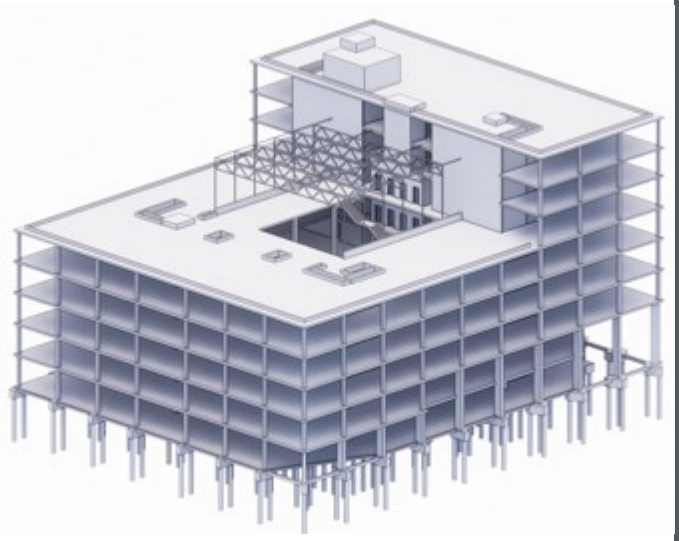
June 2023
Flood Risk Assessment

Upper Brook Street Masterplan
(McLaren / Kadans)



Flood Risk Assessment

Upper Brook Street Masterplan (McLaren/Kadans), Manchester

UBS-HDR-ZZ-XX-RP-S-000002

Blackfriars, London

Document Control

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1 Introduction

1.1 Scope of Report

Kadans Science Partner Ltd (Kadans) have commissioned HDR to undertake a Flood Risk Assessment (FRA) and Drainage Strategy in relation to a Sci-Tech proposed development at Elizabeth Yarwood Court, located at Block B of the Upper Brook Street Strategic Regeneration Framework Guidance (SRFG) 2019 site. The Sci-Tech development is part of McLaren/Kadans development of the Upper Brook Street Masterplan where a PBSA development will be delivered as well. It is understood that the scheme will comprise demolition of the existing Elizabeth Yarwood Court building, and the construction of a 6 to 9 storey Sci-Tech office and laboratory building.

1.2 Site Description

McLaren/Kadans development forms one element of the wider Upper Brook Street Illustrative Masterplan which can be seen within the submitted Supporting Planning Statement.

The masterplan proposals are being brought forward by Kadans Science Partner, McLaren Property, Property Alliance Group and Moda Living. The masterplan intends to transform the currently vacant sites, re-establishing their important role in the area by re-introducing permeability, public realm, and active community-facing uses at ground floor. The emerging masterplan includes 2.9 acres of new public realm and green spaces, a new public square, as well as a series of high-quality new buildings of varying heights to provide for approximately 700,000ft2 of sci-tech accommodation, 1,800 purpose-built student accommodation beds, and 25,000ft2 of active ground floor uses.

The Site is approximately 1.084 hectares (ha) in size and is located in Manchester, between Upper Brook Street to the southwest, Kincardine Road to the northeast and Cottenham Street to the southeast. The Site is partially in use as a temporary paid car park. The paid car park is located on a section of the Site which was formerly in use as a Citroën car dealership and is accessed from both Upper Brook Street (UBS) to the southwest and Kincardine Road to the northeast. On this section of the site a PBSA building is proposed, as previously mentioned.

The remainder of the Site designated as Block B and allocated for a Sci-Tech development comprises the former sheltered housing scheme that ceased to be operational in June 2021 and associated landscape and parking areas (see Figure 1-1).
The far southwest of the Site is covered by a canopy associated with a disused car showroom. The Flood risk assessment and drainage strategy outlined in this report covers the Block B Sci-Tech Building development site only. It is understood that a separate assessment is carried out for the adjacent PBSA development.

A topographic survey of the Site has been undertaken and is provided in Appendix A. The existing Site is relatively flat, with a high point of approximately 40m Above Ordnance Datum (AOD) in the south, with slightly elevated levels falling to around 39m AOD also along the western boundary. Ground levels across the rest of the Site generally fluctuate between 38.7m and 38.9m AOD.

