stone and growth/planting media will offset this

#### Urban Creep

- 7.20 As stated above, Urban Creep has been considered but is not applicable to the development as the property of 192 Hawthorn Road is a block of flats. Urban creep is not applicable to flats.

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<sup>3</sup> <https://www.arun.gov.uk/surfacewater/>

<sup>4</sup> <https://www.arun.gov.uk/download/full-surface-water-drainage-design-checklist-pcengd2-september-2024docx.docx?ver=27069&doc=docm93jjjm4n21070.docx>

## Summary

7.21 The approach to the layout and design of the surface water drainage strategy has been outlined and presented in the plans in *Appendix P* of this report. With specific reference to the drainage hierarchy, the proposed drainage strategy is discussed, below.

### The Drainage Hierarchy

7.22 The NPPF states that opportunities to reduce overall flood risk should be sought and achieved through sustainable development and careful drainage design. This can be achieved through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems (SuDS). SuDS are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:

- Reduce the causes and impacts of flooding;
- Remove pollutants from urban run-off at source;
- Combine water management with green space with benefits for amenity, recreation and biodiversity.

7.23 To deliver SuDS benefits and ensure that a development reduces overall flood risk, there is an established hierarchy of surface water drainage methods that should be considered. The most preferable and sustainable are at the top and the least preferable and least sustainable at the bottom.

7.24 The drainage hierarchy is a sequential check that intends to ensure that all practical and reasonable measures are taken to manage surface water as high up the hierarchy (with '1' being the highest) as possible, and that the amount of surface water managed at the bottom of the hierarchy is minimised. The Planning Practice Guidance to the National Planning Policy Framework (NPPF) states that "*Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable*".

7.25 The drainage hierarchy presented in the NPPF presents only four tiers of drainage options. This has been expanded on and adopted by others and now can be viewed as the following:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer
8. Discharge rainwater to the foul sewer

7.26 Developers should not choose the method that is the most convenient or represents the lowest cost. LPA's, LLFA's and Water Authorities may enforce the surface water drainage hierarchy and demand that the highest practicable tier of the hierarchy is used before accepting the use of lower, less sustainable tiers.

7.27 The first two tiers of the drainage hierarchy ensure that surface water is retained within the site boundary and does not increase flood risk to others. This is always the most preferable method of surface water management.

- 7.28 The next six tiers of the hierarchy provide regional control, but with decreasing levels of pollution removal and reduced potential for amenity and habitat creation.
- 7.29 Within the lower six tiers of the drainage hierarchy, there must be some form of flow restriction, so that off-site surface water discharge is reduced, as much as is reasonably practicable. This requires on-site storage facilities, which may include ponds, swales, subsurface storage tanks and System C (non-infiltration) permeable pavements with flow control devices. Again, methods that provide the most potential for amenity and pollution removal should be favoured.
- 7.30 With regards to the proposed development and its drainage strategy, the tiers of the drainage hierarchy that have been achieved are summarised in Table 7.2, below:

*Table 7.2 - Compliance with the Drainage Hierarchy*

Tier	Discharge Method	Achievement of Tier	Notes
1	Store rainwater for later use	✓	Water butts specified
2	Use infiltration techniques	✗	Not viable: clay soils, high groundwater.
3	Attenuate rainwater in ponds or open water features	✓	Rainwater gardens
4	Attenuate rainwater by storing in tanks or sealed water features	✗	N/A
5	Discharge rainwater direct to a watercourse	✗	No watercourses in the area
6	Discharge rainwater to a surface water sewer/drain	✓	Surface water outflow directed to public surface water system
7	Discharge rainwater to the combined sewer	✗	N/A
8	Discharge rainwater to the foul sewer	✗	N/A

### Summary

- 7.31 Because infiltration is not viable and there are no watercourses in the area, the drainage strategy for the proposed extension uses the highest available tiers of drainage hierarchy for both attenuation and discharge. Moreover, the proposed drainage strategy removes surface water discharge to the foul sewer as it currently does, so provides multiple benefits to the local sewerage system and a reduction in flood risk.

### MicroDrainage Hydraulic Modelling

- 7.32 The drainage strategies for each development area have been designed in MicroDrainage's Network hydraulic modelling module.

- 7.33 The results of the MicroDrainage hydraulic modelling for the development can be seen in Appendix S. The rainwater garden has been modelled as a filter drain because rainwater gardens do not exist within MicroDrainage as a structure. The filter drain was used as a proxy for the rainwater garden because of how the porous subbase media within rainwater gardens is structurally identical to a filter drain.
- 7.34 The results of the hydraulic modelling confirm that the drainage strategies as outlined above can attenuate and discharge all surface water generated in the 1 in 100-year + 45% rainfall event, inclusive of all LLFA requirements and design criteria, without flooding.
- 7.35 The discharge rates of the drainage strategy to the surface water sewer should be compared to what is currently discharging to the foul sewer and will be removed. This shows the improvement and overall benefit that the proposed drainage strategy provides over the existing situation. This is in Table 7.3, below.

Table 7.3 - Comparison of existing and proposed surface water discharges to the site

Runoff	Where to	Return Period		
		1 in 1 / 1 in 2	1 in 30	1 in 100
Existing Surface Water Runoff Rate	Foul sewer	1.89 l/s	4.20 l/s	5.35 l/s
Proposed Surface Water Runoff Rate	Surface water via SuDS	0.70 l/s	0.90 l/s	1.00 l/s
<b>Reduction (l/s):</b>		<b>1.19 l/s</b>	<b>3.30 l/s</b>	<b>4.35 l/s</b>
<b>Reduction (%age):</b>		<b>63%</b>	<b>79%</b>	<b>81%</b>

- 7.36 Therefore, the proposed drainage strategy represents a minimum 63% reduction in surface water runoff and also removes a significant surface water load from the foul sewer and redirects it to the surface water sewer.

## 8.0 Foul Water Drainage

- 8.1 The peak foul flow rate from the proposed extension has been calculated based on Southern Water's foul sewerage modelling criteria. In summary, the calculation is based on the foul flow element, plus an allowance for misconnected surface water. While this is unlikely noting the small scale of the development and the improvements to the site's overall drainage that are proposed, it provides a precautionary approach.
- 8.2 It is proposed that the foul waste from the proposed extension will connect to the existing private foul sewerage on site, which drains to the northeastern site boundary and towards the public foul sewer thereafter.
- 8.3 Based on Southern Water's foul sewerage modelling criteria, the calculated design foul flow from the proposed development is 0.01 l/s. Because of the surface water load that is being removed from the development, plus the existing foul load that is being removed through the demolition of the detached accommodation, the development doesn't represent an increase in foul loads but does represent an overall decrease in the burden on the local foul sewerage.
- 8.4 Therefore, we do not anticipate any issues with the proposed development and the capacity of the foul sewer.
- 8.5 All Water and Sewerage Companies (WaSC's) have a legal obligation under Section 94 of the Water Industry Act 1991 (the Act) to provide developers with the right to connect to a public sewer regardless of capacity issues. This, in conjunction with Section 91(1) of the Act effectively means that Southern Water cannot object and the LPA cannot refuse to grant planning permission on the grounds of insufficient capacity or that no improvement works are planned for an area. The case precedent for this is a Supreme Court decision in *Barratt Homes vs Welsh Water*, in which the court held that the developer has an absolute right to connect to the existing sewer, whether or not it overloads the system. It ruled that the specific wording of the legislation allows for this right to be exercised, at no cost to the developer, apart from the normal connection charges.
- 8.6 Where local sewerage infrastructure constraints are identified, network reinforcements are delivered by the WaSC through New Infrastructure Charges on developers. For non-strategic sites, the WaSC company have a maximum of 24 months to deliver sewerage improvements from the date of the outline or full planning consent.
- 8.7 New Infrastructure Charges on developers mean that the delivery of improvements to drainage is generally linked to funding made available from approved planning permissions.
- 8.8 Therefore, if there are any existing capacity issues in the local public foul sewerage, this would be addressed by the network reinforcement process, and the proposed development would bring about an increase in the capacity and condition of the local foul sewerage so that it will have capacity for the new development's foul drainage.

## 9.0 Surface Water Runoff Quality

- 9.1 The NPPF states that development should not have a detrimental impact on the environment, including the water environment. The technical guidance to the NPPF provides further advice on the benefits of ensuring runoff quality is to an appropriate standard.
- 9.2 The CIRIA SuDS Manual provides guidance on the treatment of surface water runoff. With regards to the proposed development the only surface water that needs treatment is roof water.
- 9.3 Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roof water runoff as 'very low'. The only requirement for roof water runoff is the removal of gross solids and sediments.
- 9.4 This would be achieved using the catchpit 'upstream' of the rainwater garden. Additionally, the Polypipe Linflex filter pipe is lined with geotextile, which would stop silts and fines entering the porous subbase media of the rainwater garden, which itself has a filtration effect on surface water flows and would be sealed with geomembrane and geotextile itself. Once surface water leaves the subbase media of the rainwater garden, it would be completely filtered and free of gross solids and sediments.
- 9.5 The drainage strategy is not taking surface water from any parking or vehicle accesses, thus no further pollution mitigation strategies are required to account for metals and hydrocarbons, as these will not be present in the roof water.

## 10.0 Residual Risk

- 10.1 Whilst the drainage strategy has been designed to attenuate surface water from the 1 in 100-year plus 45% rainfall event, there could be a small residual risk of failure or poor performance of on-site infrastructure. Therefore, appropriate and regular maintenance of the drainage infrastructure should be undertaken by the site management agents.
- 10.2 To assist with this process, a Drainage Management and Maintenance Plan has been prepared, which sets out the principles for the long-term management and maintenance of the proposed surface water drainage components specified in the development. The Drainage Management and Maintenance Plan can be seen in [Appendix T](#).
- 10.3 The purpose of this document is to ensure that there is a robust inspection and maintenance plan going forwards. This will help ensure the optimum operation of the surface water drainage systems and that they will be regularly maintained for the lifetime of the development. This will contribute to reducing the risk of surface water flooding both on- and off-site.

## 11.0 Exceedance Events

- 11.1 Exceedance events are those greater than the design rainfall event (i.e., greater than the 1 in 100-year rainfall event plus 45% for climate change).
- 11.2 Any rainfall events greater than the design rainfall event may cause flooding due to them 'exceeding' the capacity of the drainage system. In this situation it is imperative to check whether flooding would occur and, if so, whether it needs to be contained on site. Exceedance flows should not ingress into any properties on site and should not cause nuisance to any neighbouring sites or buildings.
- 11.3 The drainage system drains as designed drains a very small area. Any exceedance events and the surface water runoff they create will therefore also be small in volume, especially because the rainwater garden SuDS system as designed does not flood in the 1 in 100-year + 45% rainfall event.
- 11.4 Also, because of the LLFA's design criteria assumes zero losses due to vegetation interception, evaporation and surface roughness (CV of one), and cannot include for storage/conveyance within the pipes around/between the plots and the main drainage system (MADD Factor of zero). Therefore, the drainage system, as designed, represents an *extremely* conservative strategy that, in a real-world scenario, would not receive the surface water that has been catered for in the MicroDrainage hydraulic model. As such, the designed drainage system would, in operation, have capacity for events far beyond that of the 1 in 100-year rainfall event plus 45% for climate change.
- 11.5 Notwithstanding this, a high-level plan of exceedance flows has been produced to show the pathways exceedance flows would take across each of the development areas. These can be seen in [Appendix U](#).

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## 12.0 Summary and Conclusion

- 12.1 This FRA and Drainage Strategy has been produced by Motion on behalf of their client, Lamb Property Investments Ltd. It supports the planning application for the proposed development at 192 Hawthorn Road, Bognor Regis, West Sussex. The development proposes to demolish an existing accommodation unit to the rear of 192 Hawthorn Road and deliver a ground floor extension to 192 Hawthorn Road to provide an additional self-contained residential unit within the main property.
- 13.0 The EA's Flood Map for Planning shows that the site is within Flood Zone 1 and is not at risk of fluvial or tidal flooding.
- 14.0 The updated 2040 - 2060 RoFSW mapping for the site shows that the site is at 'very low' risk of surface water flooding, now and in the future. There is an area of 'high' surface water flood risk in Hawthorn Road. However, because the site is at least 600mm higher than Hawthorn Road and no flow paths cross or advance into the site, surface water flood risk is not an impediment to the development.
- 15.0 The site is not at risk from other forms of 'local' flood risk, although there are high groundwater levels in this part of Bognor Regis and this is reflected in the BGS Groundwater Flooding Susceptibility map, which shows that the site is within an area with potential for groundwater flooding at the surface. This hydrogeological situation has also influenced the drainage strategy. Ground investigations carried out by recent developments nearby to 192 Hawthorn Road have recorded groundwater levels at just below surface. Because of this, and the clay geology to several metres below ground level, infiltration is not a viable form of surface water discharge for the development. Therefore, the drainage strategy has followed the approved approach of other nearby developments in Bognor Regis, which have not used infiltration and have employed alternative methods of surface water discharge.
- 16.0 The proposed small-scale development proposes a simple but effective SuDS strategy to manage and discharge surface water. Water butts will be fitted to the downpipes of the extension and the drainage from the main dwelling, after which rainwater will be directed to a rainwater garden located in the existing garden/greenspace within the site. The rainwater garden provides all SuDS pillars, thus reduces water quantity through attenuation, improves water quality through the removal of pollutants and silts, provides amenity and aesthetic value and, finally, provides a biodiversity benefit through the replacement of lawn grass with a mixture of planting within the rainwater garden. Surface water outflow from the rainwater garden will be discharged at the practicable minimum of 1.0 l/s to one of the two large surface water culverts (600mm dia.) in Hawthorn Road.
- 17.0 The site currently drains some of its roof and surface water to the foul drainage system. The proposed development and its drainage strategy will remove some of these misconnections and will redirect surface water to the public surface water sewerage system. Therefore, the proposed drainage strategy will not only reduce surface water outflow from the areas that are to be developed when compared to the existing, but it will also alleviate the existing load on the public foul sewer system.
- 18.0 The drainage strategy has been hydraulically modelled in MicroDrainage's Network module and has shown that it can attenuate the 1 in 100-year + 45% rainfall event without flooding, inclusive of the current LLFA design standards.
- 19.0 A drainage management and maintenance plan has been produced that shows how the proposed drainage system will be maintained in perpetuity.
- 20.0 Exceedance flows have been considered and an exceedance plan produced.
- 21.0 Foul waste from the site will connect to the existing foul sewerage on site.
- 22.0 In conclusion, this drainage strategy has shown that the proposed development is at a very low residual risk of flooding, and this makes it appropriate in this location. Similarly, the drainage strategy has shown that the development can manage its foul and surface water sustainably – as well as provide multiple

benefits over the existing situation. Therefore, flood risk and surface water management should not form an impediment to the progress of this application.

