

# Flood Risk Assessment and Drainage Strategy

## Generator Building, Finzels Reach



WB03193/FR03

Finzels Reach Property LLP

## FRA ADDENDUM

Project:	<b>Generator Building – Finzels Reach</b>	<b>WB03193 – FR03</b>
Subject:	Flood Risk Assessment and Drainage Statement for Structural Works	Revision: V1
Client:	Finzels Reach Property LLP	
Prepared by:	Gemma Goodmore (Project Engineer)	
Approved by:	Seymour D'Oyley (Associate Director)	Issue date: 13-12-2017

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## 1 Introduction

- 1.1 This report has been prepared by Clarkebond on behalf of Finzels Reach Property LLP to support a planning application for proposed structural and drainage alterations to the Generator Building in Finzels Reach, Bristol. The assessment is an addendum to the Flood Risk Assessment (FRA) prepared for the entire Finzels Reach development which was approved by Bristol City Council in April 2005 (Planning Ref: 04/02177/F). It has been undertaken in accordance with National Planning Practice Guidance for flood risk and coastal change (NPPG).
- 1.2 The wider Finzels Reach site covers approximately 2.3ha and is located alongside the Bristol Floating Harbour in Bristol's Redcliffe Conservation Area at National Grid Reference ST 59202 72939 (See Figure 1, Appendix A). The harbour forms the northern and eastern boundary, Counterslip forms the southern boundary and buildings off Victoria Street and Bath Street form the western boundary. The Generator Building is located in the south-east of Fintel's Reach alongside Counterslip and East Tucker Street (See Figure 2, Appendix A).
- 1.3 The information, views and conclusions drawn concerning the site are based, in part, on information supplied to Clarkebond by other parties. Clarkebond has proceeded in good faith on the assumption that this information is accurate. Clarkebond accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to Clarkebond from others.

## 2 Existing Building and Development Proposals

- 2.1 The Generator Building is a Grade II Listed building constructed in 1899 for steam-powered electricity generation for the Bristol Tramway system. The original building was four-storeys with a basement and mezzanine third floor, but in the 1980's it was converted into offices which included the insertion of three additional floors (two full floors and one mezzanine) and extension of the original mezzanine floor into a full floor.

2.2 The proposal is for the building to be retained for office space (A2 class), which is in line with the existing site-wide planning approval. The ground floor will include office space, a reception area and lift core. The proposed structural works include:

- Reinstall former main entrance and provision of atrium with new lifts and stairs at the southern end of the building;
- Provision of additional office floor space;
- Install sealed metal plates across openings on the harbour frontage (which are not watertight at present) below the consented protection level of 10.1m AOD;
- Install non-return valve in existing foul manhole.

2.3 The proposed floor plans are included in Appendix B.

### **3 Hydrology**

3.1 The site is located on the Floating Harbour which is a section of the River Avon bound by lock gates which keep the water levels artificially low. The levels are maintained by control of flows entering the harbour by Netham Lock upstream of the site and exiting the harbour via the underfall Sluices in normal tide conditions.

3.2 To mitigate the effect of large flows entering from the Avon the harbour can be pre-lowered by the harbour Office allowing an additional freeboard of some 200mm which is beneficial in reducing water level at the harbour low points. Water from the Avon can only enter the western end of the harbour through Cumberland Basin and the Junction Lock gates during locking operations or during a high spring tide (over 8.5m AOD) when tidal waters can overtop the crest level of Cumberland Basin and flow around the Junction Lock gates.

3.3 On the opposite side of the harbour below Castle Park are outfalls for part of the culverted section of the Bristol River Frome which runs under Bristol City Centre. This section of culvert acts as storm water overflow and only discharges into the harbour during high storm flows when the main culvert for the Frome becomes tide locked. In heavy rainfall when flows in the River Frome are very high, much of the excess river water is diverted into the Northern Storm Water Interceptor which discharges river flows directly into the Avon near the Suspension Bridge. This would serve to reduce the levels of the harbour adjacent to the site, protecting it from the effects of high fluvial flows.

3.4 Figure 3 (Appendix A) includes a schematic of the Floating Harbour showing the interaction with the River Avon and the Bristol River Frome.

### **4 Flood Risk**

4.1 The site is located in Flood Zone 3a (see Figure 4, Appendix A). The main source of flood risk to the site is from tidal flooding with a risk of extreme tides in the River Avon overtopping the lock gates and entering the harbour. The fluvial flood risk to the site is low due to the presence of the

Northern Storm Water Interceptor which diverts flows from the River Frome away from the harbour, and the presence of the lock gates at Netham. Other sources of flooding (surface water, groundwater, sewer, reservoir) were not considered to be significant and so the consented mitigation is designed in response to the tidal risk.

- 4.2 National Planning Practice Guidance for flood risk and coastal change (NPPG) states that developments should be designed to cope with the 1-in-200 year tidal event (0.5% chance of occurring each year) accounting for the effects of climate change over the development lifetime. Table 1 shows the flood level data provided by the Council in 2015, which has been used to inform the site-wide flood protection.

**Table 1 – Flood Level Data from Bristol City Council**

Storm Event Annual Exceedence Probability (AEP)	Site Flood Level Data (m AOD)
1000 year fluvial event (0.1% AEP) – 2010 Scenario	Flood free
100 year fluvial event (1% AEP) – 2110 Scenario	Flood free
200 year tidal event (0.5% AEP) – 2010 Scenario	Flood free
200 year tidal event (0.5% + Climate Change AEP) – 2110 Scenario	9.7m AOD
200 year tidal event (0.5% + Climate Change AEP) – 2115* Scenario	9.8m AOD

*(\*BCC provided flood levels for the 2110 year tidal event (not the 2115 year event which would represent the likely effect of climate change based on the estimated life of the proposed development), therefore an estimation of the climate change effects (0.10m) was made for the period 2110-2115 from DEFRA guidance)*

- 4.3 The site is shown to be flood free for the 200 year event in present day. This is because of the influence of the lock gates keeping the harbour level low, so there is only a tidal flood risk when the level of the lock gates are overtopped (i.e. tide greater than 8.5m AOD). This means for present day the likelihood of flooding is less than 0.5% in any given year. However, in 100 years' time, the site is predicted to flood to a level of 9.8m AOD for the same probability event. As the site is at risk from the 1 in 200 year event accounting for climate change, it is considered to be in Flood Zone 3a (See Table 2).

**Table 2: Definition of Flood Zones (taken from Table 1 of NPPG)**

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding.
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 sea flooding.
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 sea flooding.
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. The Strategic Flood Risk Assessments should identify the areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.

- 4.4 Although the site is at risk of flooding, it passed the Sequential Test which was undertaken by Bristol City Council in the identification of suitable development sites in the local plan. The site has been allocated for mixed-use development under Policy BCAP SA6: Site Allocations in Redcliffe (site ref. SA601) of the 'Bristol Central Area Plan' adopted on 17 March 2015.