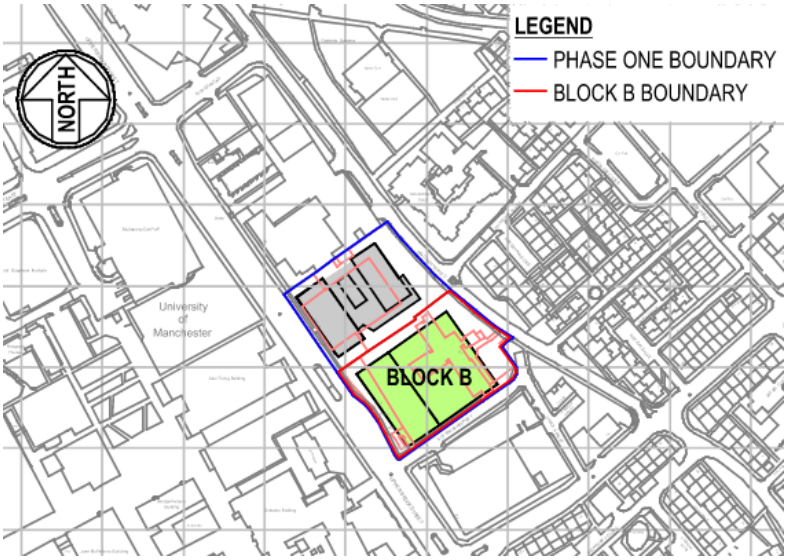

Figure 1-1. Site Location and Boundary

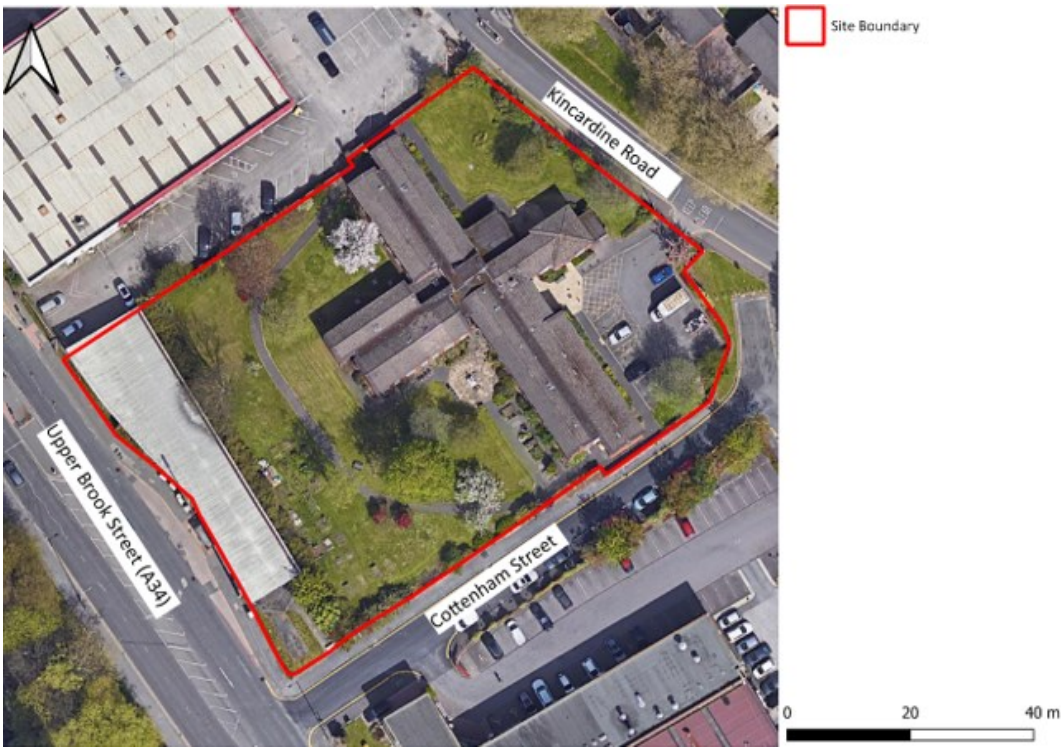

Figure 1-2. Block B Site Location (Google)

1.3 Development Proposal

The Sci-Tech development proposals (Appendix B), hereafter referred to as the 'Proposed Development') comprise demolition of the existing building and canopy in the west, and the construction of a Sci-Tech office and laboratory building, with an associated service yard. The proposed building provides approximately 13,723m2 of combined laboratory and office space along with a ground floor publicly accessible café, meeting room suites throughout the building, and a secure cycle store and cycle changing. The building massing is split into a low level 6 storey block (inc. plant) to Kincardine Road, jumping up to 9 storeys (inc. plant) at Upper Brook Street, with an atrium to the centre of the floorplates that houses informal breakout spaces and forum seating at ground floor.

2. Planning Policy Guidance

2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[1], last revised in July 2021, states that vulnerable development types should be directed away from areas at highest risk of flooding (whether existing or future risk). Where development is necessary in flood risk areas, the development should be made safe for its lifetime without increasing risk elsewhere.

The NPPF states that, when determining planning applications, Local Planning Authorities (LPAs) should ensure that flood risk is not increased elsewhere as a result of development. Where appropriate, applications should be supported by a site-specific FRA. Development should only be permitted in areas at risk of flooding where it can be demonstrated that:

- Within the Site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;
- The development is appropriately flood resistant and resilient;
- Any residual risk can be safely managed; and
- Safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

Major Developments should incorporate Sustainable Drainage Systems (SuDS) unless there is clear evidence that this is inappropriate. The systems used should:

- Take account of advice from the Lead Local Flood Authority (LLFA);
- Have appropriate proposed minimum operational standards;
- Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development, and;
- Where possible, provide multifunctional benefits.

2.2 Planning Practice Guidance

The Planning Practice Guidance (PPG)[2] notes provide additional advice to LPAs, to ensure that the NPPF is applied correctly when assessing development in areas at risk of flooding. Assessments of flood risk should identify sources of current and future risk and describe how these will be accounted for in a mitigation strategy.

A sequential approach should be employed, which involves applying the 'Sequential Test' and, if needed, the 'Exception Test'. This is designed to ensure that areas at little or no risk of flooding are developed in preference to higher risk areas.

For site-specific risk assessments, the characteristics of a possible flood event should be considered. The ability of users to safely access and exit a site during a 'design'

[1] Ministry of Housing, Communities and Local Government, March 2012. National Planning Policy Framework [online], available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

[2] Ministry of Housing, Communities and Local Government, August 2022. Planning Practice and guidance: Flood Risk and Coastal Change [online], available at: Flood risk and coastal change - GOV.UK (www.gov.uk)

flood event and to evacuate before an extreme flood event (0.1% annual probability of flooding with allowance for climate change) should also be assessed.

The 'design' flood event is considered to be fluvial flooding likely to occur with a 1% annual probability (a 1 in 100 chance each year), or tidal flooding with a 0.5% annual probability (1 in 200 chance each year). In addition, the 1% annual probability pluvial event should also be considered.

Development layouts should be designed to locate the most vulnerable aspects of a development within areas of lowest flood risk, unless there are overriding reasons present. In addition, measures to avoid flood risk vertically can be taken by locating the most vulnerable uses in areas of lower flood risk. Such measures should also account for any residual flood risks occurring due to flood risk management infrastructure.

Management measures, such as safe access and egress routes, should be provided to deal with any residual risk remaining after avoidance, control and mitigation measures have been utilised. The provision of adequate flood warning should also be considered.

The lifetime of a non-residential development depends on the characteristics of that development, but a period of at least 75 years is considered to form a starting point for assessment. Given the nature of the development proposals, the proposed development is considered to have a proposed lifespan of at least 75 years.

The PPG provides guidance on flood risk vulnerability and flood zone compatibility. The following flood zones refer to the probability of river and sea flooding, without the presence of defences:

- **Zone 1: low probability**, less than 0.1% annual probability of river or sea flooding (<1 in 1000) in any year;
- **Zone 2: medium probability**, between a 1% and 0.1% annual probability of river flooding (1 in 100 to 1 in 1000) or between a 0.5% and 0.1% (1 in 200 to 1 in 1000) annual probability of sea flooding in any year;
- **Zone 3a: high probability**, 1% or greater (>1 in 100) annual probability of river flooding or a 0.5% or greater (>1 in 200) annual probability flooding from the sea in any year;
- **Zone 3b: functional floodplain**, where water flows or is stored in times of flood, identification should take account of local circumstances but will typically flood with an annual probability of 3.3% (>1 in 30) or greater in any year or is designed to flood in an extreme 0.1% (1 in 1000 annual probability) flood.