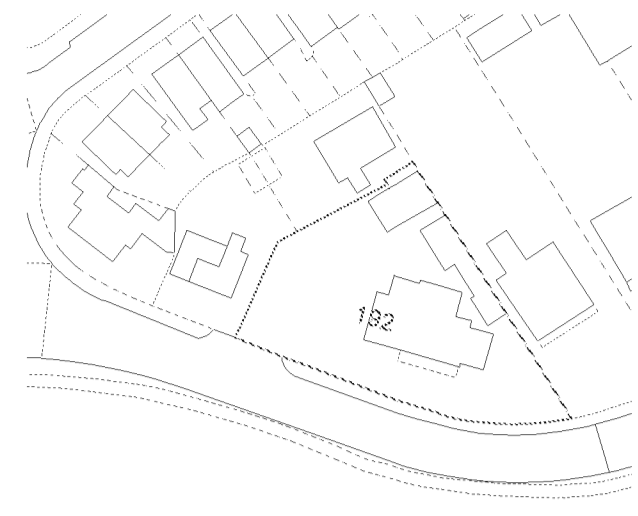
- 22.1 ADC's 'Full Surface Water Drainage Checklist' has been completed to demonstrate compliance, and details how all information reasonably required to complete the application, and the drainage strategy, has been provided. This and is included in [Appendix V](#).

Appendix A  
Site Location Plan



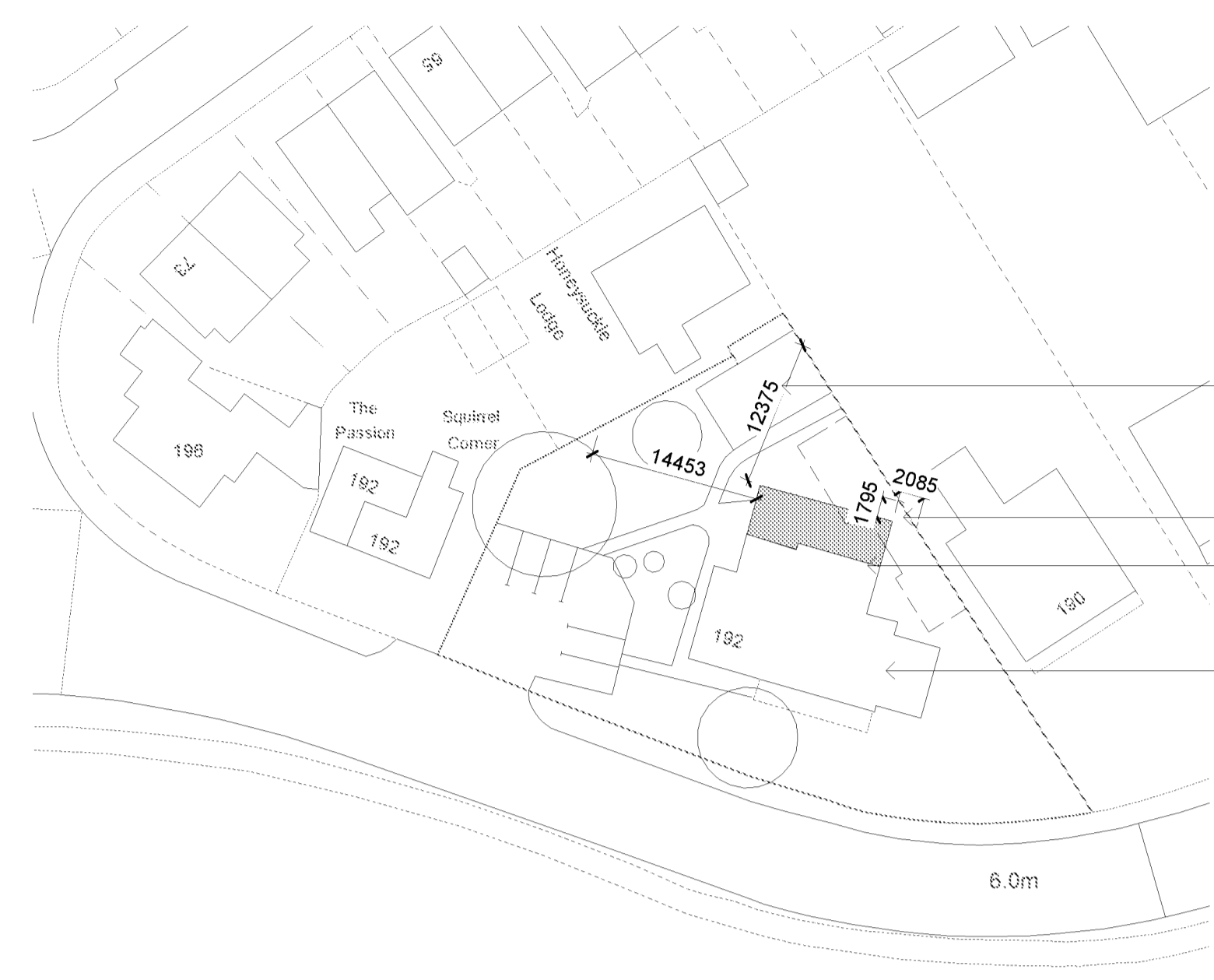
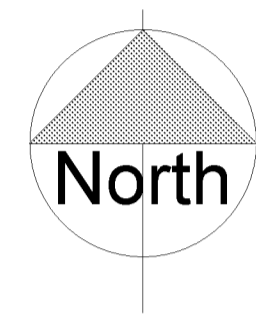
## Appendix B

### Proposed Development Layout and Elevations



Site plan 1:1250

Site Plan 1:500



- Communal area
- Detached accommodation to be demolished
- Proposed extension
- Main building



Front Elevation

1:100



Side Elevation



Rear Elevation



Side Elevation

Revisions

0.5 0 0.5 1 1.5 2 2.5  
SCALE 50  
1: m

1 0 1 2 3 4 5  
SCALE 100  
1: m

5 0 5 10 15 20 25  
SCALE 500  
1: m

10 0 10 20 30 40 50  
SCALE 1250  
1: m

Materials

Drawing Number	2025/10	Sheet	1 of 5
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Project	Proposed details January 2025
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Job Title	192 Hawthorne Road Bognor Regis PO21 2UX
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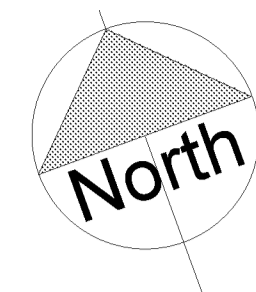
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Drawings to be read in conjunction with all other Designers and structural engineers contract drawings and specifications: Any discrepancies must be brought to the attention of the Designer immediately.  
The contractor must verify all dimensions by site measurement before ordering materials or manufacturing components.  
Substitute materials and products to those named will be acceptable if proven to be of equal or higher performance and not in conflict with other elements

**M.J.Humphrey**  
Ltd

   
Chartered Association of Building Engineers

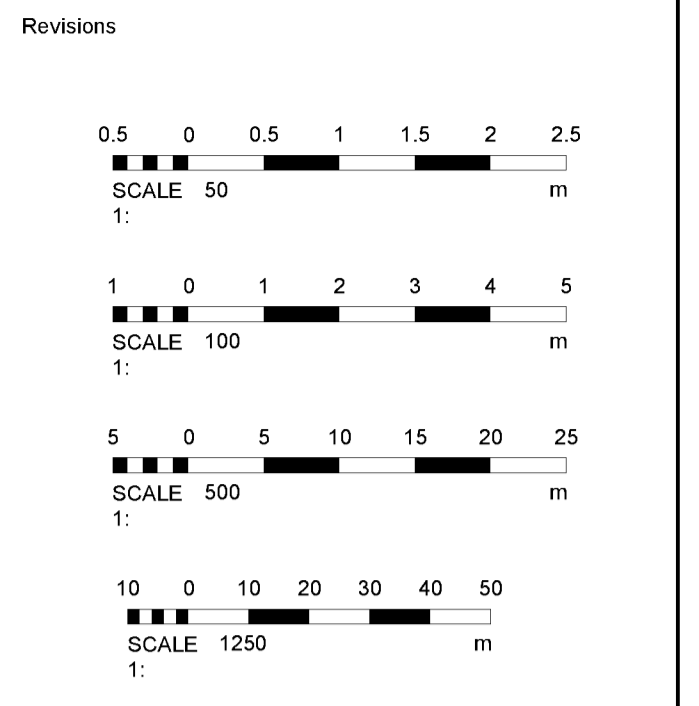
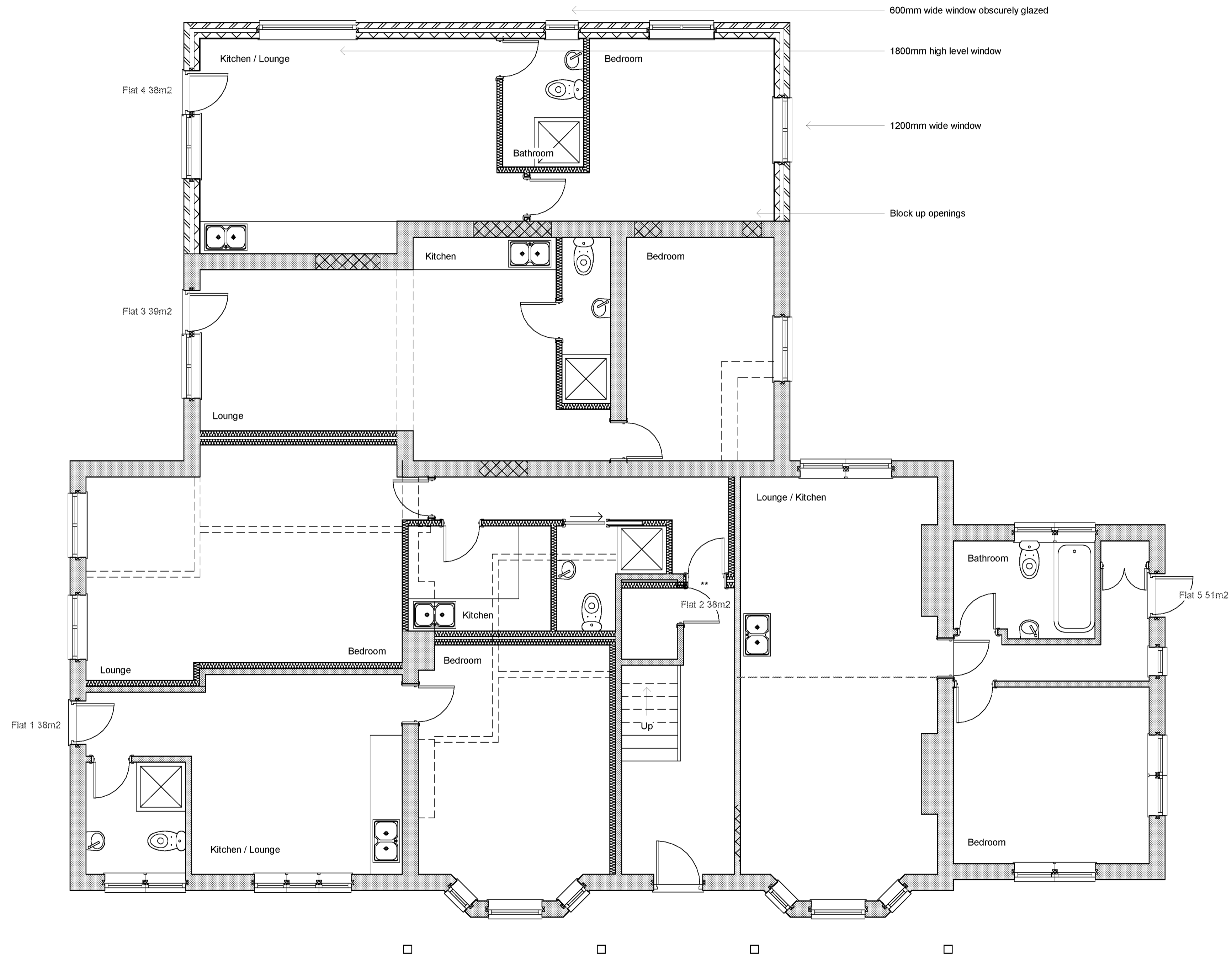
Mel Humphrey MRICS, MBEng  
9 Aldsworth Avenue  
Goring By Sea  
West Sussex  
BN12 4XQ  
Mel@mjhumphrey.co.uk  
07701055182

Adam Humphrey  
4 Thalassa Road  
Worthing  
West Sussex  
BN11 2HH  
Adam@mjhumphrey.co.uk  
07812419142



Main building - Ground Floor

1:50



Materials

Drawing Number	2025/10	Sheet	2 of 5
Size	A1	Scale	1:50, 1:100, 1:500, 1:1250
Project	Proposed details January 2025		
Job Title	192 Hawthorne Road Bognor Regis PO21 2UX		