## **5 Consented Mitigation**

- 5.1 According to the original site-wide FRA produced in 2004, the level of protection required was up to 9.4m AOD which was based on flood level data from previous modelling. However, based on the more recent flood levels, the new agreed level of protection is 10.1m AOD which provides 300mm freeboard on the flood level of 9.8m AOD.
- 5.2 The Finished Floor Level (FFL) of the main entrance to the Generator Building from Counterslip will be above the protection level at 10.81m AOD, but the remaining ground floor area is proposed to be 9.32m AOD. The office space is classified as 'Less Vulnerable' development under Table 2 (Paragraph 066) of NPPG and is considered acceptable to have a FFL below the flood level provided that other measures of protection are provided. This approach has been agreed for other 'Less Vulnerable' development in Finzels Reach.
- 5.3 The building will be protected over the development lifetime by the consented site-wide flood protection measures, which include:
- Site wide flood barrier made up of demountable barriers and flood resistant building walls (See Appendix C);
  - Watertight construction of walls and floor of basement car park;
  - Raised air vents above 10.1m AOD;
  - Building openings along Harbourside constructed from reinforced, watertight materials;
  - Sensitive / electrical equipment contained in watertight housings or above the level of 10.1m AOD;
  - Closure of pedestrian bridge prior to a flood event;
  - Flood evacuation plan which informs site management team of measures to evacuate and secure the site; and
  - Non-return valves on drainage below flood level.
- 5.4 The sealing of the building openings at the Generator Building will help to ensure the provision of the site-wide flood protection. The proposed plant room is located on the sixth floor to minimise the risk of damage in floods which exceed the design standard or in the event of defence failure.
- 5.5 Foundations for the demountable flood barriers will be provided between the Generator Building and the buildings adjacent, and the barriers will be stored within the main basement car park area under East Tucker Street. As the site is not at risk in present day, it is accepted that the site-wide flood barrier will only be operational once the entire site has been re-developed.
- 5.6 The site will be signed up to Floodline; a flood forecasting system that provides flood warnings to the site management team, who will evacuate the site and deploy the site-wide protection

measures. The actions required by the site management team before, during and after a flood are fully described in the Flood Emergency Management Plan (FEMP) which was produced for the site as a whole.

## **6 Drainage Strategy**

- 6.1 The proposed drainage strategy is included in Appendix D.
- 6.2 The main drainage network for Finzels Reach is already constructed. There is a 150mm diameter storm sewer that runs along the East Tucker Street with an outfall to the Floating Harbour just north of the Generator Building. Water levels in the harbour are managed so discharge is unrestricted and no attenuation is required.
- 6.3 Surface water runoff from half of the roof (facing East Tucker Street) and the roadway between Temple Plot and the Generator Building will be collected by downpipes with lateral connections into the existing storm sewer. The existing downpipes on the harbour side of the building will discharge directly into the harbour as per the existing arrangement. The rainwater pipes must be fully sealed to the below ground pipework to ensure that flood water does not breach the flood barriers between the harbour and the face of the building.
- 6.4 Foul flows will connect into the existing 225mm diameter foul sewer on East Tucker Street. The only change to the existing sewer will be the addition of a non-return valve in the final manhole on site (Manhole F9) in order to prevent surcharge in a tidal flood.

## **7 Conclusion**

- 7.1 To conclude, the proposed works to the Generator Building meet the requirements of the consented site-wide flood mitigation measures which are in accordance with NPPG.