Climate change allowances for river flow and rainfall intensity are determined in accordance with the local river management catchment. Allowances are provided to cover development lifespans to the 2050s epoch (from present day to the year 2060) and the 2070s epoch (between 2061 and 2125).

Given the 75 year minimum lifespan of the Proposed Development, and the Block B Site's location in the Irwell Management Catchment, the design climate change allowance for peak river flow and rainfall intensity is 35% and 45% respectively.

Table 2 of the PPG splits flood risk vulnerability into five classifications. The compatibility of these development uses within each Flood Zone is set out in Annex 3 of the NPPF:

- **Essential Infrastructure**: essential transport and utility infrastructure, wind turbines;
- **Highly Vulnerable:** emergency services (those required to be operational during flooding), installations requiring hazardous substances consent, basement dwellings;
- **More Vulnerable:** residential dwellings, hospitals, schools, hotels, drinking establishments;
- **Less Vulnerable**: retail, offices, storage and distribution, leisure, restaurants; and
- **Water-Compatible**: Development: docks, marinas, wharves.

The Proposed Development is considered to be 'Less Vulnerable', comprising of office and laboratory space. Since the Block B Site has historically been used for sheltered accommodation, which is classified as 'More Vulnerable', there will be a reduction in vulnerability as a result of Proposed Development.

2.3 Non-Statutory Technical Standards for Sustainable Drainage Systems

The Non-Statutory Technical Standards for Sustainable Drainage Systems[3] was published in March 2015 and is the current guidance for the design, maintenance, and operation of SuDS.

Technical standard S3 states that runoff rates from a new development to any drain, sewer or surface water body must be as close as reasonably practicable to the equivalent greenfield runoff rate for the Block B Site area. This must be maintained for all rainfall events up to and including the 1 in 100-year event. Accordingly, surface water discharge rates from a new development should never exceed those from the Block B Site prior to redevelopment.

Technical standard S5 requires that the runoff volume from developments on a previously developed site, resulting from the 1 in 100-year 6-hour duration storm event, must be attenuated to a value as close as is reasonably practicable to the equivalent greenfield runoff volume. The post development runoff volume must not exceed the runoff volume from the Block B site prior to redevelopment.

Standards also indicate that drainage systems should be designed to ensure that flooding does not occur on any part of a site for a 1 in 30-year rainfall event (standard S7) and that flooding of a building (including the basement and utility plant) does not occur during a 1 in 100-year rainfall event (standard S8). Technical standard S12 states that pumping should only be used as part of a surface water drainage system where it is not reasonably practicable to discharge runoff via gravity.

2.4 Sequential and Exception Testing

The Block B Site lies within Flood Zones 1 and 2. The historic use predominantly comprised sheltered accommodation, the building of which is to be demolished and

[3] Department for Environment, Food and Rural Affairs, March 2015. Non-statutory technical standards for sustainable drainage systems, (available at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards).

replaced with a Sci-Tech office and laboratory block as part of the Proposed Development, reducing the vulnerability of the site within Flood Zone 2. The proposed building also in part lies within Flood Zone 1. This FRA sets out how the Proposed Development would remain safe for the lifetime of the Proposed Development, whilst ensuring that flood risk is not increased elsewhere.

It is worth noting that based on the Manchester City, Salford City and Trafford Councils Level 2 Strategic Flood Risk Assessment (SFRA), the Block B Site is highlighted as being situated between both the Brunswick (M0011) Housing, and Oxford Road Corridor (M0042) Employment Regeneration Zones (Appendix C). On the basis that the Site is within an area that has been allocated for development, it is assumed that the Sequential Test has been passed.

In line with the NPPF 'Less Vulnerable' development is considered appropriate in Flood Zone 2 and the Exception Test is not required.

2.5 Manchester Core Strategy

The Manchester Core Strategy[4] was adopted in July 2012 and is the key document in the Manchester Local Plan. It sets out the long-term strategic policies for Manchester's future development and will form the framework that planning applications will be assessed against.

With regard to Flood Risk and Drainage, the Core Strategy sets out the following policies:

2.5.1 Policy EN14: Food Risk

All new development should minimise surface water runoff, including through the incorporation of SuDS and the appropriate use of Green Infrastructure. Developers should have regard to the surface water runoff rates in the Strategic Flood Risk Assessment (SFRA) User Guide. In Critical Drainage Areas (CDAs), evidence will be required to justify the surface water runoff approach and runoff rates achieved.

2.6 Manchester Local Food Risk Management Strategy

The Manchester Local Flood Risk Management Strategy[5] (LFRMS) was adopted in 2014, and its overall aim is to ensure that local flood risk is properly managed by using the full range of options in a coordinated way. This will be achieved by meeting overarching objectives for managing local flood risk, as set out below:

- Reduce the likelihood, severity, and consequences of flooding from ordinary watercourses, from groundwater, and from surface water runoff; and
- Seek opportunities to improve water quality and biodiversity through flood risk management activities.

With regard to Flood Risk and Drainage, the LFRMS sets out the following policies:

[4] Greater Manchester Council Core Strategy [online], (available at: Core Strategy 2012-2027 | Core Strategy 2012-2027 | Manchester City Council)

[5] Manchester City Council Local Flood Risk Management Strategy [online], (available at: Details of the LFRMS | Manchester's Local Flood Risk Management Strategy (LFRMS) | Manchester City Council)

2.6.1 Policy 6: Ensure that local flood risk is properly considered for new development proposals

Within CDAs, and consistent with Core Strategy policy EN14 Flood Risk, developers should aim to minimise surface water runoff from developments, and achieve at least the following runoff rates:

- Greenfield runoff on greenfield sites up to the 1 in 100 year plus 40% climate change event.
- A 50% runoff rate reduction for Brownfield sites, with an aim of reducing runoff to greenfield rates up to the 1 in 100 year plus 40% climate change event.

2.7 Manchester City, Salford City and Trafford Councils Level 1 SFRA

The Manchester City, Salford City and Trafford Councils Level 1 Hybrid SFRA[6] informs the application of the Sequential Test and helps with identifying whether the Exception Test is likely to be necessary. Existing data was used to make an assessment of flood risk from all sources now and in the future. This is a hybrid SFRA because it fills in the gaps from the Level 1 SFRA from 2008 (now withdrawn) and also fulfils the criteria for a Level 2 SFRA.