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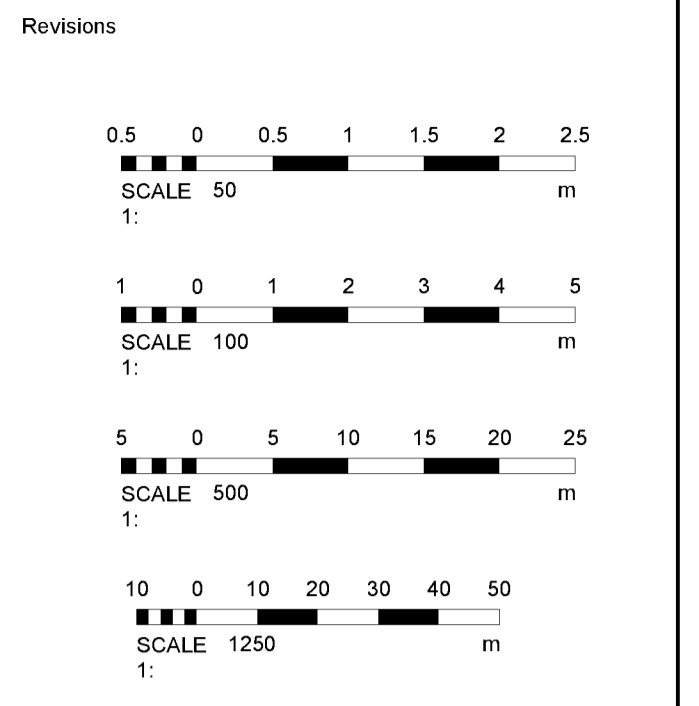
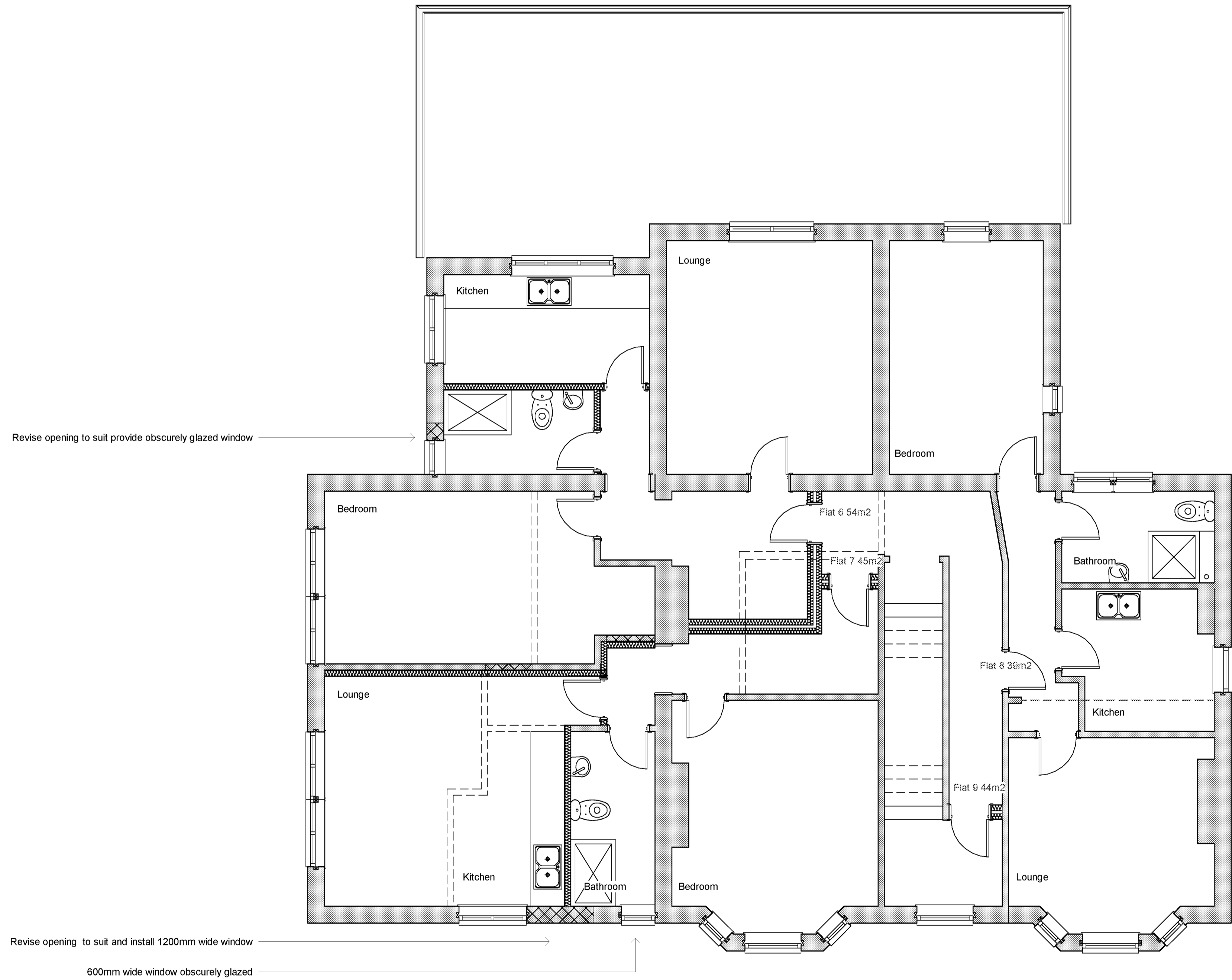
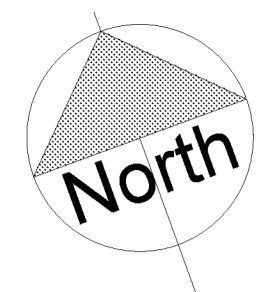
**M.J.Humphrey**  
Ltd



Mel Humphrey MRICS, MBEng 9 Aldsworth Avenue Goring By Sea West Sussex BN12 4XQ	Adam Humphrey 4 Thalassa Road Worthing West Sussex BN11 2HH
Mel@mjhumphrey.co.uk 07701055182	Adam@mjhumphrey.co.uk 07812419142

Main building - First Floor

1:50



Materials

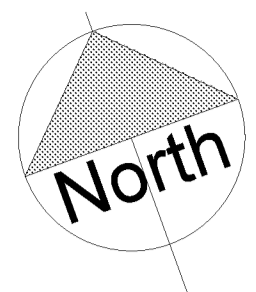
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Job Title	192 Hawthorne Road Bognor Regis PO21 2UX		

Do Not scale from this drawing except for planning as photocopies will be subject to distortion  
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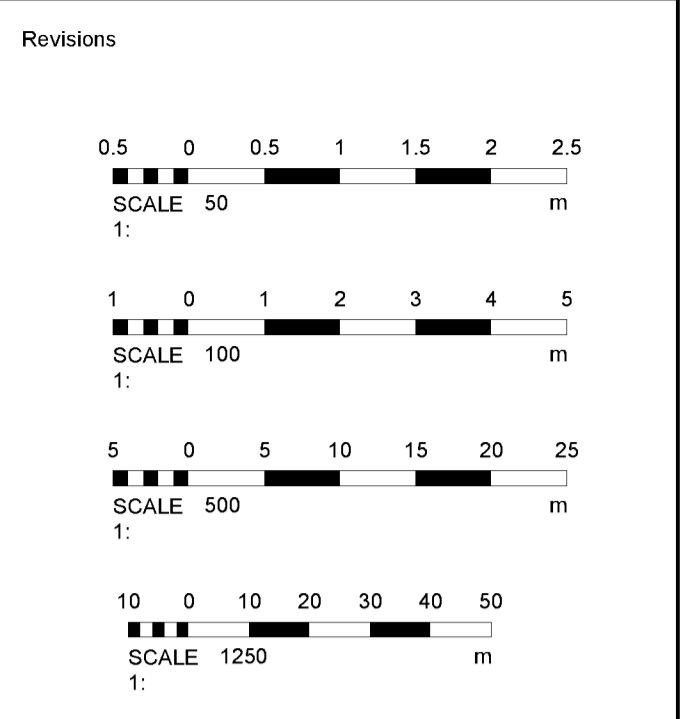
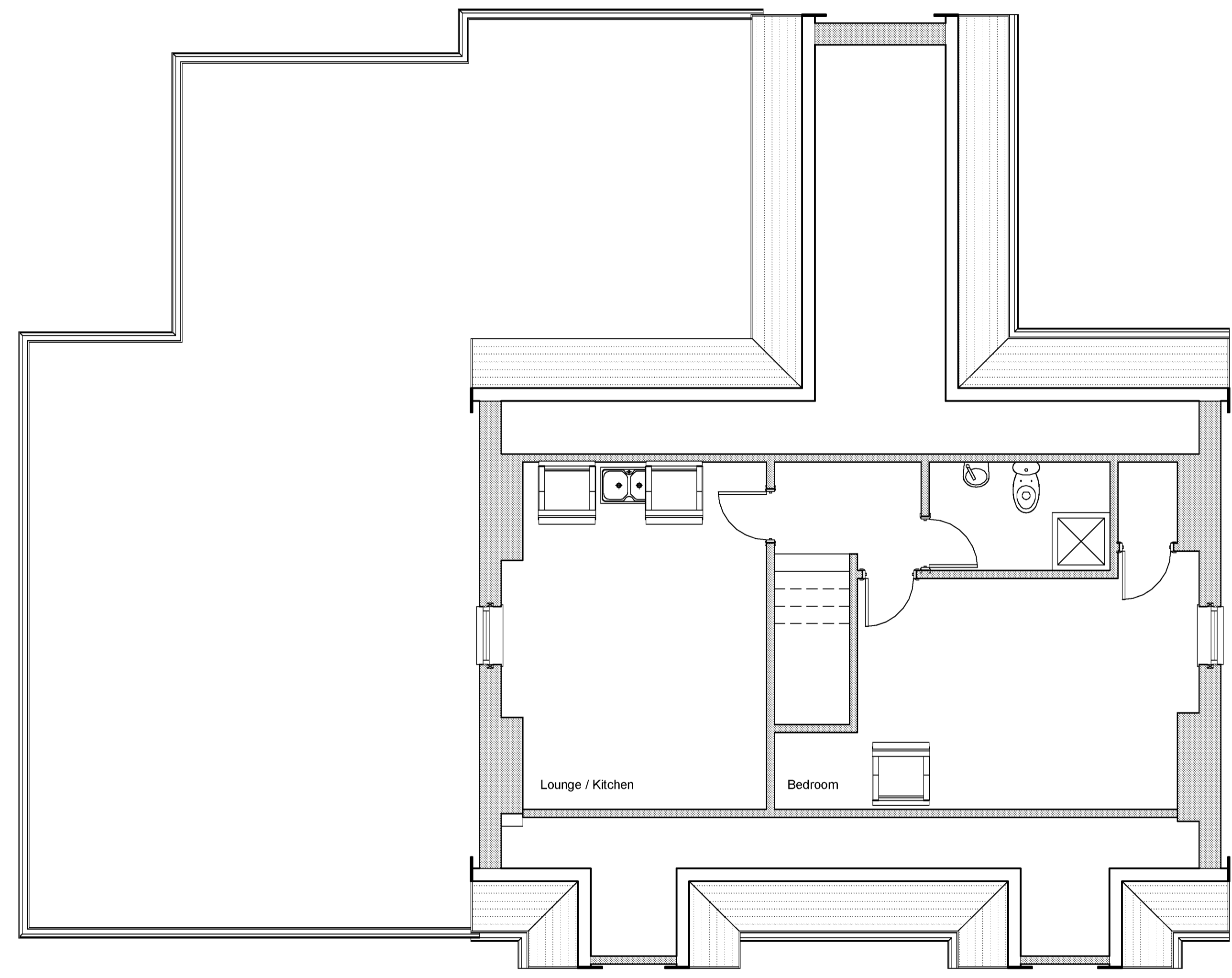
**M.J.Humphrey**  
Ltd



Mel Humphrey MRICS, MBEng 9 Aldsworth Avenue Goring By Sea West Sussex BN12 4XQ Mel@mjhumphrey.co.uk 07701055182	Adam Humphrey 4 Thalassa Road Worthing West Sussex BN11 2HH Adam@mjhumphrey.co.uk 07812419142
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Main building - Second Floor  
1:50



Materials

Drawing Number	2025/10	Sheet	4 of 5
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Size	A1	Scale	1:50, 1:100, 1:500, 1:1250
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Project	Proposed details January 2025
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Job Title	192 Hawthorne Road Bognor Regis PO21 2UX
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Do Not scale from this drawing except for planning as photocopies will be subject to distortion  
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**M.J.Humphrey**  
Ltd