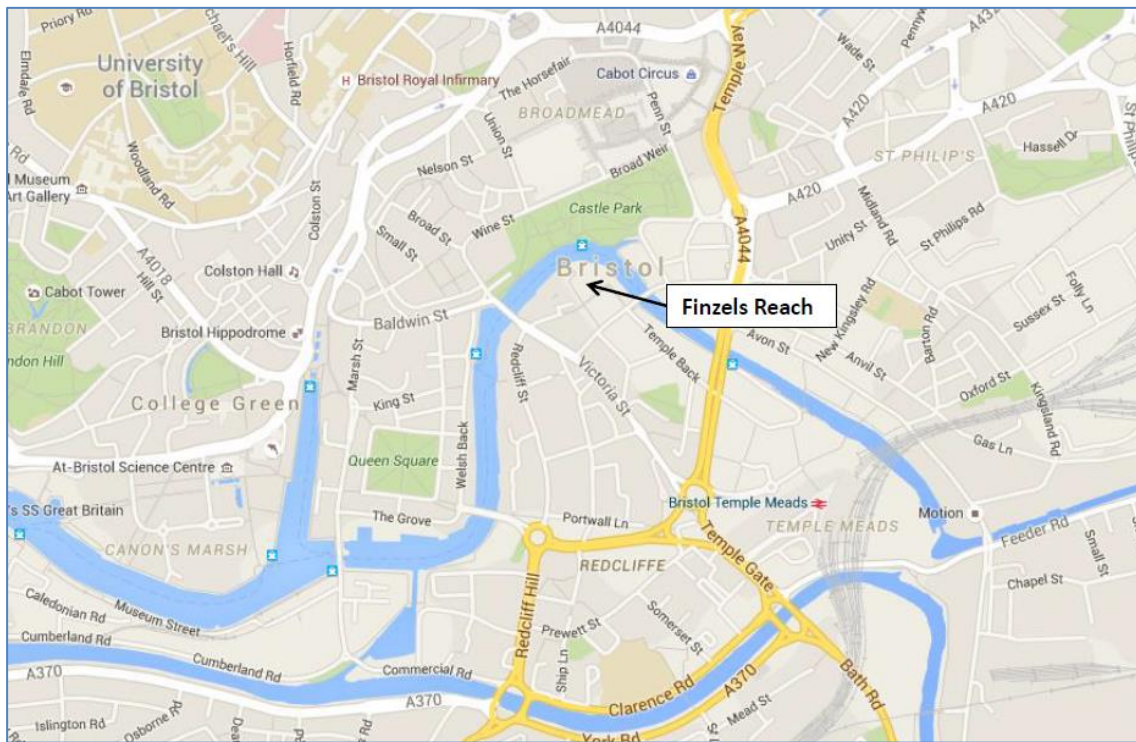
## **APPENDIX A – Figures**

Figure 1 – Location of Finzels Reach

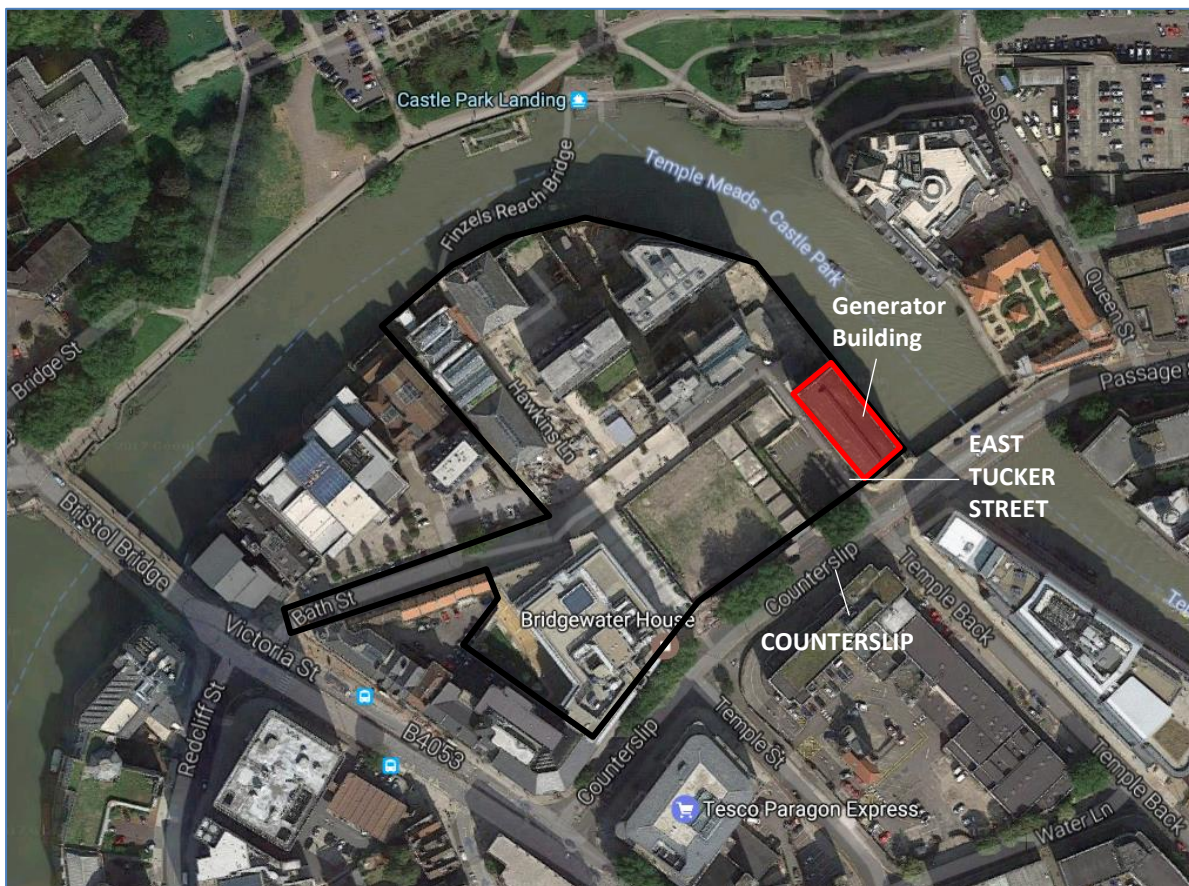
Figure 2 – Location of Generator Building  
(2 pages)