2.8 Manchester City, Salford City and Trafford Councils Level 2 SFRA

The Manchester City, Salford City and Trafford Councils Level 2 SFRA (2011)[7] details the planning focus and policy for the local area. The SFRA makes reference to the different zones of regeneration and redevelopment that could have a significant impact on surface water runoff to local watercourses and the sewer network.

2.9 Greater Manchester Combined Authority Level 1 SFRA (2019)

The Greater Manchester Combined Authority Level 1 SFRA[8] aims to initiate the sequential risk-based approach to the allocation of land for development and identifies whether application of the Exception Test is likely to be necessary using the most up-to-date information and guidance. This will help to inform and provide the evidence base for the GMSF and each individual council's local plans.

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[6] Manchester City, Salford City and Trafford Councils Level 1 SFRA (2010) (available at: https://www.manchester.gov.uk/downloads/download/3871/strategic_flood_risk_assessment_sfra).

[7] Manchester City, Salford City and Trafford Councils Level 2 SFRA (2011) (available at: https://www.manchester.gov.uk/info/500207/planning_and_regeneration/4700/strategic_flood_risk_assessment/2).

[8] Greater Manchester Combined Authority Level 1 SFRA (2019) (available at: Supporting Documents - Greater Manchester Combined Authority (greatermanchester-ca.gov.uk).

2.10 Greater Manchester Combined Authority Level 2 SFRA (2020)

The Greater Manchester Combined Authority Level 2 SFRA[9] is to support the Greater Manchester Spatial Framework (GMSF) which is being produced by the GMCA on behalf of the 10 local authorities of Greater Manchester. This Level 2 SFRA aligns closely with the Greater Manchester Spatial Framework and will help guide policy making in the GMSF to assist in achieving sustainable development across Greater Manchester.

[9] Greater Manchester Combined Authority Level 2 SFRA (2019) (available at: https://www.greatermanchester-ca.gov.uk/GMCAFiles/PFE/Supporting%20documents/04%20Sustainable%20and%20Resilient%20Places/04.02.18%20GM%20SFRA%20Level%202%20-%20Report.pdf).

3 Potential Sources of Flooding

3.1 Tidal and Fluvial

The Block B Site is remote from any tidal waterbodies, and as such the risk of flooding from tidal sources is considered to be low.

The Environment Agency's (EA) Flood Map for Planning (Figure 3-1) indicates that the Block B Site is located within Flood Zone 1 and 2, and is therefore considered to be at a low to medium probability of fluvial flooding. EA mapping also shows that the Site is at a reduced risk of flooding. The flood risk to the Site is due to the culverted Corn Brook (classified as an Ordinary Watercourse), which is located approximately 100m to the south of the Site.

The EA's flood risk mapping shows that there is a low risk of fluvial flooding, i.e. this area has a chance of flooding of between 0.1% and 1% each year (1 in 100 to 1 in 1000 annual probability).

Figure 3-1. Environment Agency Flood Map for Planning

Source: Environment Agency Flood Map for Planning, (available at: https://flood-map-for-planning.service.gov.uk/)

The Manchester City, Salford City and Trafford Level 1 SFRA (2010) states that the culverted nature of the Corn Brook results in significantly longer overland flow paths for floodwaters before they return to the channel, than would be expected in an open channel. This is reflected by the fairly considerable area of Flood Zone 2 within the surrounding area.

The Manchester City, Salford City and Trafford Level 2 SFRA (2011) states that, in the Conurbation Core CDA, surface water flow paths are largely linked to the natural floodplains of 'hidden' or 'lost' culverted watercourses that run through this area.

In order to confirm the risk of flooding to the Block B Site, the EA's flood data was obtained for the Corn Brook (Appendix D). This data includes flood levels at the Site, and flood extents for the wider Manchester area.

The flood levels provided within the Block B Site Boundary (Appendix D), and the associated floodplain extents (Figure 3-2) show that the Site is unaffected by fluvial flooding from the Corn Brook up to and including the 1 in 100 year plus 35% climate change event (also remaining safe in the 1 in 100 plus 70% climate change, and 1 in 200 year events).

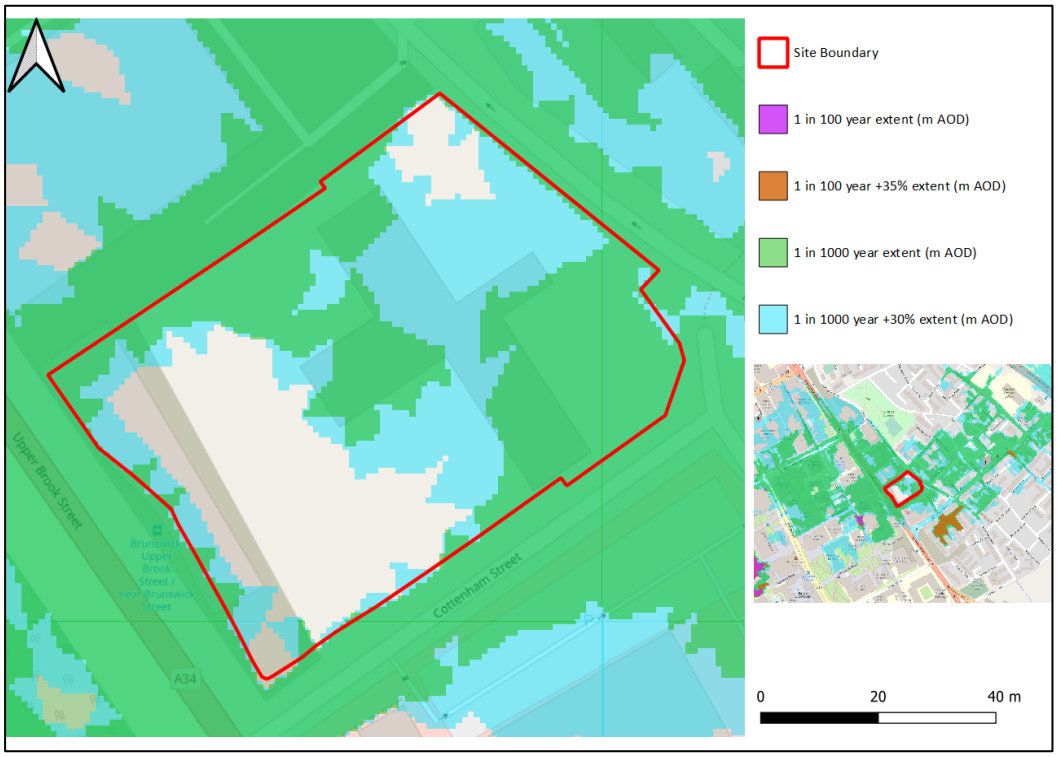


Figure 3-2. Modelled Fluvial Flood Levels (Source: Corn Brook Modelling Study, JBA (2019))

Planning policy requires developments to consider fluvial flood risk up to and including the 1 in 100 year event, taking into account the impacts of climate change. This is referred to as the 'design' flood event, during which flood risk to the Proposed Development, and impacts as a result of the Proposed Development, need to be quantifiably assessed.