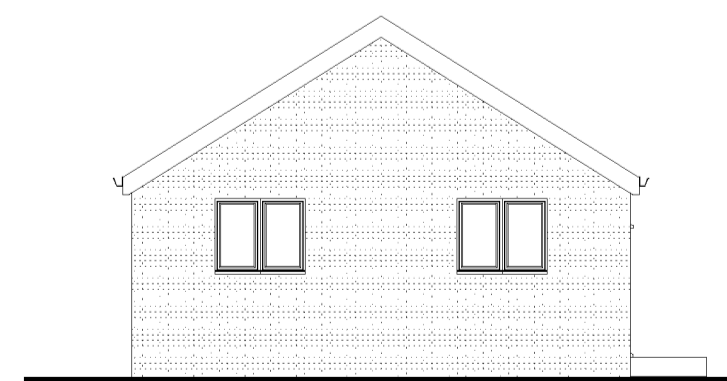
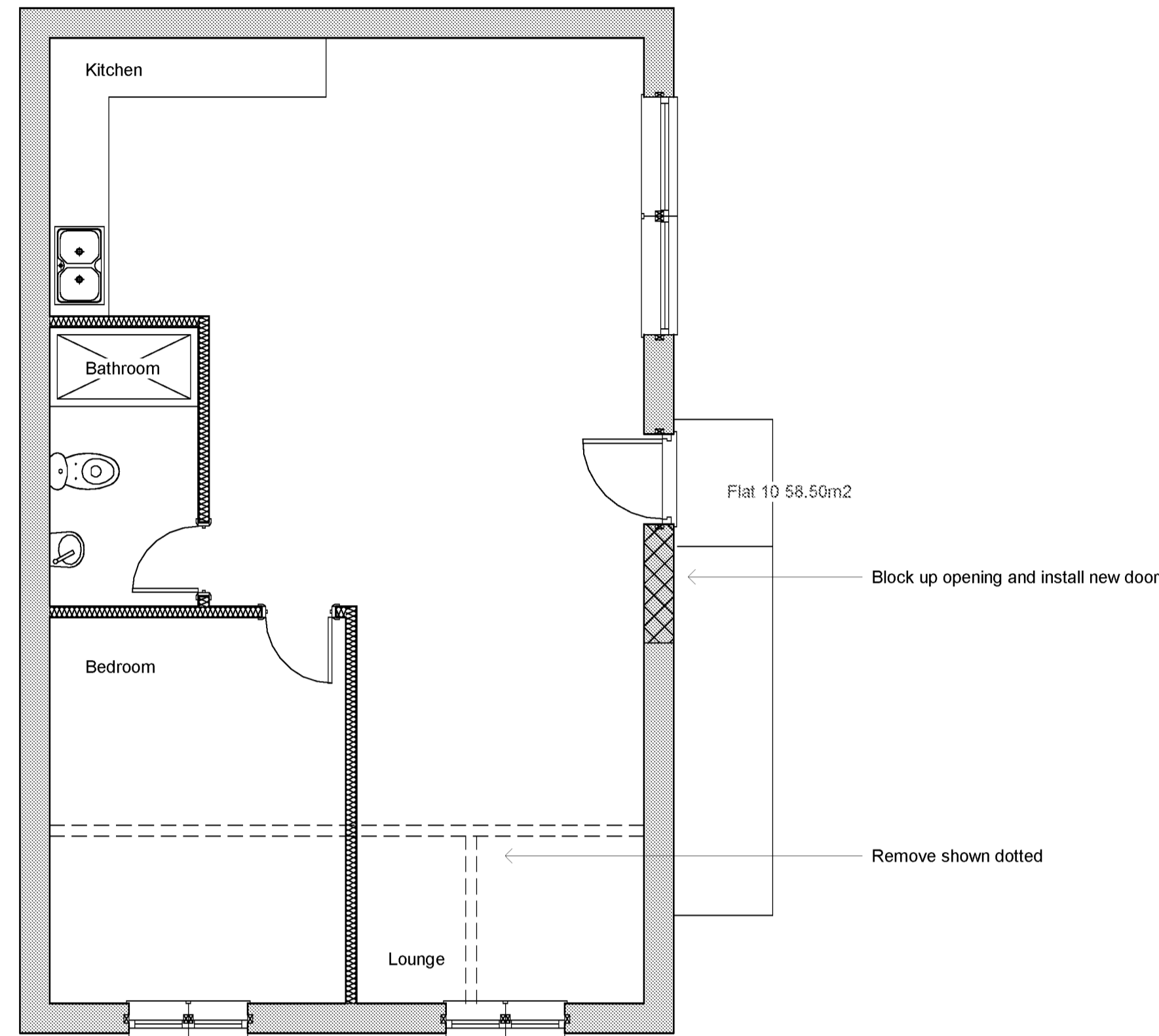
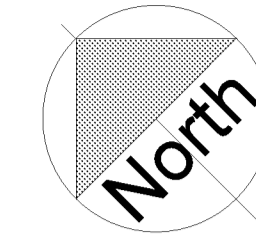


Mel Humphrey MRICS, MBEng 9 Aldsworth Avenue Goring By Sea West Sussex BN12 4XQ	Adam Humphrey 4 Thalassa Road Worthing West Sussex BN11 2HH
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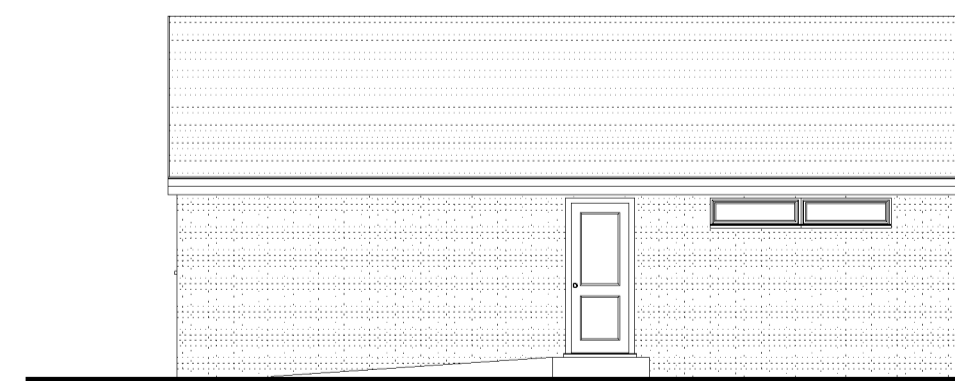
Mel@mjhumphrey.co.uk 07701055182	Adam@mjhumphrey.co.uk 07812419142
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Detached Unit ( former communal area ) - Ground Floor

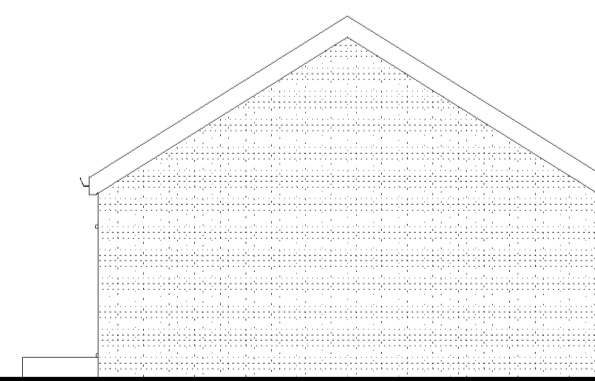
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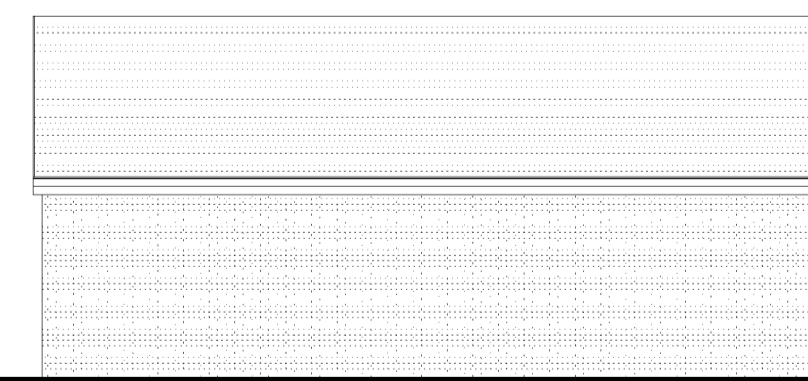
Front Elevation



Side Elevation

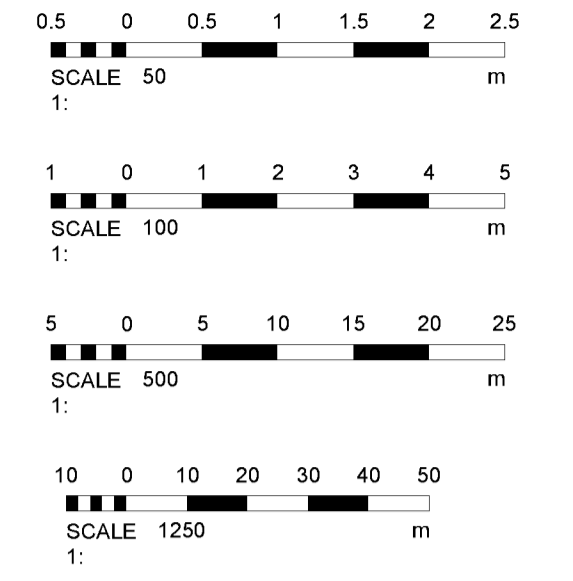


Rear Elevation



Side Elevation

Revisions



Materials

Drawing Number	2025/10	Sheet	5 of 5
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Size	A1	Scale	1:50, 1:100, 1:500, 1:1250
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Project	Proposed details January 2025
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Job Title	192 Hawthorne Road Bognor Regis PO21 2UX
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Do Not scale from this drawing except for planning as photocopies will be subject to distortion  
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**M.J.Humphrey**  
Ltd



Mel Humphrey MRICS, MBEng 9 Aldsworth Avenue Goring By Sea West Sussex BN12 4XQ	Adam Humphrey 4 Thalassa Road Worthing West Sussex BN11 2HH
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Mel@mjhumphrey.co.uk 07701055182	Adam@mjhumphrey.co.uk 07812419142
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Appendix C  
Satellite Site View