**Figure 1 – Location of Finzels Reach**

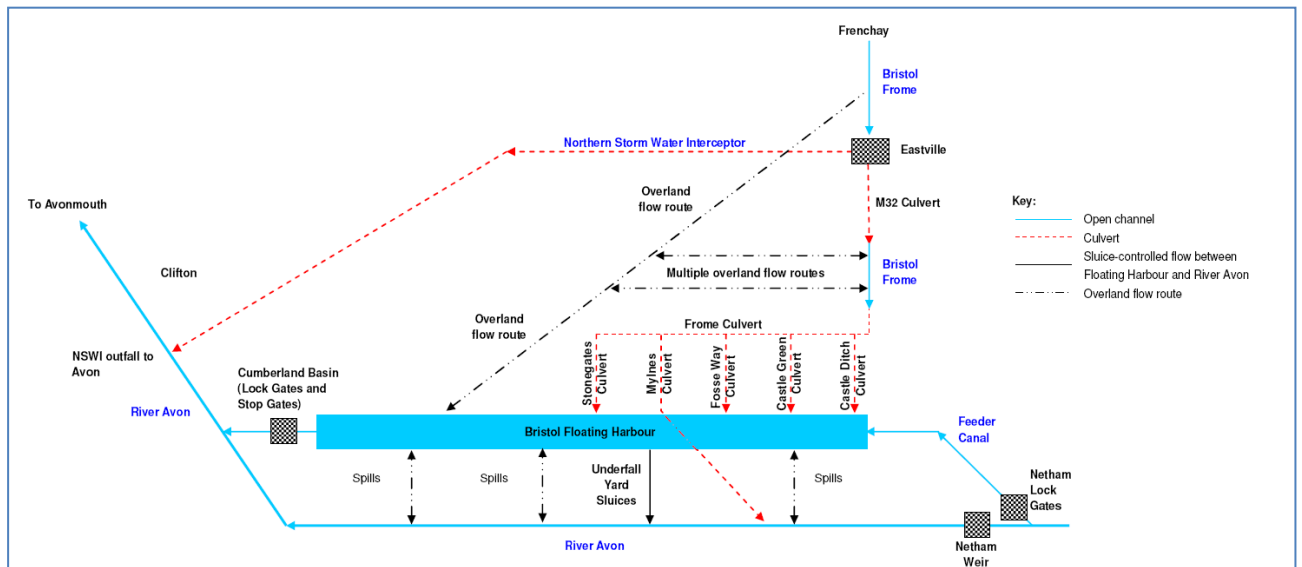


**Figure 2 – Location of Generator Building**

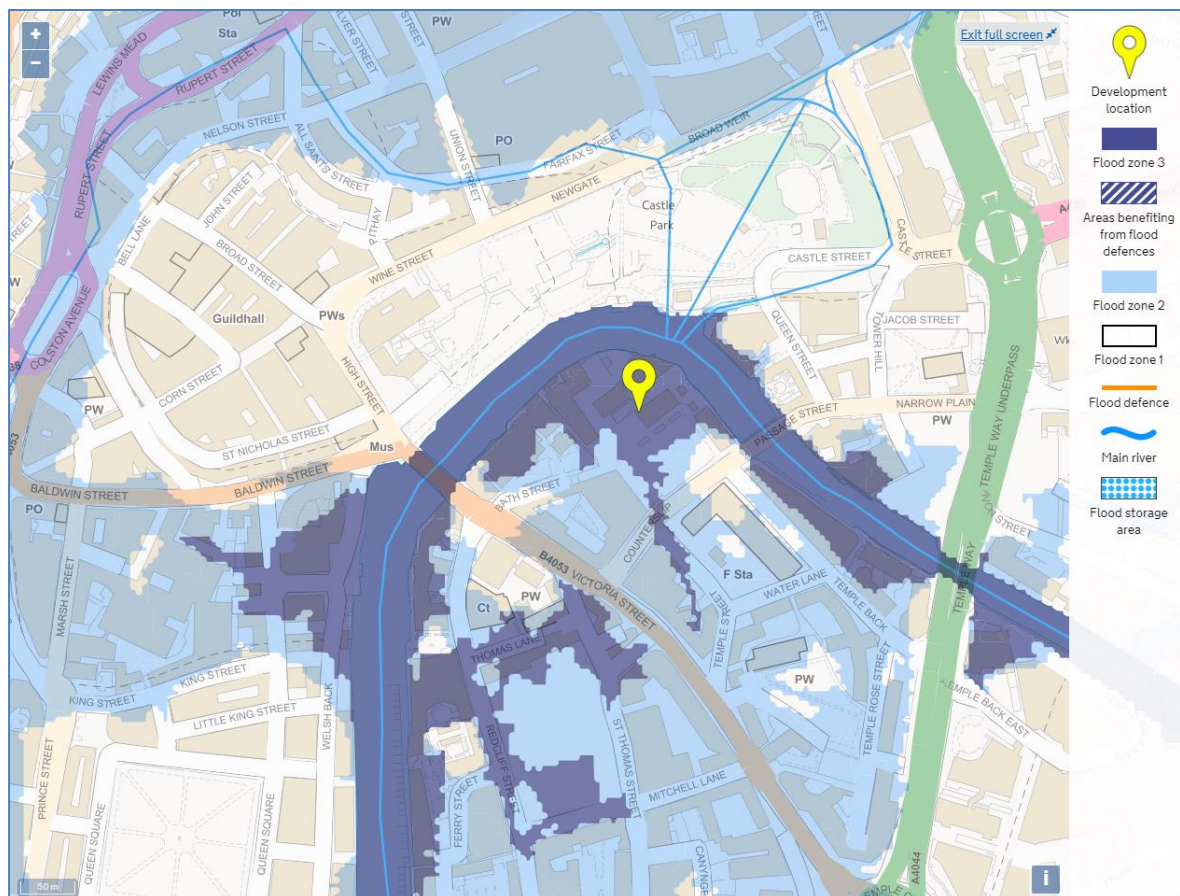




**Figure 3 – Schematic of the Floating Harbour showing the interaction with the Avon and Bristol Frome**

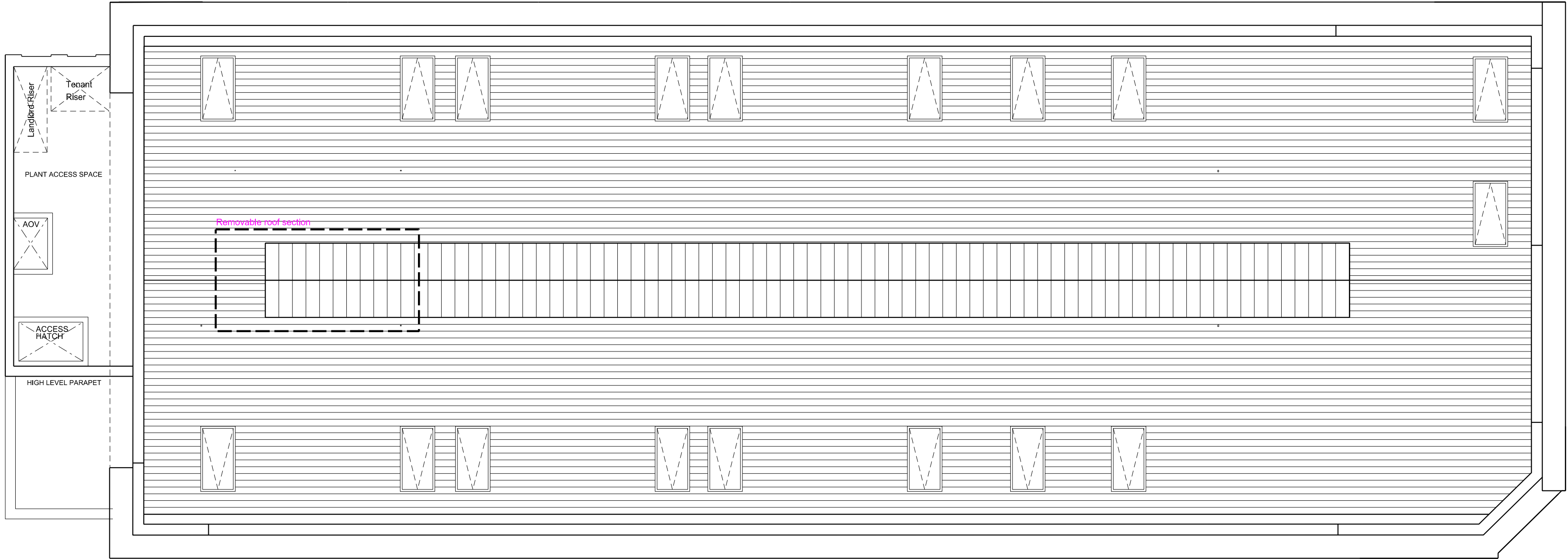


**Figure 4 – Flood Map for Planning**

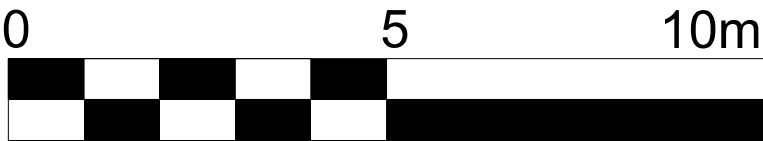


## **Appendix B – Proposed Floor Plans**

Drawings 3303\_L\_050 to 3303\_L\_057  
(8 pages)



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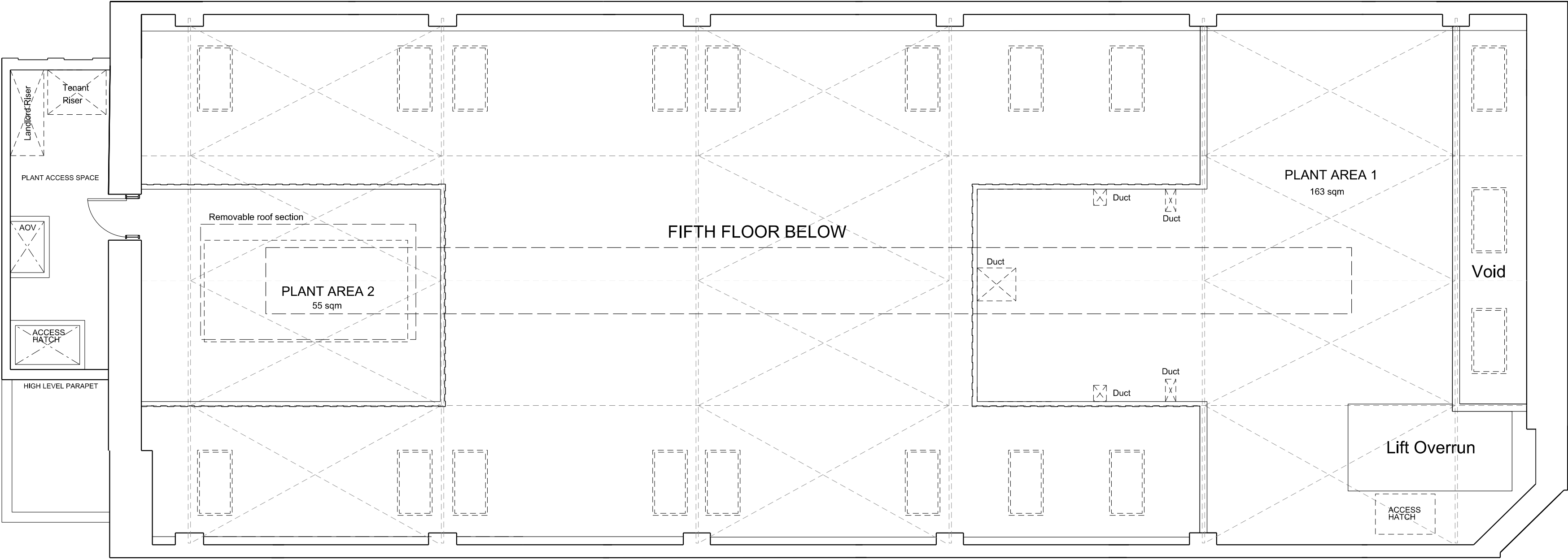
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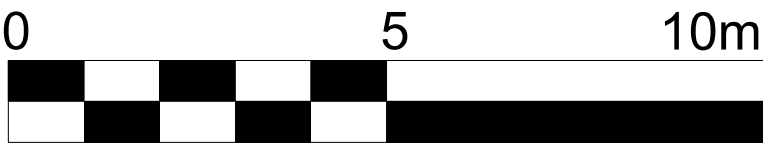
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Drawn	BDR	Project	FINZELS REACH: GENERATOR BUILDING	Rev	-
Scale	1:100 @ A2	Drawing	PROPOSED ROOF PLAN		
Date	27/10/17	Number	3303_L_057		