In line with planning policy the Block B Site would remain protected in the design flood event, and would not displace flood water that could otherwise cause an increase in flood risk elsewhere. The Proposed Development is therefore considered appropriate.

However, taking a highly precautionary approach the residual risk to the Proposed Development has been considered, to confirm the potential risk during an extreme 1 in 1000 year event (flood level of 38.96m AOD). The internal Finished Floor Level (FFL) of the Proposed Development is to be set at 38.63m AOD (Appendix B), and therefore this would result in a nominal flood depth of 0.33m in this extreme event.

Table 3-1 Fluvial Flood Levels

Fluvial Flood Event	Flood level (m AOD)	Approximate flood depth relative to FFL of 38.63m AOD (m)
1 in 100 year plus 35% climate change	N/A	N/A
1 in 1000 year	38.96	0.33

Source: Corn Brook Modelling Study, JBA (2019)

Given the shallow depth, occupants of the Block B Site would remain safe, and would be able to evacuate either off Site (if safe to do so), or could use the internal staircases to access the first floor and a place of safe refuge.

The Block B Site lies within an EA Flood Warning Area (the Lower River Irwell catchment including areas in Greater Manchester), and it is recommended that operators of the Proposed Development sign up to receive advance warnings. A Flood Management Plan should be put in place prior to occupation of the Proposed Development, which would ensure the safety of its users.

3.2 Pluvial

Pluvial flooding occurs when natural and engineered systems lack capacity to manage the volume of rainfall. Pluvial flooding can occur during an extreme, high intensity rainfall event which overwhelms the local surface water drainage systems. This flood water will then be conveyed via overland flow routes based on the local topography.

3.2.1 Surface Water Flooding

The Manchester City, Salford City and Trafford Level 1 SFRA shows that the Block B Site is situated within an area which is classified as being within the ‘Conurbation Core’ CDA. Surface water flow paths in this CDA are largely linked to the natural floodplains of 'hidden' or 'lost' culverted watercourses that run through the area, such as the Corn Brook. The exact location of this Culvert is not shown in any mapping in the Manchester City, Salford City and Trafford Level 1 (2010) or Level 2 (2011) SFRAs.

The EA’s Risk of Flooding from Surface Water mapping (Figure 3-3) indicates that the Block B Site is at a very low, low, and medium risk of surface water flooding. The areas of the Block B Site at medium risk of surface water flooding are on the northern and western boundaries, outside of the proposed building extent.

The majority of the Block B Site is shown to be at very low risk and the areas of low risk are shown to be predominantly in the east and north west. The proposed built development will be within these areas of very low to low risk and will not extend in to the medium risk extents.

The EA’s medium risk extent (1 in 30 to 1 in 100 year annual risk) is generally taken into account for the purposes of planning, which shows that the Proposed Development will remain safe.

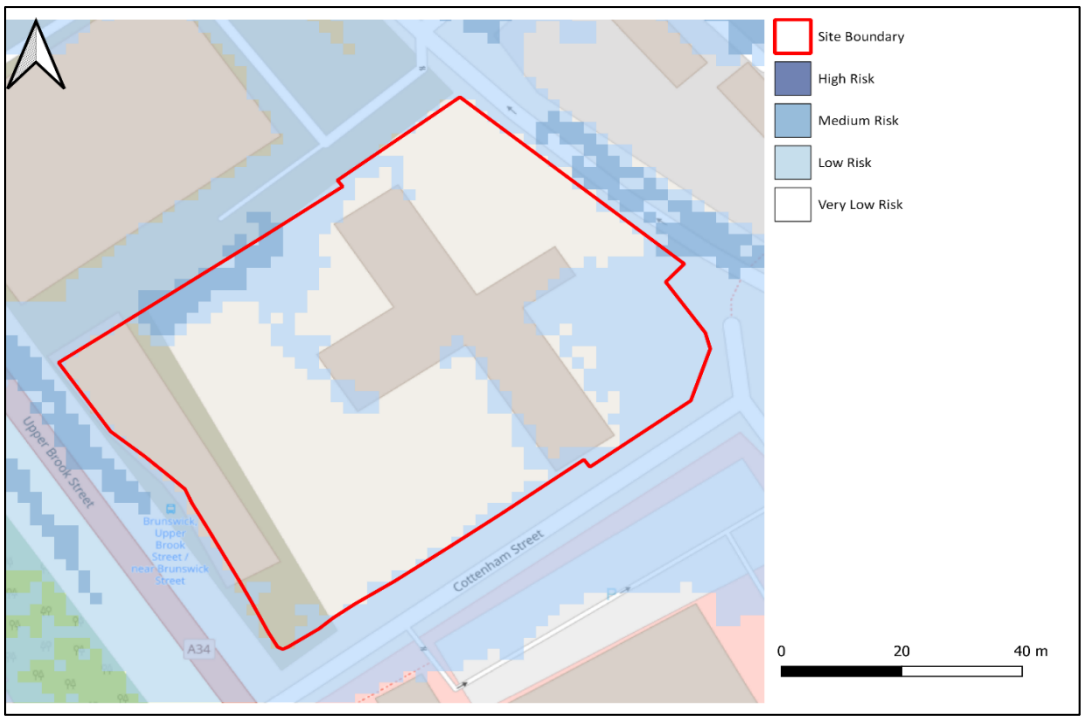


Figure 3-3. Environment Agency Flood Risk Surface Water Map

Source: Environment Agency Surface Water Flood Extent mapping (available at: https://check-long-term-flood-risk.service.gov.uk/risk).

Although Block B Site levels are to be lowered in some areas, levels around the Site (i.e. highway and pavement levels) will be maintained. With this in mind, it is considered that there is limited potential for overland surface water flows to enter the Site. Particularly from areas associated with the medium risk flooding to the north within Kincardine Road where the existing and proposed vehicular access is located.