Hawthorn Rd

Hawthorn Rd

Hawthorn Rd

Hawthorn Rd

Hawthorn Rd

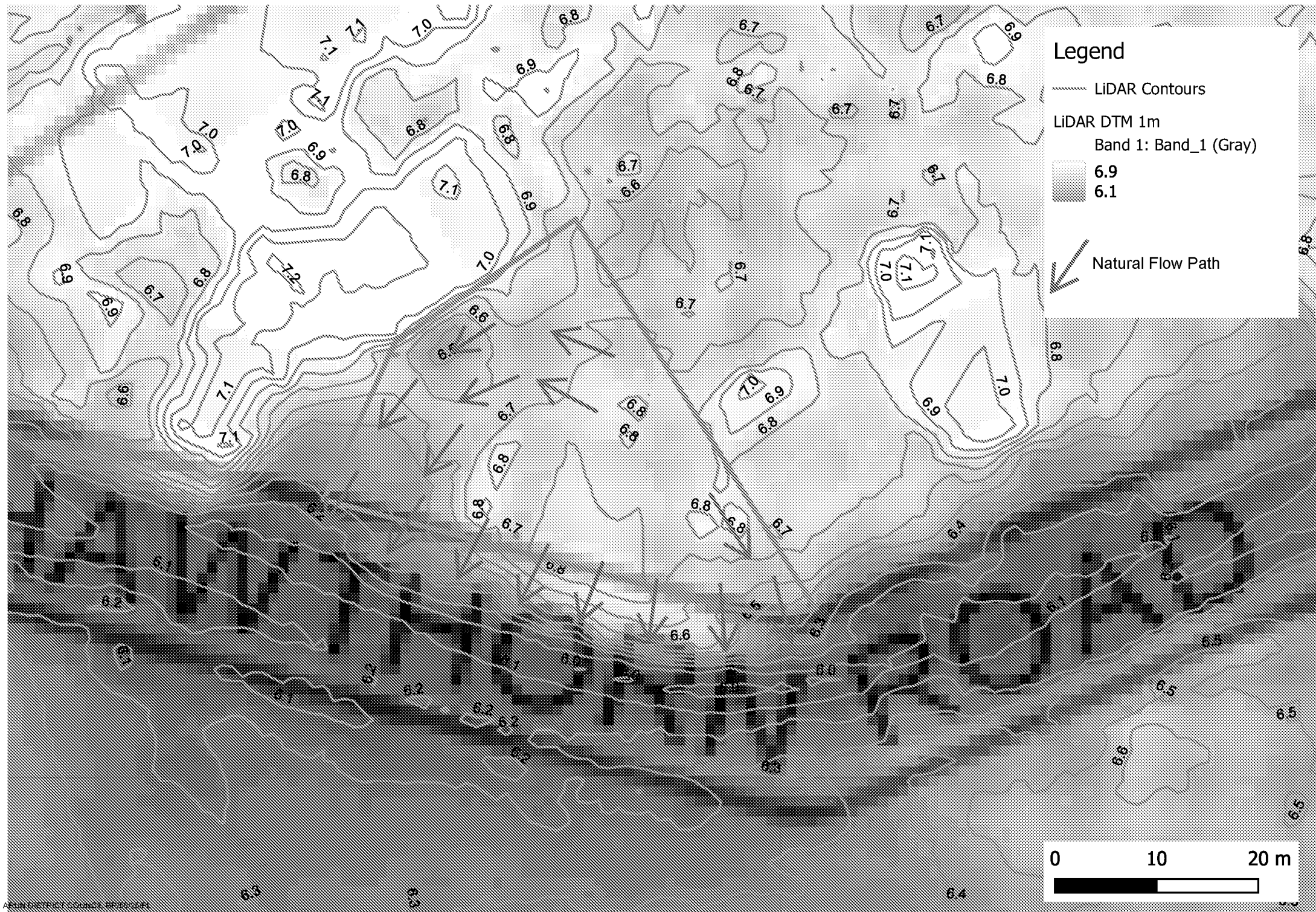
192

Larche UK

Jericho House

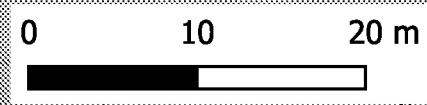
Appendix D

LiDAR Levels and Contour Plan



**Legend**

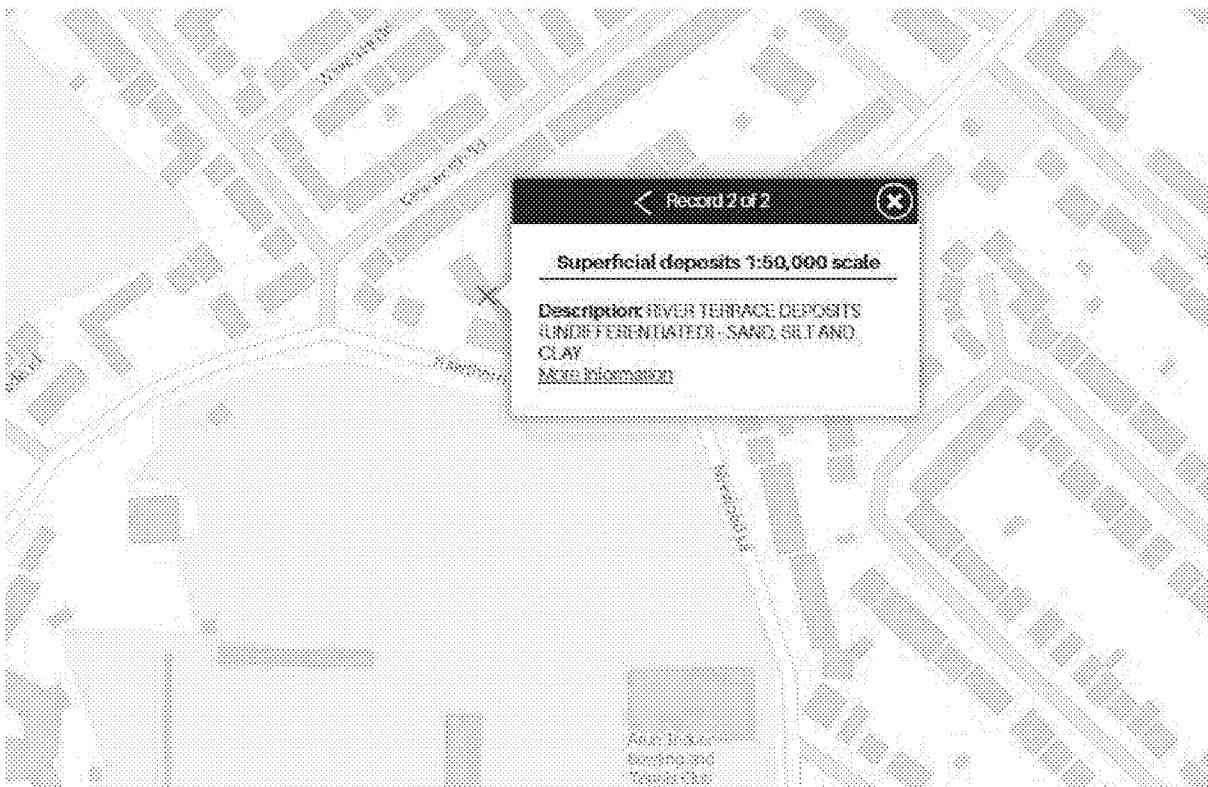
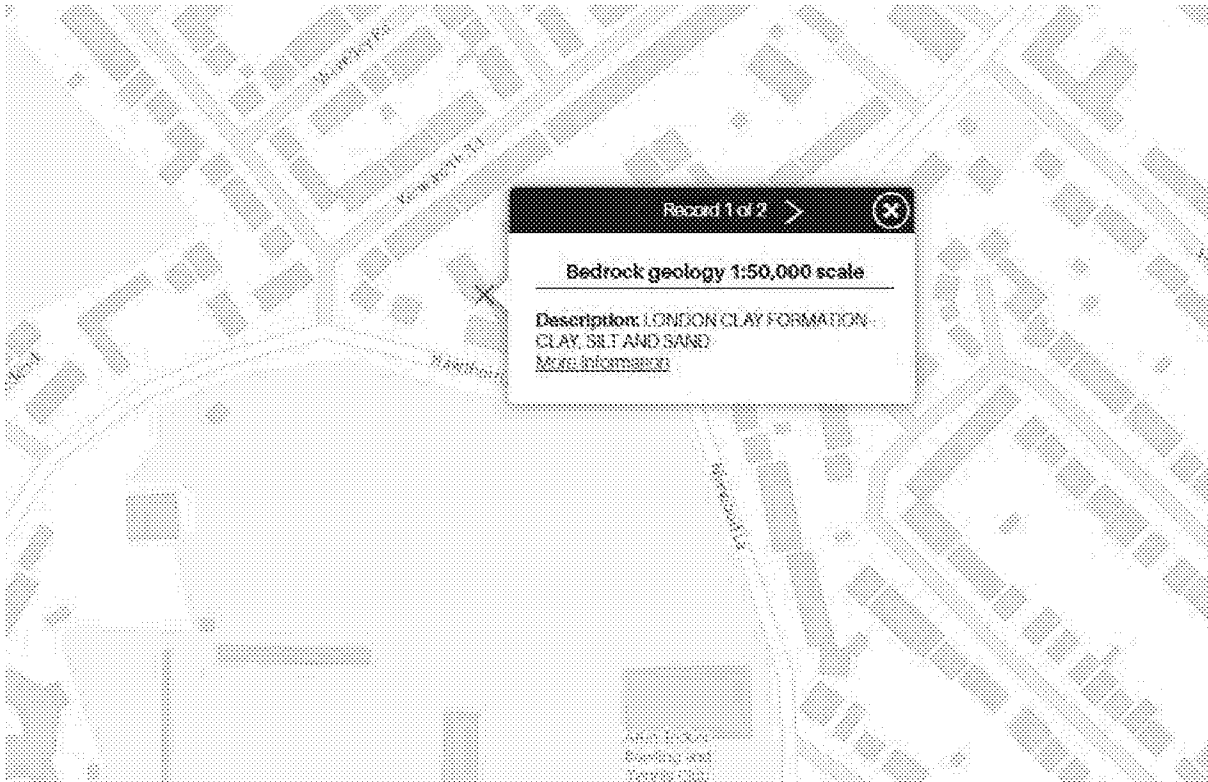
- LiDAR Contours
- LIDAR DTM 1m
  - Band 1: Band\_1 (Gray)
  - 6.9
  - 6.1
- ↖ Natural Flow Path



Appendix E

BGS GeoIndex Geological Descriptors

## BGS 1:50,000 GeoIndex Onshore Geological Descriptors



Appendix F

BGS Borehole Log SZ99NW44

**RECORD OF BOREHOLE No: 13**

Location : *BODNOR MAIN DRAINAGE*  
Contract No. : *467*  
Type of Boring : *Shell & Auger*  
Date (started) : *5-7-69*

Borehole Dia : *8"*  
Casing : *8" to 18'-0"*  
Ground Level : *20.58' D.D.*

Depth of Casing	Water Level	SAMPLES			STRATA		DESCRIPTION OF STRATA	
		Depth	Type	No.	Legend	Depth		Thickness
						0'-0"		
						1'-0"	1'-0"	TARMAC
						1'-0"	0'-6"	CONCRETE
		3'-8" - 8'-10"	U	1		2'-5"	1'-0"	MADE GROUND (brick rubble and fill)
		3'-0" - 5'-3"	U	2				Firm (changing to stiff at 5'-0") brown grey sandy silty CLAY
		7'-6"	D	3				
		3'-6" - 10'-10"	U	4		8'-6"		
		12'-0"	D	5		8'-0"		Stiff red MARL
		15'-0" (K=8)	D	6		15'-0"		Lobby brown sandy GRAVEL
						End		

REMARKS:

*Water first encountered at 10'-8" B.G.L.*

SCALE 1" = 5'

Foundation Engineering Ltd.



Appendix G

Application BR/188/20/DOC Groundwater Monitoring Data



14 Redwood Place,  
Aldwick,  
Bognor Regis,  
PO21 3BS

Units 15 & 16 • Ford Lane Business Park •  
Ford • Arundel • West Sussex • BN18 0UZ

Company number:  
FAO: Mr J. Parsons

Date: 28/02/2020  
Our Ref: 20.1023



Dear Mr Parsons

**RE: 41 – 47 Pevensey Road Groundwater Monitoring**

We are writing to you following our recent ground investigation at the land rear of 41-47 Pevensey Road, Bognor Regis, PO21 5NY as instructed by Mr Peter Cleveland of Henry Adams LLP (the Client representative).

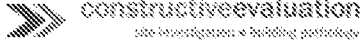
At the time of the investigation the plot consisted of a series of four semi-detached properties with extended soft landscaped rear gardens (Figure 1). The site is located on the southern side of Pevensey Road approximately ~110m south of The Regis School.

**Scope of Ground Investigation**


The aim of the ground investigation was to ascertain the soil profile up to 3mbgl with installation of a standpipe for winter groundwater monitoring. Figure 2 shows the final positions of two boreholes and installs. The completed ground investigation is listed below:

- Two (2no) windowless sampling boreholes to a depth of 3mbgl.
- Two (2No) installations of slotted and plain standpipe tubing with flush type lockable covers.




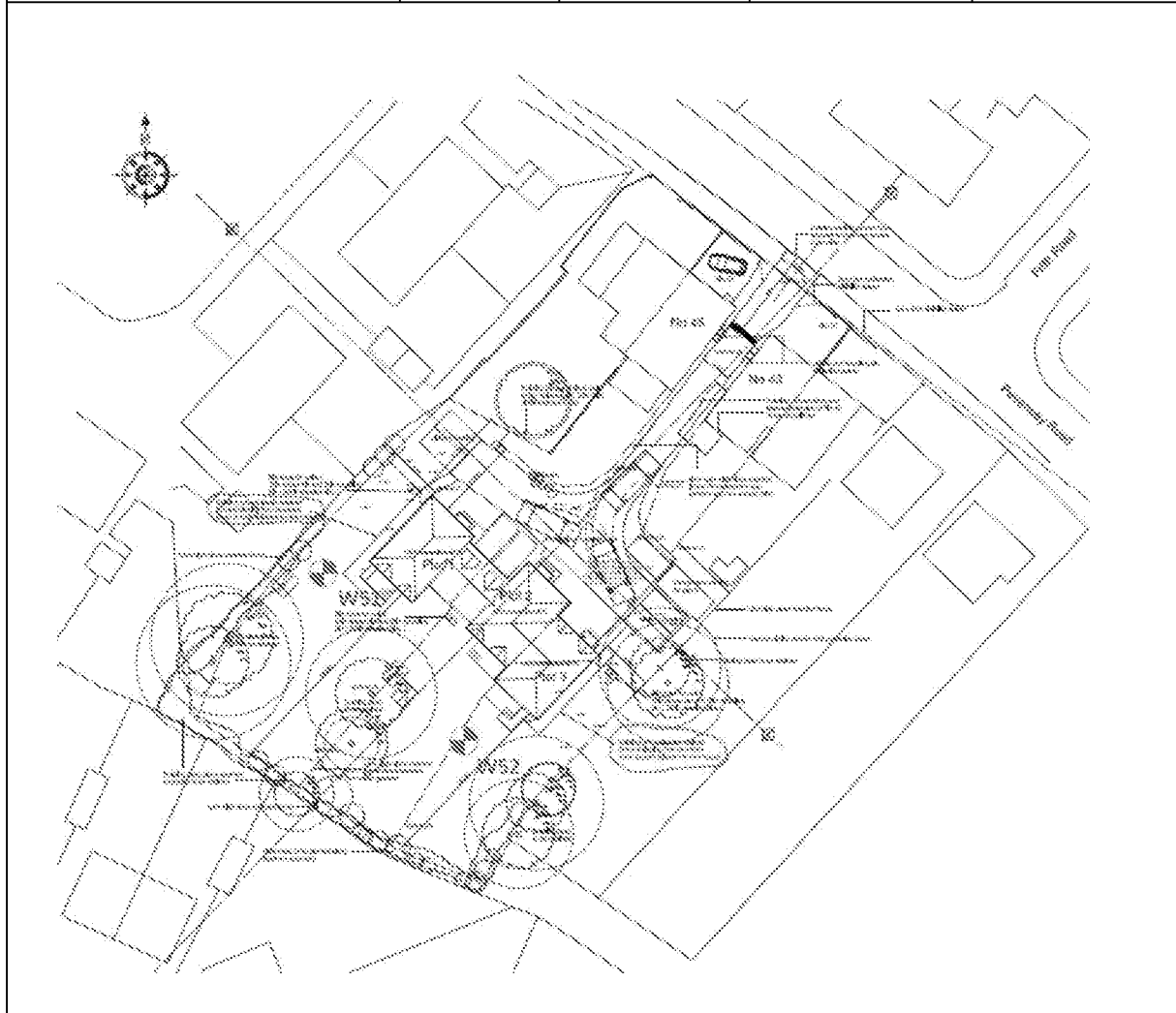
 <i>Unit 15 &amp; 16, Ford Lane Business Park, Arundel, BN18 0UZ</i>	<b>41 – 47 Pevensey Road, Bognor Regis</b>			Project Ref. <b>20.1023</b>
				Sheet 1 of 1
<i>Telephone: 01243 533499 Web Address: www.ceitduk.com</i>	Created By: <b>IB</b>	Checked: <b>ME</b>	Approved: <b>SPD</b>	Date: <b>February 2020</b>



Reproduced by permission of H.M. Stationery Office.	Map extracted at a scale of 1:25,000	N 
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<h1>Site Location</h1>	Scale: NTS <b>FIGURE 1</b>
------------------------	-------------------------------

 <b>constructiveevaluation</b> <small>the investigation &amp; testing authority</small> Unit 15 & 16, Ford Lane Business Park, Arundel, BN18 0UZ	<b>41 – 47 Pevensey Road, Bognor Regis</b>			Project Ref. <b>20.1023</b>
				Sheet 1 of 1
Telephone: 01243 533499 Web Address: www.celtduk.com	Created By: <b>IB</b>	Checked: <b>ME</b>	Approved: <b>SPD</b>	Date: <b>February 2020</b>



	Site plan with final locations of boreholes with installations	
--	--	--

<h1>Site Plan</h1>	Scale: NTS
	<b>FIGURE 2</b>



# Borehole Log

Borehole No.

**WS1**

Sheet 1 of 1

Project Name: 41-47 Pevensey Road

Project No.  
20.1023

Co-ords:

Hole Type  
WS

Location: Bognor Regis


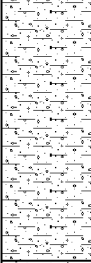
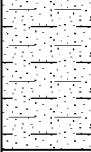
Level:

Scale  
1:50

Client: Peter Cleveland

Dates:

Logged By  
ME

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	▼				0.20		 Dark brown slightly sandy CLAY with frequent rootlets. Sand is fine to medium. (TOPSOIL)		
							 Soft to firm orange brown sandy slightly gravelly CLAY with occasional grey mottling between 0.9m and 2.0mbgl. Sand is fine to medium. Gravels are fine, sub-angular to sub-rounded flint.	1	
					2.00		 Grey brown clayey medium to coarse SAND.	2	
					3.00		End of Borehole at 3.000m	3	
								4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks

Groundwater encountered at 0.75mbgl during hand pit excavation.





# Borehole Log

Borehole No.

**WS2**

Sheet 1 of 1

Project Name: 41-47 Pevensey Road

Project No.  
20.1023

Co-ords:

Hole Type  
WS

Location: Bognor Regis

Level:

Scale  
1:50

Client: Peter Cleveland

Dates:

Logged By  
ME

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
	▼				0.20		Dark brown slightly sandy CLAY with frequent rootlets. Sand is fine to medium. (TOPSOIL)	1	
					1.80		Soft to firm orange brown sandy slightly gravelly CLAY with occasional grey mottling from 1.0m to 1.8mbgl. Sand is fine to medium. Gravels are fine, sub-angular to sub-rounded flint.	2	
					3.00		Grey slightly clayey medium to coarse SAND.	3	
							End of Borehole at 3.000m	4	
								5	
								6	
								7	
								8	
								9	
								10	

Remarks

Groundwater encountered at 0.92mbgl during hand pit excavation.