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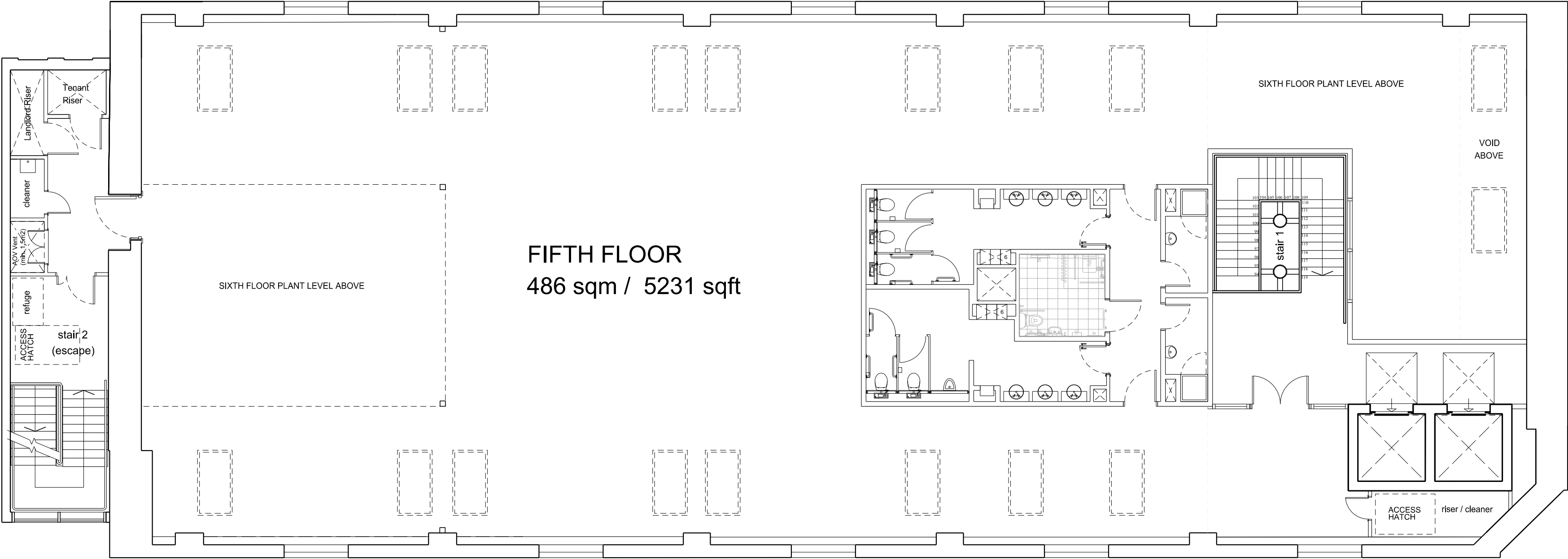
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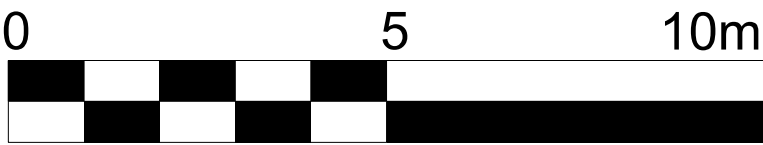
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Drawn	JWJ	Project	FINZELS REACH: GENERATOR BUILDING
Scale	1:100 @ A2	Drawing	SIXTH FLOOR (PLANT ROOMS) PLAN
Date	Nov 2017	Number	3303_L_056
Rev -			



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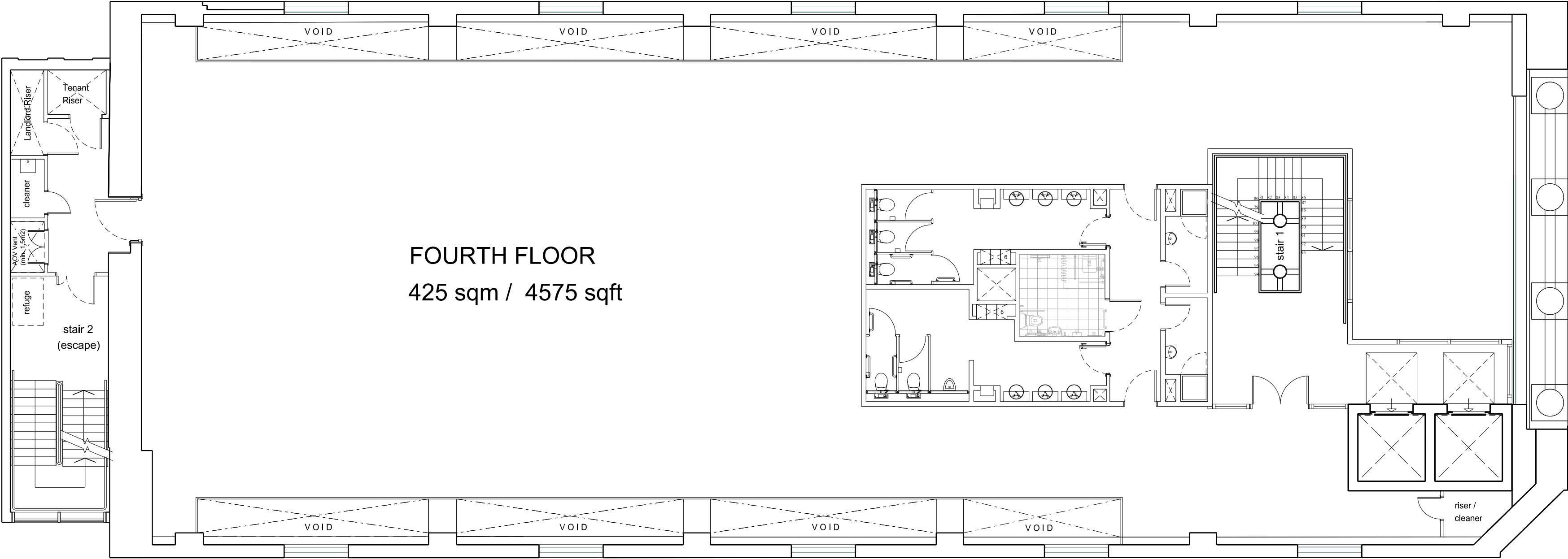
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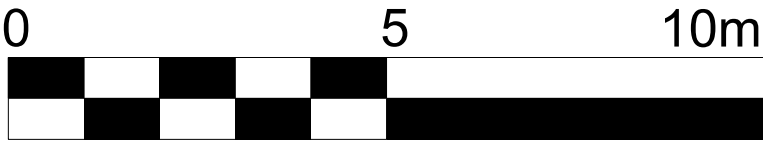
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Drawn	JWJ	Project	FINZELS REACH: GENERATOR BUILDING
Scale	1:100 @ A2	Drawing	PROPOSED FIFTH FLOOR PLAN
Date	Nov 2017	Number	3303_L_055
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FOURTH FLOOR  
425 sqm / 4575 sqft