Furthermore, a surface water drainage strategy (including SuDS) is to be provided as part of the development (discussed in further detail later within this report) which has been designed to accommodate and attenuate runoff from the Site for all events up to and including the 1 in 100 year plus climate change event.

3.2.2 Sewer Flooding

Neither the Manchester City, Salford City and Trafford Level 1 or Level 2 SFRAs, nor the Sewer Asset Plan provided by United Utilities provide any historic sewer flood records for the Block B Site or surrounding area. The Greater Manchester Combined Authority Level 1 SFRA (2019) includes a Sewer flooding incidence map (Appendix E), which shows that no incidents of sewer flooding have been recorded with 800m of the Site.

The United Utilities sewer records (Appendix F) show the presence of combined sewers to the north and east of the Block B Site, underneath Cottenham Street and Kincardine Road, and a privately owned surface water sewer beneath Upper Brook Street to the west. Given the nature of the proposed development, and levels of these sewers, relative to the proposed ground floor FFL, the risk of flooding from sewer sources is considered as low.

3.3 Groundwater

British Geological Survey (BGS) mapping[10] indicates the Block B Site is underlain by bedrock geology of Chester Formation (consisting of Sandstone), overlain by superficial deposits of Devensian Till. BGS borehole records from the Site and surrounding areas however indicate that made ground (including brick, rubble, ash and clay) and Clays are found to depths ranging from 0.5m to 2.0m and 0.5m to 4.0m below the ground surface respectively.

The BGS Source Protection Zone map shows the Block B Site to be located outside of any Source Protection Zone by approximately 150m (Figure 3-4). The Site is shown by the EA's Aquifer mapping[11] to be underlain by a principal bedrock aquifer, and a secondary undifferentiated superficial aquifer.

BGS Borehole Mapping both on Site[12], and in areas of the same geology nearby, show that no groundwater was struck in any record, up to depths of 7m below ground surface.

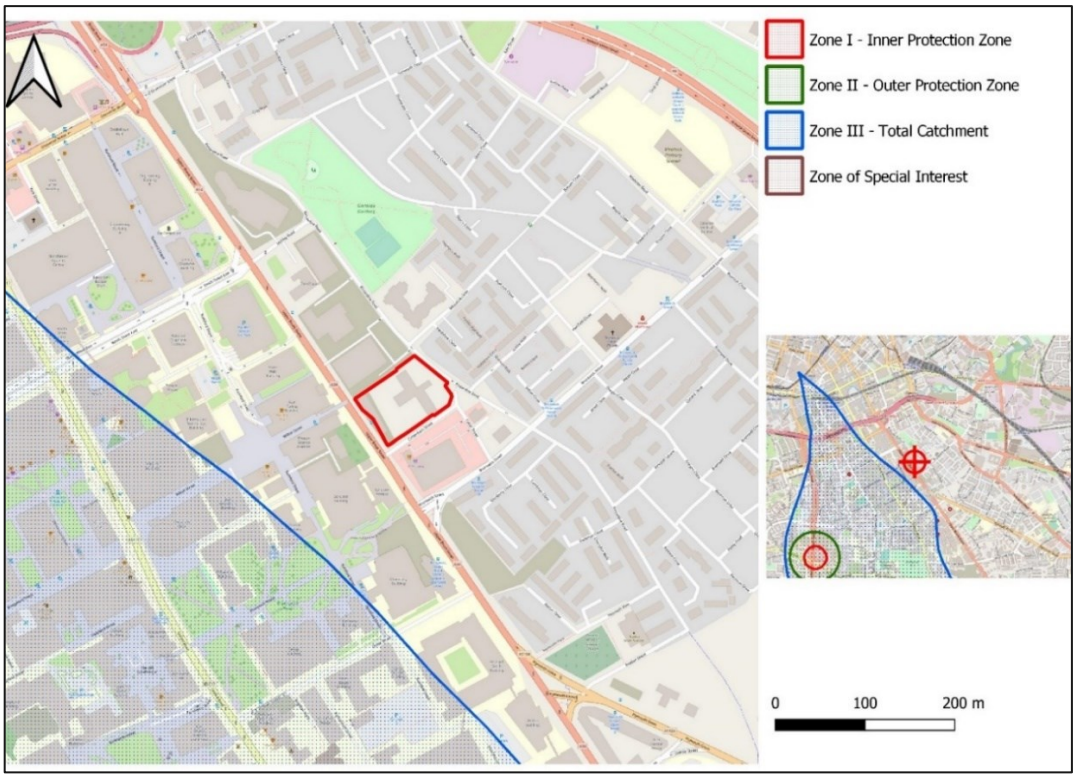


Figure 3-4. BGS Source Protection Zone Map

Source: Magic Map Online Mapper, (available at: https://magic.defra.gov.uk/magicmap.aspx)

The Manchester Level 2 SFRA Groundwater Flooding map shows the Site to be situated within an area that is not at risk of groundwater flooding (Appendix C).

No basements are proposed at the Site, and as a result, there would be no impact on the nominal flow of groundwater beneath the Site. The risk of flooding to the Proposed

[10] British Geological Survey, BGS Geology Viewer (Available: https://geologyviewer.bgs.ac.uk)

[11] Magic Map Online Mapper, (available at: https://magic.defra.gov.uk/magicmap.aspx)

[12] BGS Borehole Mapping, (available at: GeoIndex - British Geological Survey (bgs.ac.uk))

Development is as such considered to be low, and there will be no increase in groundwater flood risk elsewhere.

3.4 Artificial Sources

Based on the EA's Flood Risk from Reservoirs map (Figure 3-5), the Block B Site would be affected by reservoir flooding.

Reservoirs are designed and maintained to a very high standard, and any breach of a reservoir is considered highly unlikely. Given the nature of the Proposed Development it is not considered that there would be a significant risk, and the development is therefore considered to be appropriate.