Appendix H

Application BR/188/20/DOC Infiltration Testing

Job No.: 424861  
 Job Name: Pevensey Road

**Average soil infiltration rate  
 For carpark and roof design soakaway blanket**

Test	Result
1	4.19E-06
2	4.19E-06
3	4.19E-06
Min	4.19E-06

FOS **3.00**

Use infiltration rate  Min

**TABLE 25.2 Suggested factors of safety, F, for use in hydraulic design of infiltration systems (designed using Dettmer (1996). Note: not relevant for BRC method)**

Size of area to be drained	Consequences of failure		
	No damage or inconvenience	Minor damage to external areas or inconvenience (eg surface water on car parking)	Damage to buildings or structures, or major inconvenience (eg flooding of roads)
< 100 m <sup>2</sup>	1.5	2	10
100-1000 m <sup>2</sup>	1.5	3	10
> 1000 m <sup>2</sup>	1.5	5	10

**Soakaway Design**

Job No.:  
 Job Name: **Pevensey Road**

Car park + driveway + roofs

Area 599 m<sup>2</sup>  
 Run off Coeff 1 m<sup>2</sup>  
 599 m<sup>2</sup>

**1000 year return period**

	Storm duration (Min.)	T	N	r
R5	5	0.053393	0.01	0.046509
R10	10	0.166667	0.01	0.057207
R15	15	0.25	0.01	0.064436
R30	30	0.5	0.01	0.079877
R60	60	1	0.01	0.096402
R120	120	2	0.01	0.117772
R240	240	4	0.01	0.143714
R360	360	6	0.01	0.16141
R600	600	10	0.01	0.186783
R1440	1440	24	0.01	0.236703

**Inflow to attenuation system**

I5	27.919 m <sup>3</sup>
I10	34.267 m <sup>3</sup>
I15	38.597 m <sup>3</sup>
I30	47.247 m <sup>3</sup>
I60	57.763 m <sup>3</sup>
I120	70.546 m <sup>3</sup>
I240	86.085 m <sup>3</sup>
I360	96.684 m <sup>3</sup>
I600	111.883 m <sup>3</sup>
I1440	143.600 m <sup>3</sup>

Outflow from Tank f 1.40E-06 m<sup>3</sup>/s (From site investigation)

**Soakaway dims:**

Plan area **280 m** (Area of driveway to be used as storage blanket)  
 1 m  
 Depth **0.4 m** (below invert depth of inlet pipe)

As50 280 (Base area only)  
 Void ratio **95 %** (Permavoid or similar system)

**Outflow from Tank:**

O5	0.12 m <sup>3</sup>		
O10	0.23 m <sup>3</sup>		
O15	0.35 m <sup>3</sup>		
O30	0.70 m <sup>3</sup>		
O60	1.41 m <sup>3</sup>		
O120	2.82 m <sup>3</sup>		
O240	5.63 m <sup>3</sup>		
O360	8.45 m <sup>3</sup>		
O600	14.08 m <sup>3</sup>		
O1440	33.79 m <sup>3</sup>	0.000391 m <sup>3</sup> /s	<b>0.391067</b> L/s

**Storage required:**

	Storage (m <sup>3</sup> )	ts50	Hours
S5	27.80 m <sup>3</sup>	ts50	9.87 hours
S10	34.03 m <sup>3</sup>	ts50	12.09 hours
S15	38.25 m <sup>3</sup>	ts50	13.58 hours
S30	46.54 m <sup>3</sup>	ts50	16.53 hours
S60	56.35 m <sup>3</sup>	ts50	20.01 hours
S120	67.73 m <sup>3</sup>	ts50	24.05 hours
S240	80.45 m <sup>3</sup>	ts50	28.57 hours
S360	88.24 m <sup>3</sup>	ts50	31.34 hours
S600	97.80 m <sup>3</sup>	ts50	34.74 hours
S1440	109.81 m <sup>3</sup>	ts50	39.00 hours

Storage provided **106.4** m<sup>3</sup> Additional flood water storage mitigation volume **35.0** m<sup>3</sup>

Critical storm = **S1440**  
 Storage required = **144.81** Overflow required to culvert **0.391** L/s  
 Time to discharge = **39.00** Hours (Should be less than 24 hours)

Exceedance volume = 38.41 m<sup>3</sup>

38.41

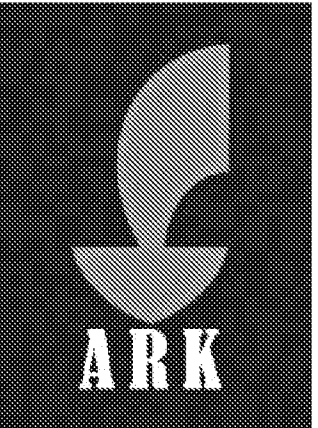
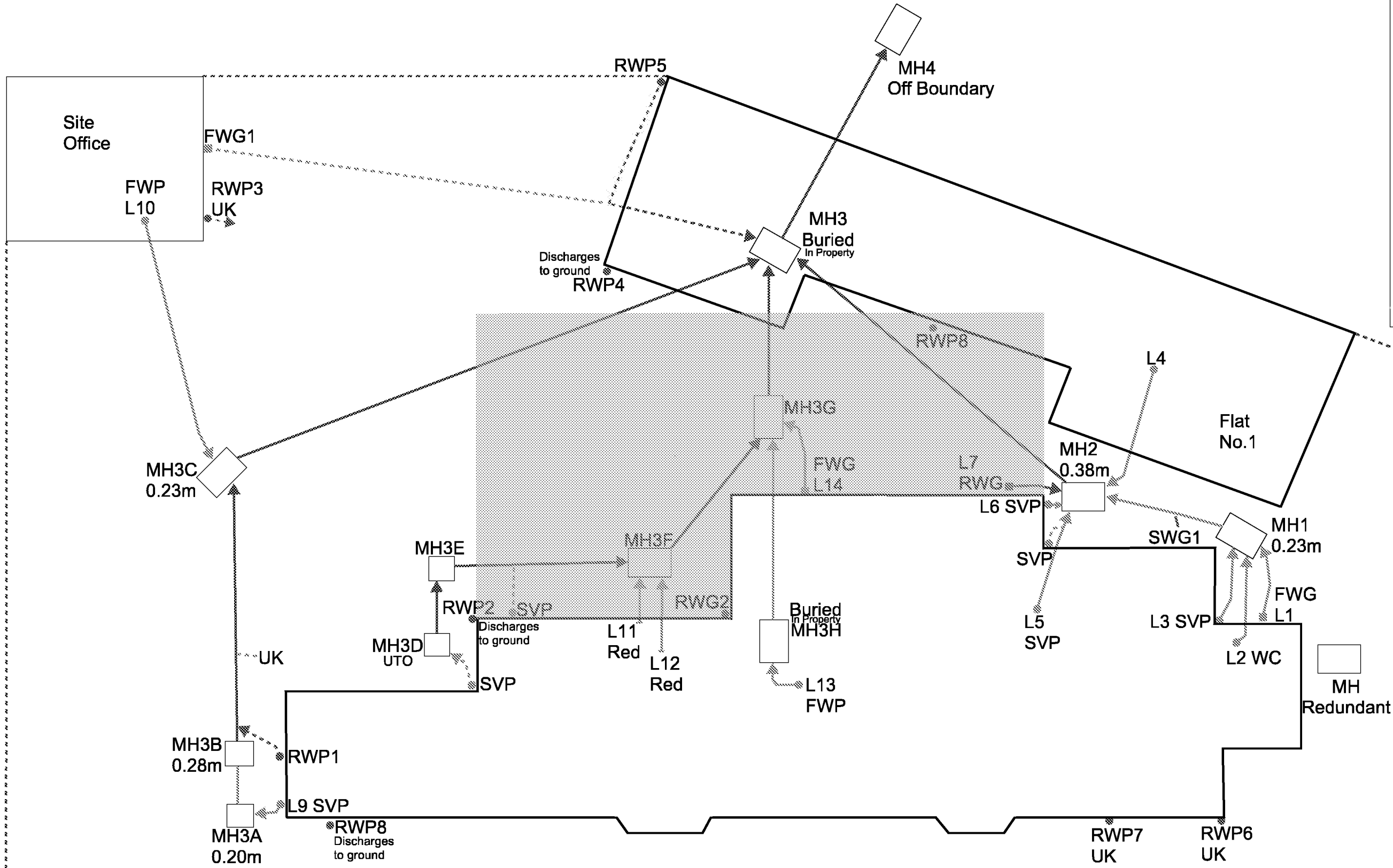
Appendix I

Site Private Drainage CCTV Survey

NOT TO SCALE  
ALL SONAR TRACING MEASUREMENTS APPROXIMATE

**KEY:**

Foul .....  
 Rain/Surface Water .....  
 Combined .....  
 Assumed / Unable to Survey / Not Surveyed .....  
 WWP = Waste Water Pipe  
 IC = Inspection Chamber  
 MH = Manhole  
 SVP = Soil Vent Pipe  
 RWP = Rainwater Pipe  
 RWG = Rainwater Gully  
 SWG = Surface/Rainwater Gully  
 CWG = Combined Water Gully  
 FWG = Foul Water Gully  
 S/A = Survey Abandoned  
 UK = Unknown  
 Red = Redundant Pipe  
 UDL = Unknown Discharge Location





**Project**

**Project Name:** 192 Hawthorn Road\_ Bognor Regis\_ PO21\_2UX

**Project Description:** Rodent Survey

**Project Date:** 01/06/2023



## Table of Contents

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023

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Section Item 2: L2 WC > MH1 (L2 WCX) .....	3
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Section Item 4: MH1 > MH2 (MH1X) .....	7
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## Project Information

Project Name	Project Number	Project Date
192 Hawthorn Road_Bognor Regis_PO21_2UX		01/06/2023

### Site

**Street:** 192 Hawthorn Road  
**Town or City:** Bognor Regis  
**Post Code:** PO21 2UX

### Contractor

**Company:** ARK Pest Control  
**Street:** 1 Lagoon Road  
**Town or City:** Orpington  
**County:** Kent  
**Post Code:** BR5 3QX





## Scoring Summary

**Project Name**  
192 Hawthorn Road\_Bognor Regis\_PO21\_2UX

**Project Number**

**Project Date**  
01/06/2023

### Structural Defects

- Grade 3: Best practice suggests consideration should be given to repairs in the medium term.
- Grade 4: Best practice suggests consideration should be given to repairs to avoid a potential collapse.
- Grade 5: Best practice suggests that this pipe is at risk of collapse at any time. Urgent consideration should be given to repairs to avoid total failure.

Section	PLR	Grade	Description
6	L5 SVPX	3	Fracture, circumferential from 12 o'clock to 12 o'clock
15	MH3DX	4	Hole in drain or sewer at 1 o'clock
17	L11X	3	Cracks, multiple from 12 o'clock to 12 o'clock
19	MH3FX	4	Fracture, multiple from 12 o'clock to 12 o'clock, finish
23	MH3GX	4	Fracture, multiple from 12 o'clock to 12 o'clock
24	MH3X	4	Multiple defects

### Service / Operational Condition

- Grade 3: Best practice suggests consideration should be given to maintenance activities in the medium term.
- Grade 4: Best practice suggests consideration should be given to maintenance activity to avoid potential blockages.
- Grade 5: Best practice suggests that this pipe is at a high risk of backing up or causing flooding.

Section	PLR	Grade	Description
1	L1 FWGX	3	Attached deposits, grease from 4 o'clock to 8 o'clock, 10% cross-sectional area loss, finish
3	L3 SVPX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
4	MH1X	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
6	L5 SVPX	3	Settled deposits, other, 10% cross-sectional area loss, finish
7	L6 SVPX	3	Attached deposits, other from 12 o'clock to 12 o'clock, 10% cross-sectional area loss, finish
9	MH2X	3	Settled deposits, other, 10% cross-sectional area loss, finish
11	MH3AX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
12	MH3BX	3	Settled deposits, other, 10% cross-sectional area loss
13	L10 FWPX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
14	MH3CX	3	Settled deposits, other, 10% cross-sectional area loss, finish
15	MH3DX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
16	MH3EX	3	Settled deposits, other, 10% cross-sectional area loss
17	L11X	4	Settled deposits, other, 70% cross-sectional area loss
18	L12X	3	Settled deposits, other, 10% cross-sectional area loss, finish



## Scoring Summary

<b>Project Name</b> 192 Hawthorn Road_Bognor Regis_PO21_2UX	<b>Project Number</b>	<b>Project Date</b> 01/06/2023
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Section	PLR	Grade	Description
19	MH3FX	5	Other obstacles in invert from 12 o'clock to 12 o'clock, 20% cross-sectional area loss
20	MH3HX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
22	L14 FWGX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
23	MH3GX	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish
24	MH3X	2	Attached deposits, other from 12 o'clock to 12 o'clock, 5% cross-sectional area loss, finish

### Abandoned Surveys

Section	PLR	Description
17	L11X	Survey abandoned
18	L12X	Survey abandoned

### Information

These scoring summaries are based on the SRM grading from the WRc.