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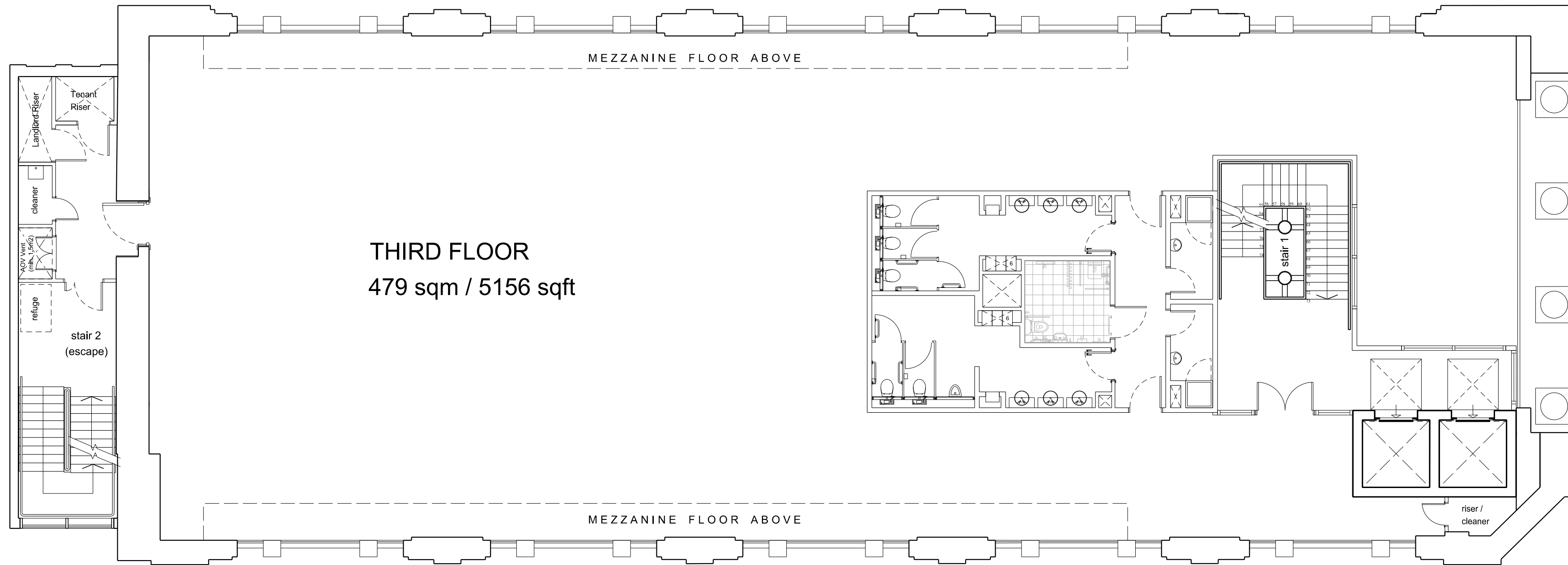
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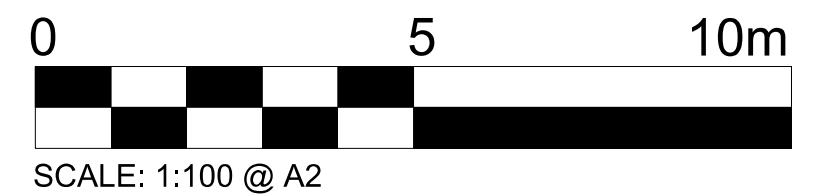
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Date	Nov 2017	Number	3303_L_054
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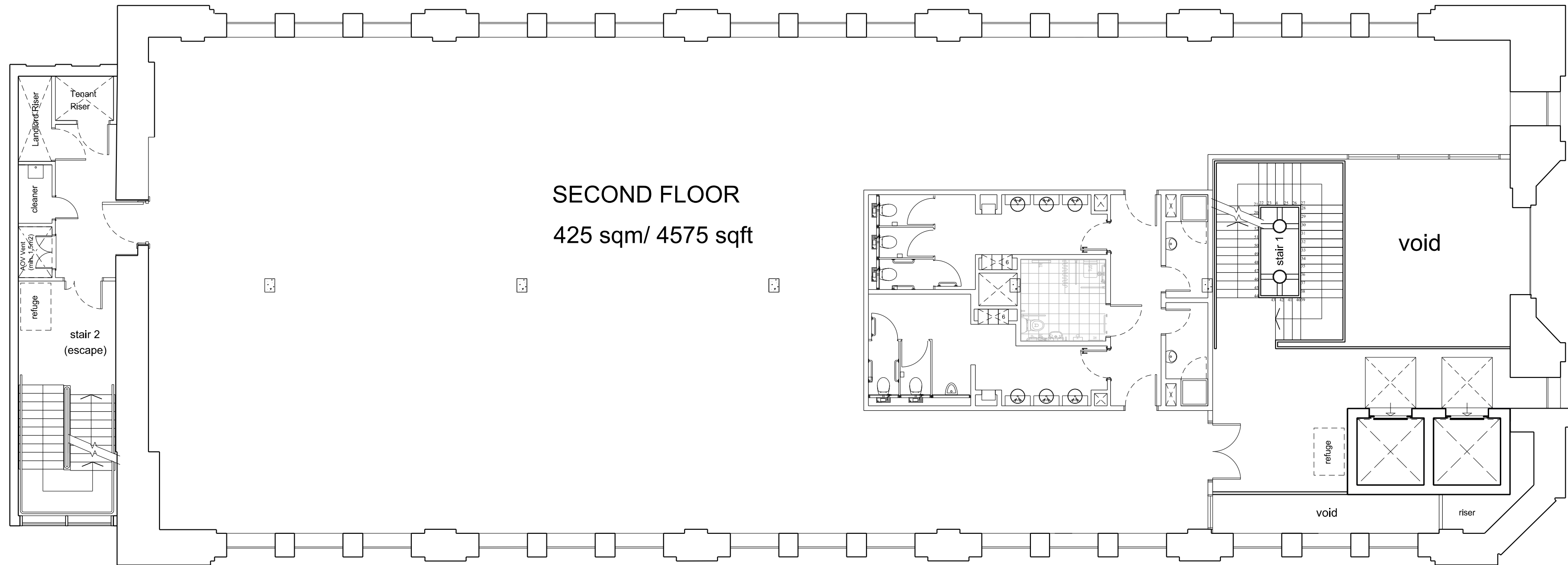
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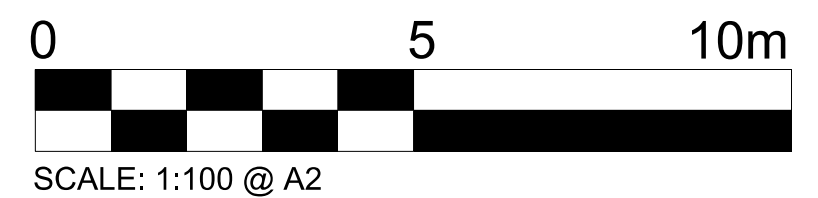