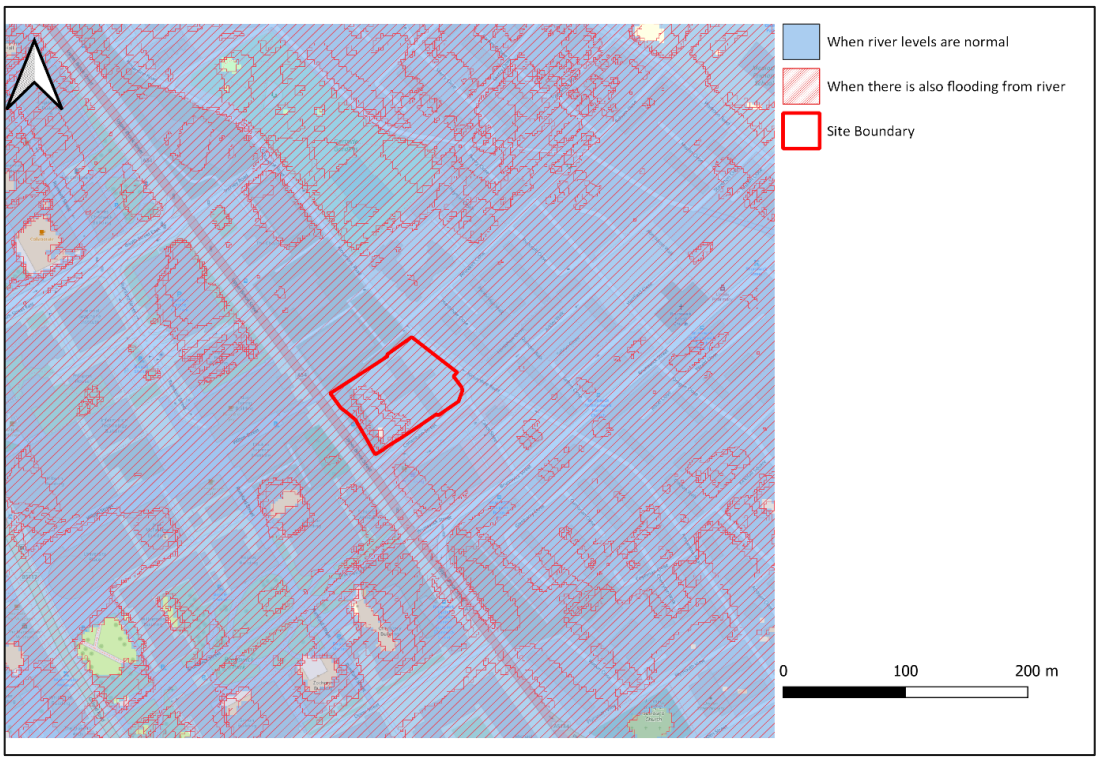


Figure 3-5. Environment Agency Flood Risk from Reservoirs

Source: Environment Agency Reservoir Flood Risk Mapping, (source: https://check-long-term-flood-risk.service.gov.uk/risk)

4 Surface Water Drainage Strategy

4.1 Existing Surface Water Drainage Regime

The Block B Site consists of a historically used sheltered accommodation building, soft landscaping, hardstanding areas and an existing canopy previously connected to the car showroom. The topographic survey (Appendix A) shows that approximately 0.303 ha of the existing Site is impermeable, as highlighted in the Drainage Catchment Areas Plan (Appendix G). The existing catchment and calculated surface water runoff from the hardstanding area is summarised in Table 4-1 below and in Appendices E and F.

Table 4-1 Existing Drainage Catchments and Discharge Rate

	Impermeable Area (ha)	Existing Discharge Rate (l/s)
Existing Block B Site	0.303	38.9

United Utilities' sewer records (Appendix F) show the presence of combined sewers beneath Cottenham Street to the southeast, and Upper Brook Street to the southwest. A private surface water sewer is also shown within Upper Brook Street, which connects into the combined sewer slightly downstream of the Block B Site.

Given the identified surface water sewer is noted as private, and is beyond the adjacent combined sewer, it is currently assumed that existing surface water runoff from the Block B Site discharges into the adjacent public combined sewers in Cottenham Street and Upper Brook Street. However, ultimately all three sewers discharge to the same public combined sewer located to the northwest of the Site. A CCTV survey sewer will be undertaken prior to detailed design, to confirm the existing connections which will be reused where feasible.

4.2 Surface Water Drainage Hierarchy

In assessing the management of surface water runoff, the following drainage hierarchy has been utilised which sets out discharge location in decreasing order of preference (Table 4-2) and is in line with the hierarchy set out within the Greater Manchester Level 1 SFRA.

Table 4-2 Surface Water Drainage Hierarchy (Block B)

Discharge Location	Comment
To ground	Borehole records on Site and in the surrounding areas of made ground (including brick, rubble, ash and clay), and Clays, to depths ranging from 0.5m to 2.0m and 0.5m to 4.0m below the ground surface respectively, are shown across the Site area. Given the impermeable nature of the underlying soils as well spatial constraints on Site, (i.e. lack of space for a 5m buffer between infilitration features and built extents/highways), infiltrating SuDS will not be suitable for the Site.
To a surface water body	The closest surface water body to the Site is the Corn Brook, which is situated more than 50m from the Site, and is culverted in nature here. No other surface water bodies are situated within 500m of the Site. With this in mind, it is considered as unsuitable to discharge to any surface water body.
To a surface water sewer	The only surface water sewer within the vicinity of the site located beneath Upper Brook Street to the West of the site. This surface water sewer is shown to be privately owned but may be a highway asset (confirmation has been requested from the Highways Manchester however a response is awaited). The Sewer Asset Plan (Appendix F) shows that at approximately 130m northwest of the Site, beneath Upper Brook Street, this Private Surface Water Drain runs into the combined surface water sewer beneath Upper Brook Street. Any advantage of surface waters from the Site discharging to this private surface water drain would as such be non-existent, relative as to a combined sewer.
To a combined sewer	With the above in mind, it is proposed to discharge surface waters at a restricted rate to the combined sewer beneath Cottenham Street to the east of the Site. As set out previously however and subject to a drainage survey, existing connections will be utilised wherever possible.

4.3 Sustainable Drainage Systems

The most sustainable way to drain surface water runoff is through the use of SuDS, which need to be considered in relation to Site-specific constraints.

SuDS mimic natural drainage and can reduce the quantity of surface water discharged, allowing a reduction of flood risk. In addition, SuDS can improve water quality and provide biodiversity and amenity benefits.

A variety of SuDS are available to attenuate surface water runoff. In order to adhere to the SuDS hierarchy, the constraints and opportunities for various SuDS have been assessed in Table 4-3. Justification is provided as to why certain features have been deemed feasible or unfeasible for use in the Proposed Development.