<b>Survey Comments &amp; Recommendations</b>					
<b>Item No.</b>	<b>Downstream Node</b>	<b>Upstream Node</b>	<b>Comments</b>	<b>Further Work Required</b>	<b>Recommendations</b>
1	MH1	L1 FWG	FW Gully - Fouling deposits noted, nothing of concern	No	None
2	MH1	L2 WC	WC - Large open joint noted on material change - Corrosion noted on pipe wall	Yes	Picote clean line to restore full flow / Install 1x 100mm Patch Liner to seal open joint
3	MH1	L3 SVP	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern	No	None
4	MH2	MH1	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern	No	None
5	MH2	L4	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern	No	None
6	MH2	L5 SVP	Multiple defects, limescale and debris noted in line	Yes	Picote/Jet clean line & install 1X 100MM Patch Liner
7	MH2	L6 SVP	Attached deposits noted in line - CCTV vision poor as a result	Yes	Jet/Picote clean & Re Survey to check for missed defects, if any
8	MH2	L7 RWG	RW Gully - Drain run sound and free flowing	No	None
9	MH3	MH2	MH3 buried, no access. Pipework appears to be bellied/back falling due to water level noted in line	Yes	Drain would benefit with a jet clean
10	MH3A	L9 SVP	Line serviceable and free flowing	No	None
11	MH3B	MH3A	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern	No	None
12	MH3C	MH3B	Scale and fouling deposits noted in line. Possibly due to poor gradient fall?	Yes	Jet clean to remove deposits and re survey to show the true condition
13	MH3C	L10 FWP	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern.	No	None
14	MH3	MH3C	MH3 Buried - Scale and fouling deposits noted in line. Possibly due to poor gradient fall?	Yes	Jet/Picote clean & Re Survey to show the true condition
15	MH3E	MH3D	Unable to open MH3D due to screws being seized - Hole noted @ 1 o'clock	Yes	Drill out screws to allow access / Install 1x 100mm Patch Liner to seal broken pipe
16	MH3F	MH3E	A minor accumulation of fouling deposits has been observed on the pipe wall, but is not of concern.	No	None
17	MH3F	L11	Redundant pipe, concrete noted in line	Yes	Cap drain at manhole entry point to ensure rodent proof
18	MH3F	L12	Redundant pipe, dry debris noted in line. Possible breach point	Yes	Cap drain at manhole entry point to ensure rodent proof

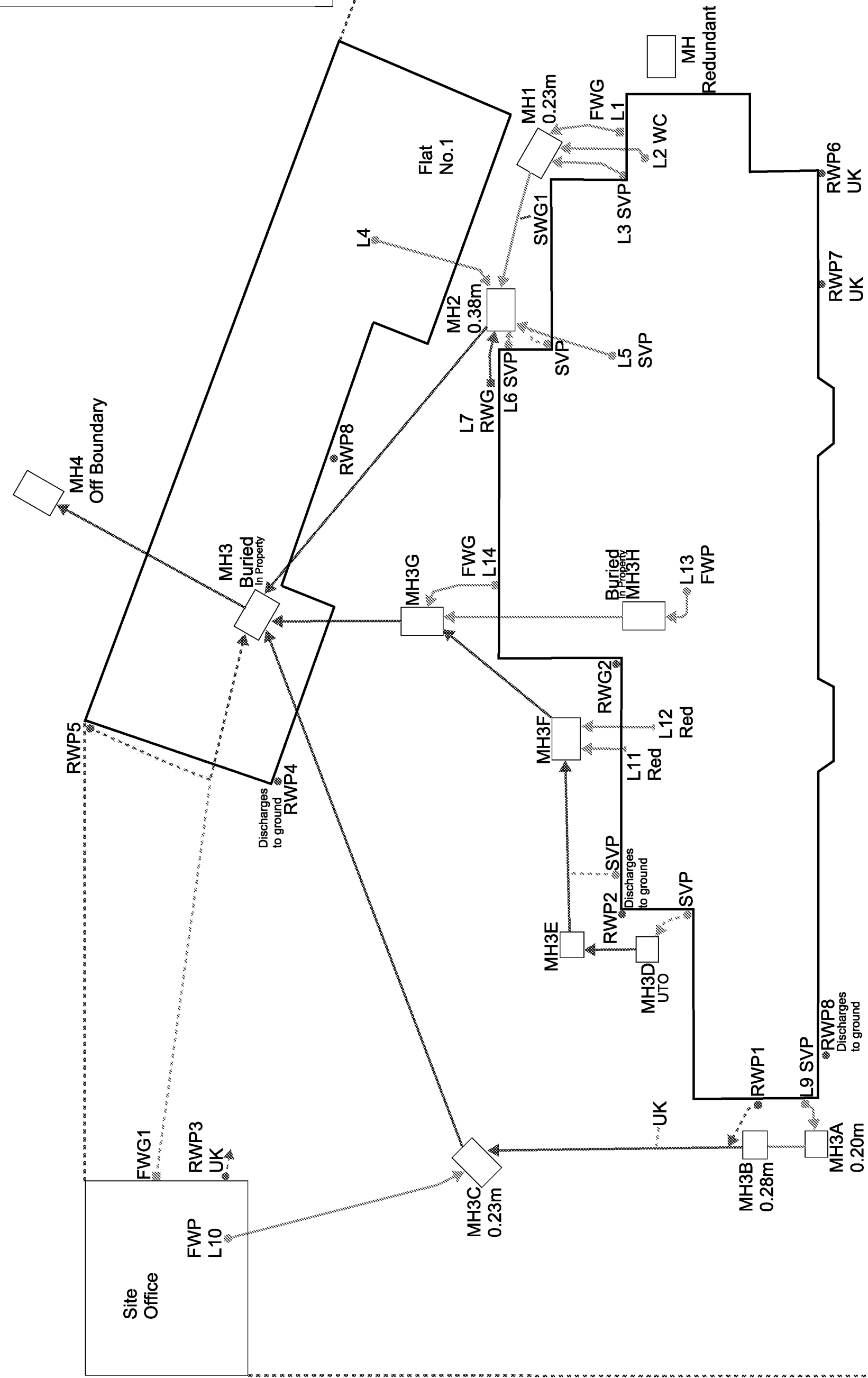
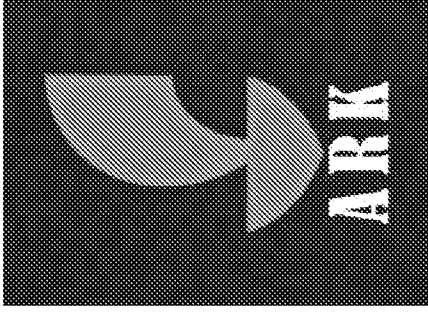
19	MH3G	MH3F	Heavy scale/fouling deposits noted in line, including multiple defects	Yes	Jet/Picote clean & Install 5m x 100mm Polyester Liner
20	MH3G	MH3H	MH3H buried internally - Scale and fouling deposits noted in line. Possibly due to poor gradient fall	Yes	Jet clean to remove deposits and re survey to show the true condition
21	MH3H	L13 FWP	MH3H buried internally. Line serviceable and free flowing	No	None
22	MH3G	L14 FWG	Gully cap missing / Grease/fouling deposits noted on pipe wall	Yes	Drain would benefit with a jet clean / Install 65mm access cap
23	MH3	MH3G	Multiple defects & limescale noted in line	Yes	Picote/Jet clean line & install 3m x 100mm Polyester Liner
24	MH4	MH3	Multiple defects, limescale noted in line	Yes	Others to expose MH3 / Picote clean & Re Survey DS to MH4
		FWG1	Grid broken - See photos	Yes	Supply and install new cast iron grid (150mm Sq)
		L7 RWG	Gully grid missing - See photos	Yes	Supply and install new cast iron grid (150mm Sq)
		RWP1	Rainwater downpipe. Rest bend to downpipe is broken - See photos	Yes	Excavate to remove and replace the rest bend to ensure watertight
		MH3D	Unable to survey chamber due to screws being seized in place. See photos	Yes	Drill out screws to allow CCTV access / Supply and Install new sealing screws
		Rodent Ingress	Rodent activity has been reported in the area of which manhole, MH3 is buried within the property beneath carpet. Two redundant pipes connecting to MH3F were also observed as seen above. In addition, no presence of a rodent blocker or Interceptor trap within MH3, will freely allow rodent entry into the private drainage system from the main Sewers	Yes	1) Others to expose MH3 & MH3H within the properties (See drawing & photos) 2) Complete the survey of both chambers 3) Install 1x 100mm Stainless steel rodent blocker within MH3 (if possible)

NOT TO SCALE

ALL DIMENSIONS TAKEN FROM MEASUREMENTS APPROXIMATE

**KEY:**

- Foul
- Rain/Surface Water
- Combined
- Assumed / Unable to Survey / Not Surveyed
- WWP = Waste Water Pipe
- IC = Inspection Chamber
- MH = Manhole
- SVP = Soil Vent Pipe
- RWP = Rainwater Pipe
- RWG = Rainwater Gully
- SWG = Surface/Rainwater Gully
- CWG = Combined Water Gully
- FWG = Foul Water Gully
- S/A = Survey Abandoned
- UK = Unknown
- Red = Redundant Pipe
- UDL = Unknown Discharge Location





## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



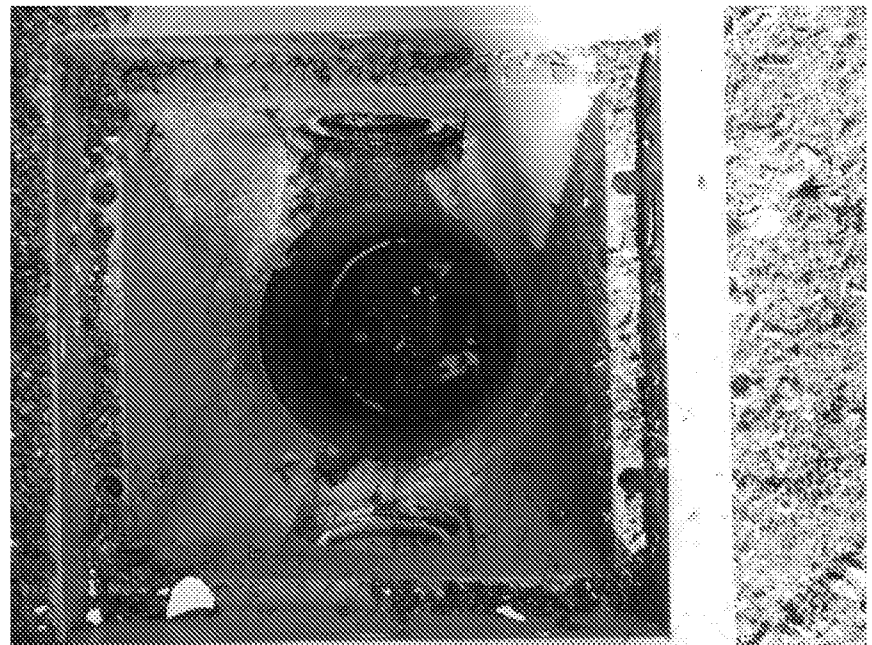
Debris removed RWG1



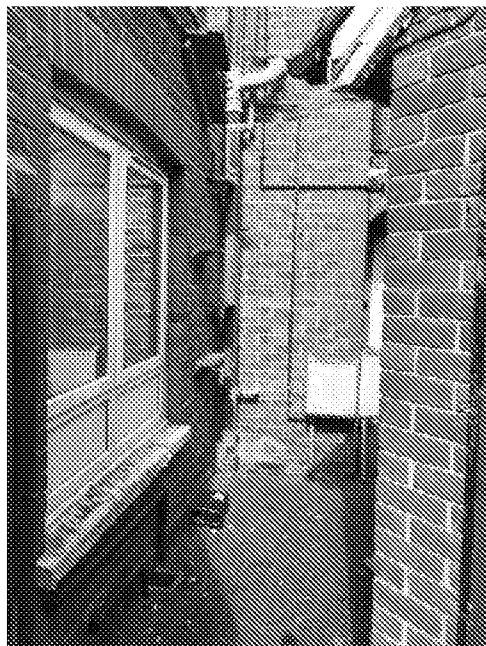
Front of property



FWG1 grid broken (0.15x0.15)



L1 FWG



L3 SVP

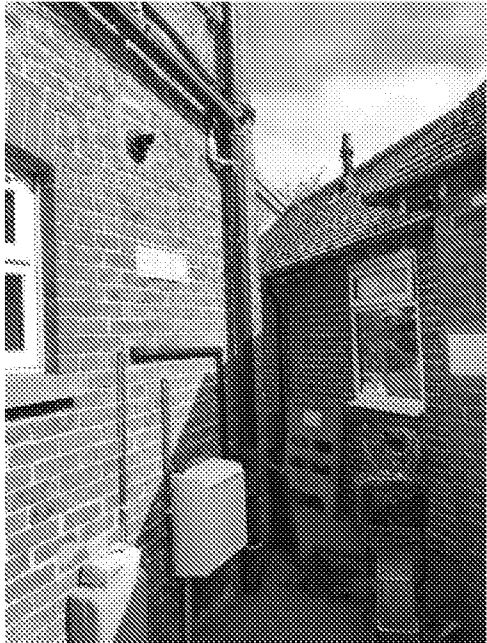


L5 SVP

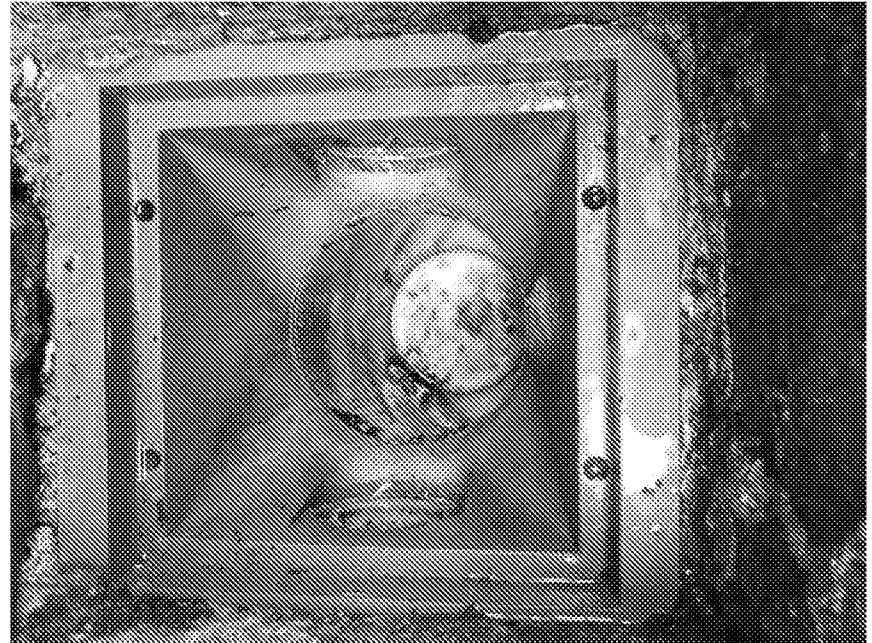


## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



L6 SVP



L7 RWG missing grid



L9 SVP overview



MH1 (1)