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Date	Nov 2017	Number	3303_L_053
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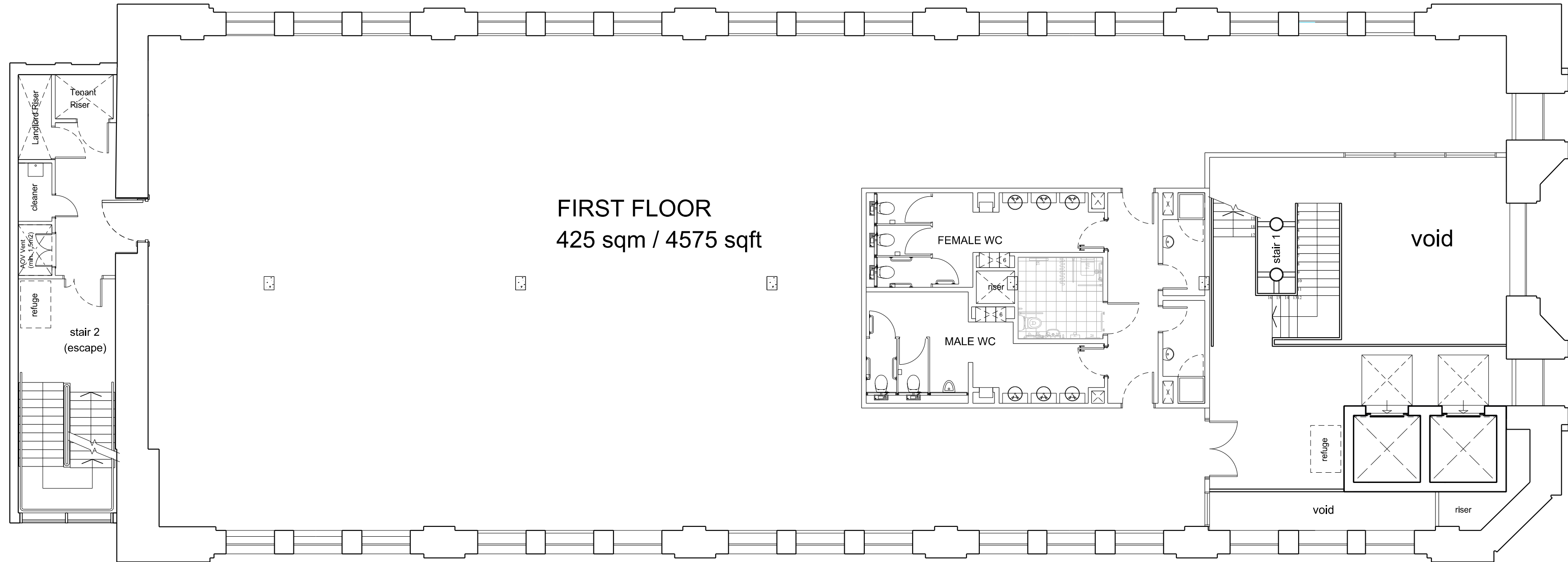
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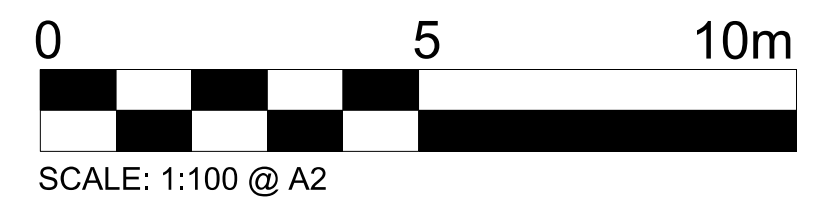


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Date	Nov 2017	Number	3303_L_052
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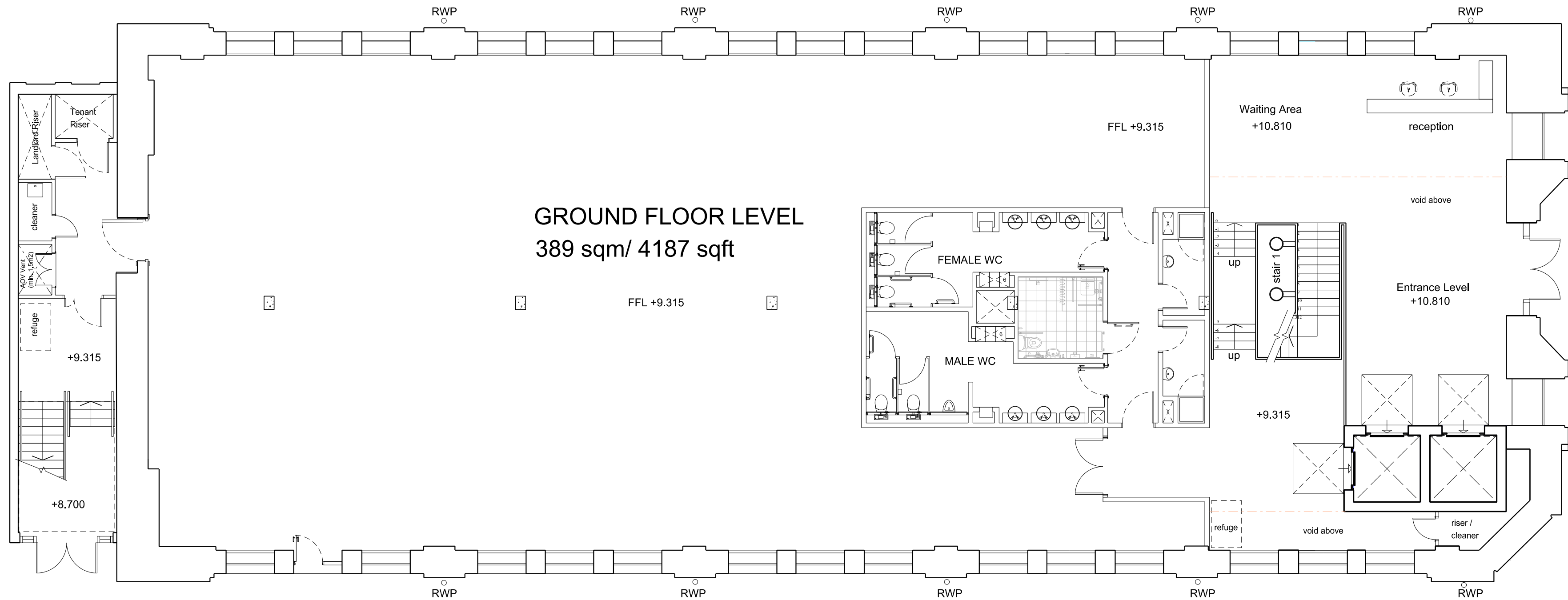
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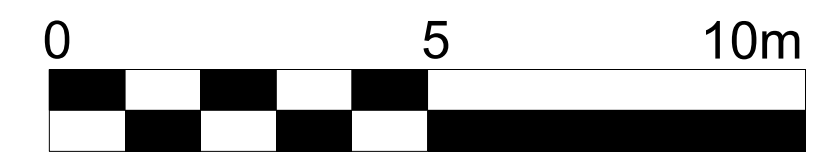