MH1

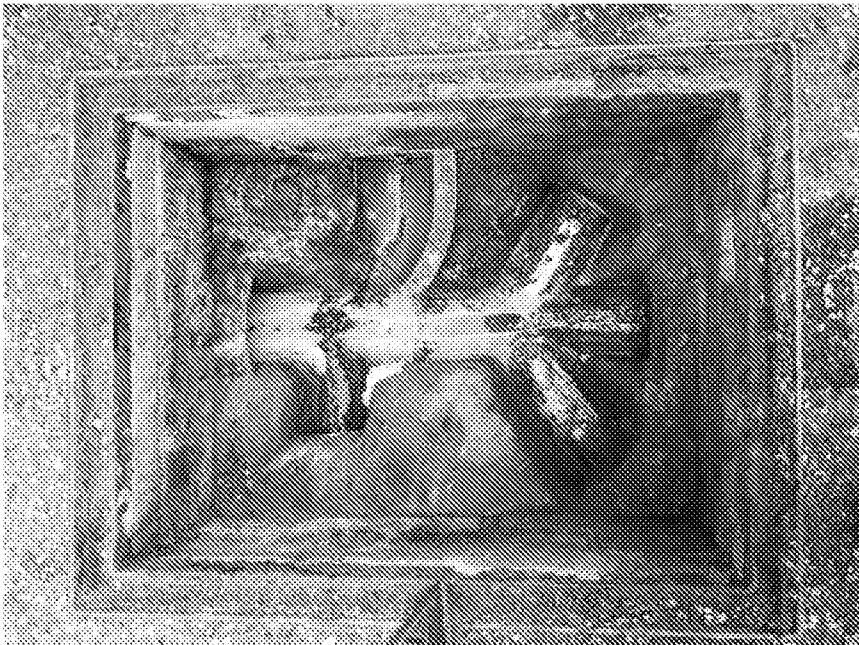


MH1-MH2 overview



## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



MH2



MH3 buried in this property



MH3-1



MH3-2



MH3-3



MH3A

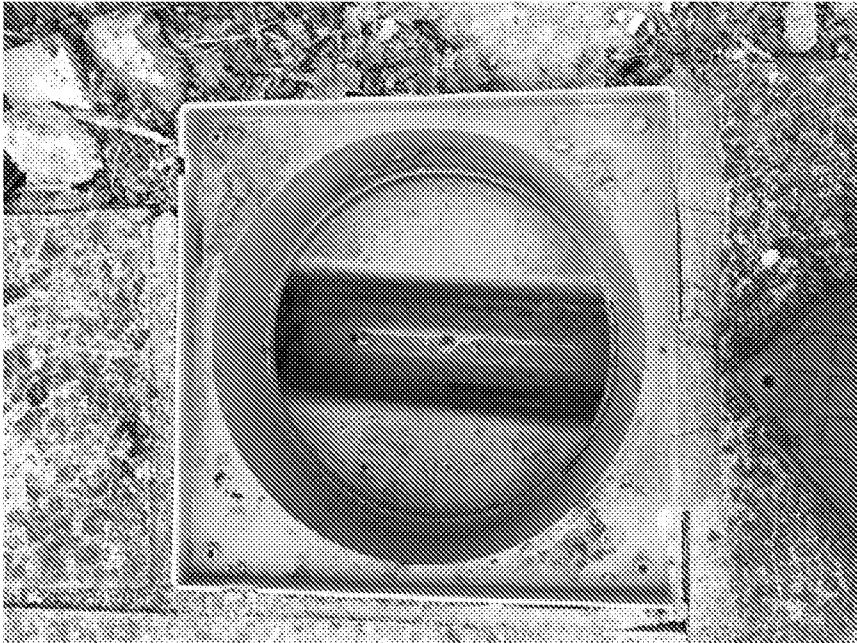


## Project Pictures

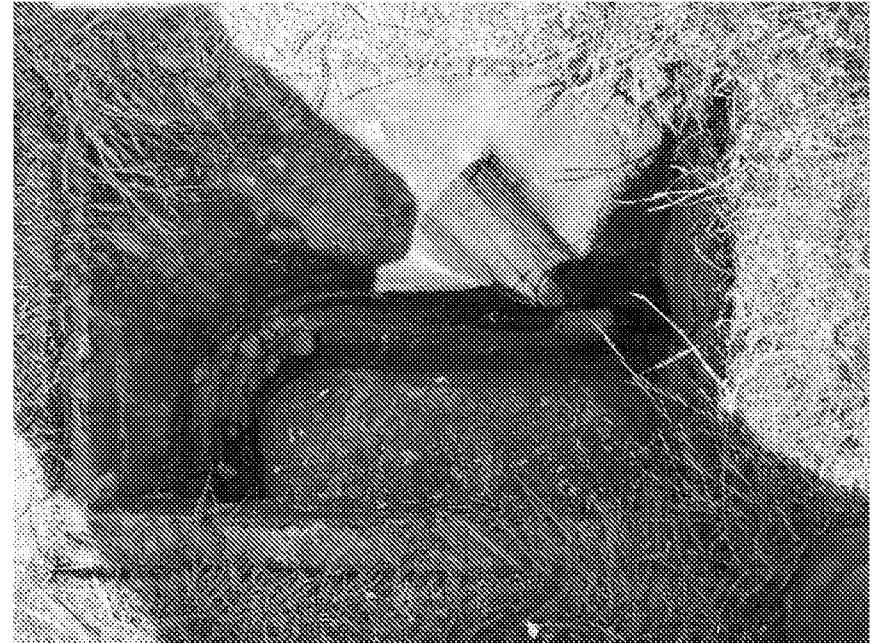
**Project Name**  
192 Hawthorn Road Bognor Regis PO21 2UX

**Project Number**

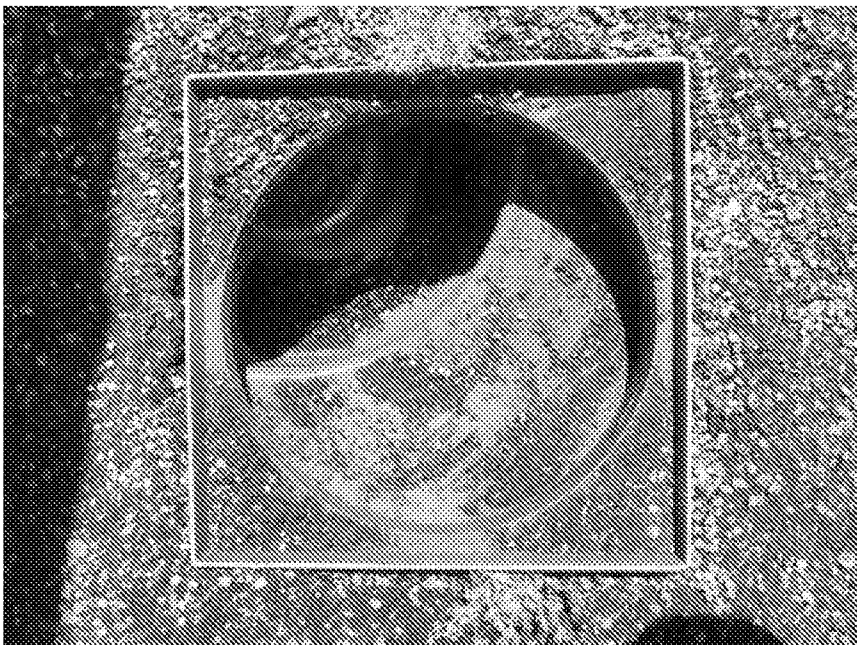
**Project Date**  
01/06/2023



MH3B



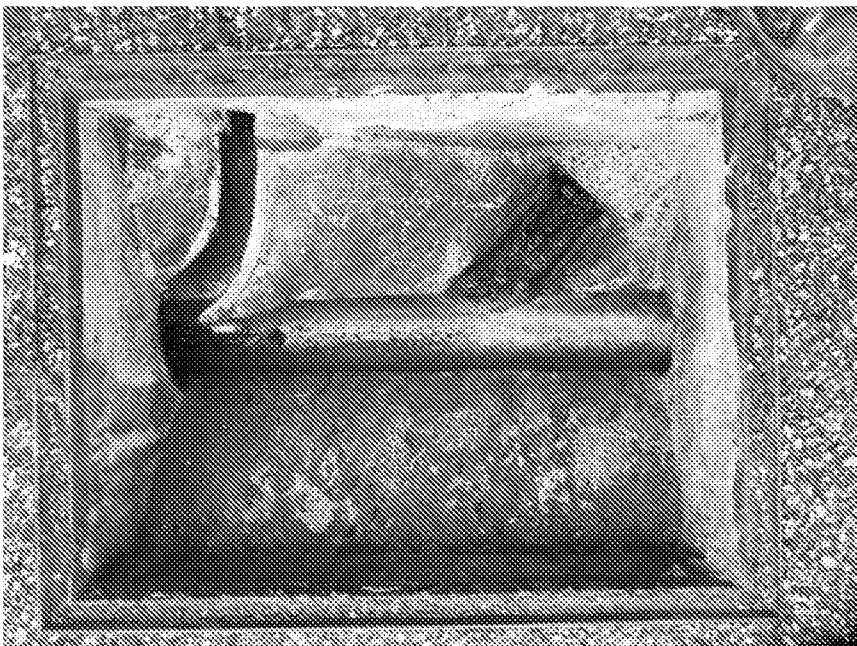
MH3C



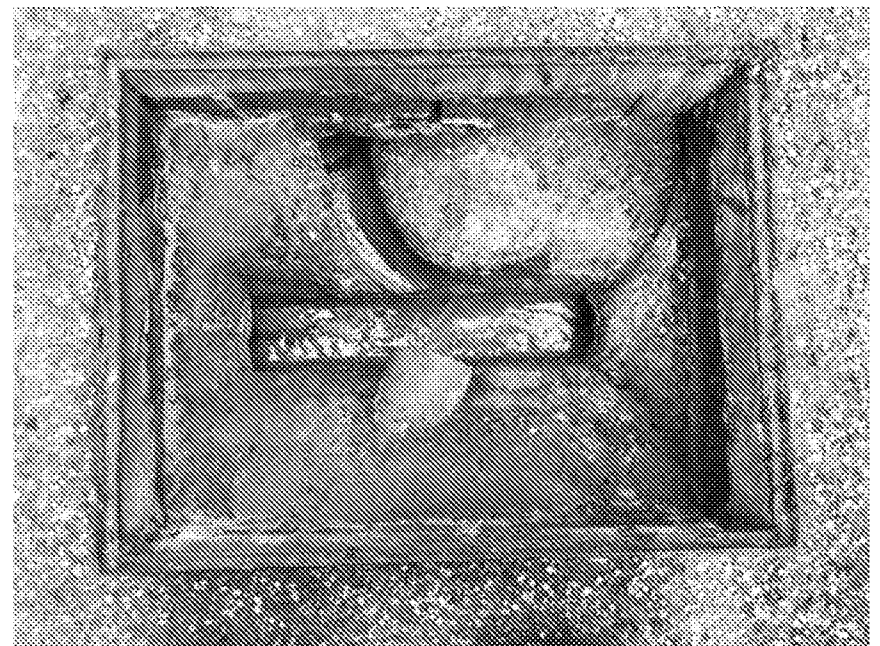
MH3E



MH3E-MH3F



MH3F

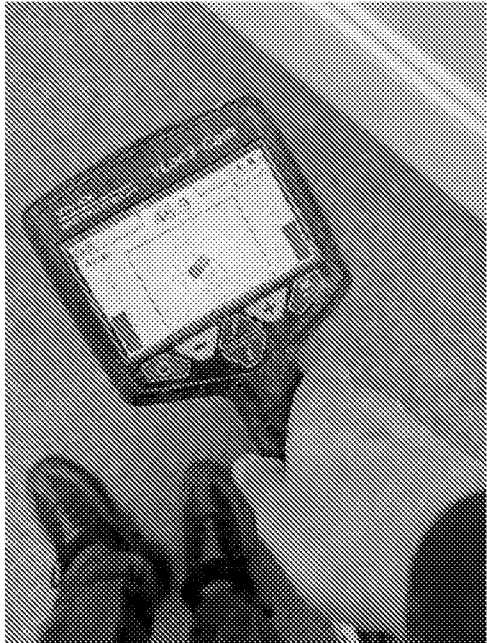


MH3G



## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



MH3H-1



MH3H-2



MH3H-3



Overview of MH3C



Overview of MH3D



Overview of RWG1



## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



Overview



Redundant manhole



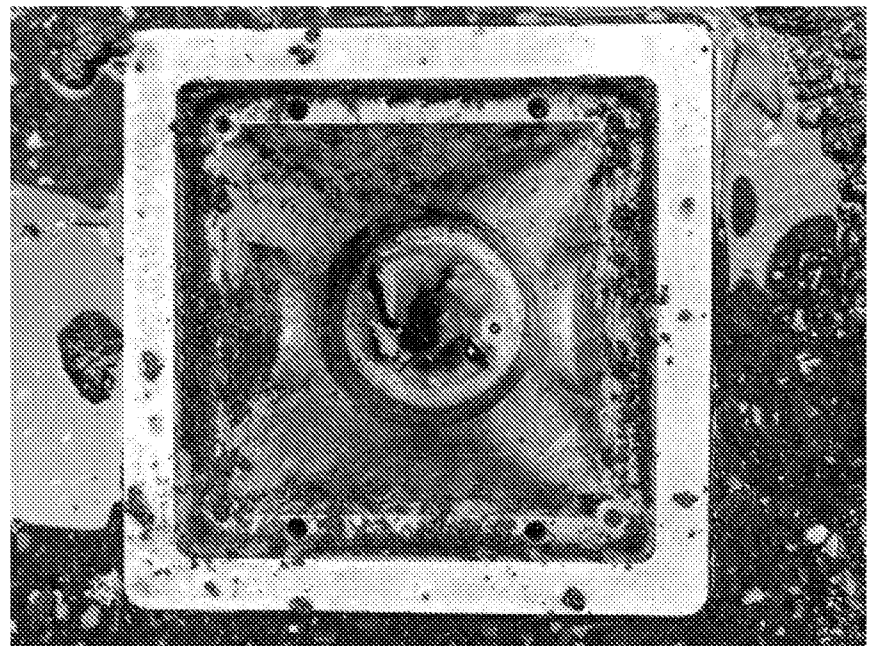
RWG1



RWP1 rest bend broken



Side of Property



SWG1



## Project Pictures

Project Name	Project Number	Project Date
192 Hawthorn Road Bognor Regis PO21 2UX		01/06/2023



Unable to remove screws on MH3D



Unknown discharge location



Where rat activity has been noted