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Date	Nov 2017	Number	3303_L_051
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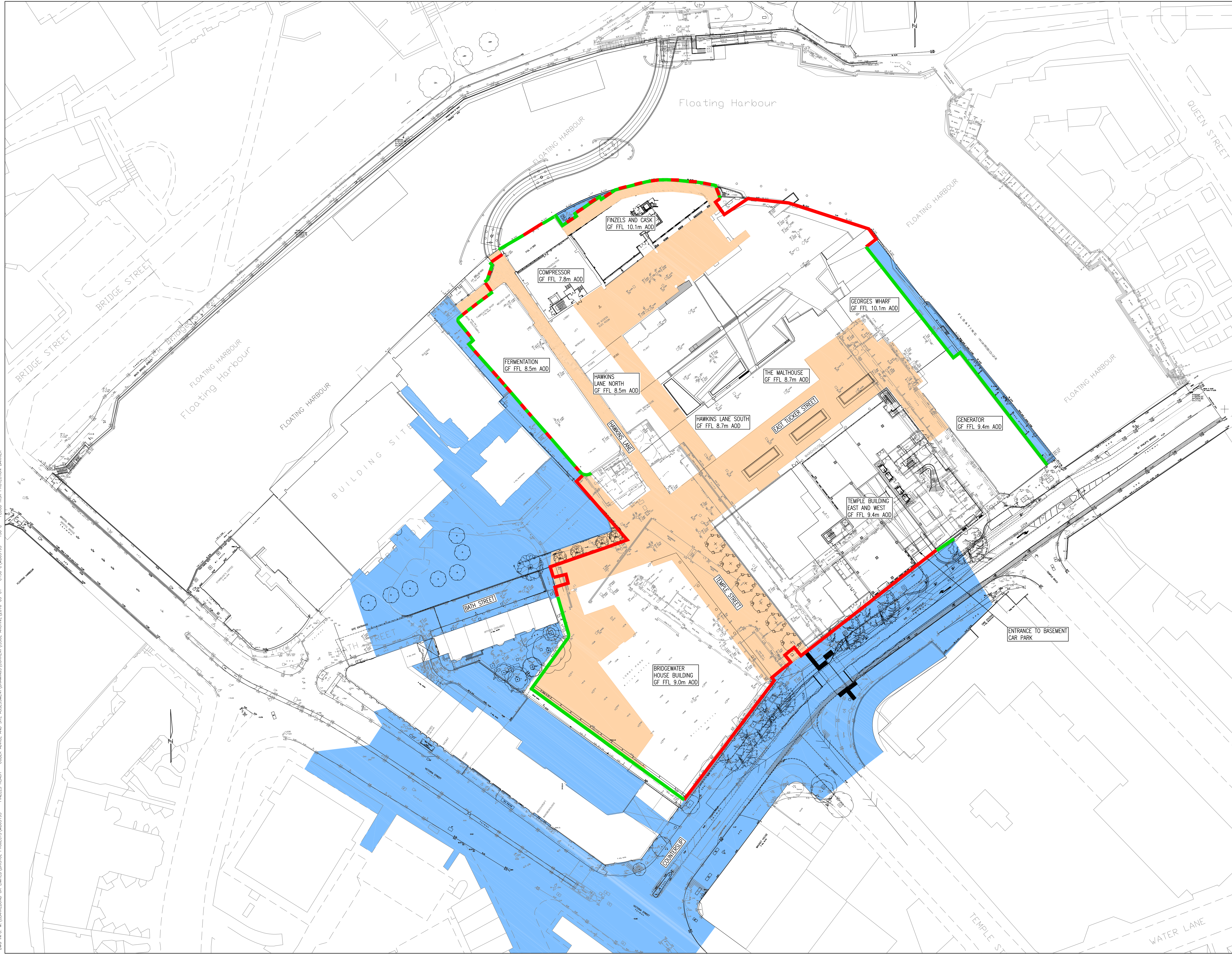
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Date	Nov 2017	Number	3303_L_050
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## **Appendix C - Site-wide Flood Protection**

Flood Risk Protection Barrier – WB03193/C/ 150  
(1 page)



DWG INFO: W:\CLARKEBOND UK LIMITED\BRISTOL PROJECTS\WB03193 - FINZELS REACH - CUBEX ADVISE AND SITE ASSESSMENT\DRAWINGS\CURRENT\ISSUE ARCHIVE\2016-09-01 - C150 C - FLOOD RISK PROTECTION BARRIER



#### CDM RESIDUAL RISKS

The work shown on this drawing is both familiar to the designers and routinely safely built in similar circumstances by competent contractors.

Risks are not considered significant.

Relevant data is included in the Pre-Construction Information Pack

Signed:

Date:

DO NOT SCALE THIS DRAWING

CONTRACTOR TO CHECK ALL DIMENSIONS AND REPORT ALL ERRORS AND OMISSIONS TO THE ENGINEER

#### KEY

- FLOOD PROTECTION- DEMOUNTABLE BARRIER
- PROTECTED AREA
- AREA VULNERABLE TO FLOODING
- FLOOD PROTECTION- FROM EXTERNAL WALLS AND BUILDING FABRIC OF EXISTING STRUCTURES

#### NOTES

- ALL FLOOD BARRIERS (GATES AND ENTRY POINTS)- T200YR + CC 9.8m AOD WITH 300mm FREE BOARD- 10.1m AOD

C	BARRIER LOCATIONS	GN	JP	01.09.16
B	FLOOD PROTECTION BARRIER AMENDED	DSH	SD	16.12.15
A	LATEST ARCHITECT LAYOUT ADDED. FLOOD BARRIER AMENDED TO SUIT	DSH	SD	26.11.15
Rev	Detail	By	CHK	Date
Revisions				

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Client  
**FINZEL'S REACH PROPERTY LLP**

Project  
**FINZEL'S REACH**

Drawing Title  
**FLOOD RISK PROTECTION BARRIER**

Drawing Status			
<b>INFORMATION</b>			
Project No.	Discipline	Drawing No.	
<b>WB03193</b>	<b>C</b>	<b>150</b>	
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Date		Revision	
<b>17.04.14</b>		<b>C</b>	

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## **Appendix D – Drainage Strategy**

Existing and Proposed Drainage – SK11  
(1 page)





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