Table 4-3 Sustainable Drainage Systems

Device	Description	Constraints / Comments	✓/✗
Green / brown roofs (source control)	Provide soft landscaping at roof level which reduces surface water runoff.	The proposed building includes a roof which is split between 8th and 6th floor levels. There is significant amount of plant to be provided on these roofs along with solar panels. In addition, the central areas of the building consists of a glass atrium. The roof areas area therefore considered unsuitable for green or brown roofs.	✗
Infiltration devices & Soakaways (source control)	Store runoff and allow water to percolate into the ground via natural infiltration.	As noted above, borehole records indicate that clays are likely beneath the Site, which implies management of surface water via infiltration is unlikely to be feasible. Furthermore, spatial constraints on-Site and the urban nature of the surrounding areas mean that there is insufficient space away from the building extent to incorporate infiltration features.	✗
Permeable surfaces (source control)	Storm water is allowed to infiltrate through the surface into a storage layer, from which it can either infiltrate and / or slowly release to sewers.	Permeable surfacing is to be used where possible within the external areas on-Site. These areas will provide source control and water quality benefits. The attenuation potential of the permeable surfacing is discussed in further detail in the following section.	✓
Rainwater harvesting (source control)	Reduces the annual average rate of runoff from a site by reusing water for non-potable	Rainwater harvesting at the Site is not currently allowed for on the basis that	✗

	uses e.g., toilet flushing or water butts.	there are no external downpipes to allow for external rainwater butts.	
Swales (permeable conveyance)	Broad shallow channels that convey / store runoff and allow infiltration (ground conditions permitting).	Given the spatial constraints of the Site it is not considered feasible to incorporate swales.	✗
Filter drains & perforated pipes (permeable conveyance)	Trenches filled with granular materials (which are designed to take flows from adjacent impermeable areas) that convey runoff while allowing infiltration (ground conditions permitting).	Filter drains are not currently included within the proposals, however the potential to replace conveyance sewers with filter drains will be reviewed at detailed design.	✗
Filter Strips (permeable conveyance)	Wide gently sloping areas of grass or dense vegetation that remove pollutants from runoff from adjacent areas.	Given the spatial constraints on-Site, filter strips are not considered feasible.	✗
Bioretention Systems / Rain Garden (end of pipe treatment).	A shallow landscaped depression which allows runoff to pond temporarily on the surface before filtering through vegetation and underlying soils. These features can also be accommodated within above ground planters.	Rain Gardens are proposed to be incorporated into the wider design of the Site's landscaping. The attenuative potential of these systems has been considered below.	✓
Infiltration basins (end of pipe treatment)	Depressions in the surface designed to store runoff and allow infiltration through the base.	Given spatial constraints on Site the use of infiltration basins are not considered feasible.	✗

Detention Basin / Pond (end of pipe treatment)	Depressions in the surface designed to store runoff without infiltration through the base. Where appropriate, permanent pools can be incorporated.	Due to spatial constraints on Site, the use of detention basins is not considered feasible.	✗
Attenuation underground (end of pipe treatment)	Oversized pipes or geocellular/sectional tanks designed to store water below ground level.	To ensure that sufficient attenuation is provided as part of the Proposed Development geocellular storage will be provided beneath the permeable sub-base. The exact details of this attenuation is considered below.	✓

Based on the Block B Site specific constraints the proposed SuDS will comprise of bioretention systems in the form of rain gardens, and permeable paving connected to geocellular storage.

The exact location of the proposed SuDS is shown in Appendix H.

4.4 Proposed Surface Water Drainage Strategy

4.4.1 Proposed Catchments and Discharge Rates

Although there are areas of green landscaping proposed within the development, these are to be considered as rain gardens and permeable paving and will therefore ultimately be drained to the attenuation feature. With this in mind, the entire Block B Site has been considered to be 100% impermeable. The proposed drainage catchment is therefore 0.562 ha, refer to Appendix G for clarity.

Using the total proposed impermeable area of 0.562 ha, the greenfield runoff rate (Qbar) has been calculated to be 2.5 l/s (refer to Appendix I). In line with planning policy it is proposed to restrict runoff rates from the Site to 2.5 l/s for all events up to and including the 1 in 100 year plus 45% climate change scenario.

When compared to the existing runoff rates (39.5 l/s), a restriction to 2.5 l/s provides a significant betterment of approximately 93% in the 1 in 100 year scenario ensuring that flood risk will not be increased elsewhere as a result of the Proposed Development.

4.4.2 Drainage Arrangement and Attenuation Requirements

MicroDrainage software has been utilised to calculate the attenuation required in order to restrict runoff to the greenfield rate of 2.5 l/s.

As noted previously, it is proposed that SuDS will be incorporated within the scheme in the form of raingardens and permeable surfacing. The permeable surfacing and rain gardens will capture runoff at source, provide treatment and amenity benefits, however to be conservative their attenuation capacity has not been considered in the modelling.

In undertaking the surface water drainage modelling, the following design parameters were applied:

- The modelling was undertaken within MicroDrainage 2020 Source Control module.
- FEH 2013 rainfall data has been utilised.
- The attenuation features have been designed to accommodate the 1 in 100 year plus 45% climate change event with no flooding.
- A porosity value of 0.95 has been assumed for the geocellular storage.
- Flow restrictions have been modelled using a hydrobrake.

Based on the results of the modelling (Appendix I), an attenuation volume of 477m^3 is required and will be provided in the form of a geocellular tank beneath the service yard in the north east. Refer to Appendix for further detail on the attenuation size and location.

Where possible the existing connections to the adjacent sewers will be utilised, however this will be dependant upon the location and invert level which will be confirmed through survey. If it is not possible to reuse these connections a new connection will be facilitated to the combined sewer within Cottenham Street to the southwest of the Block B Site. A Section 106 Sewer Connection Agreement would be submitted and agreed with United Utilities at detailed design.

Any connection would ensure that runoff rates are restricted to the 2.5 l/s greenfield rate in the 1 in 100 year plus 45% climate change event, in line with policy requirements, and would be undertaken in accordance with LLFA requirements.

4.4.3 Water Quality

The quality of surface water runoff from the Block B Site has been considered in line with the CIRIA SuDS Manual[13] simple index approach, to ensure appropriate treatment and removal of pollutants prior to discharge. Table 4-4 is based on Table 26.2 of the SuDS Manual and considers the pollution indices based on the proposed land use. The Proposed Development would include vehicular access and building roofs, and therefore will comprise a ‘very low’ to ‘medium’ pollution hazard.

Table 4-4 Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/industrial roofs)	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads and non-residential car parking with infrequent change e.g., offices i.e. <300 traffic movements per day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change	Medium	0.7	0.6	0.7

[13] CIRIA SuDS Manual (2015) (available at: https://www.susdrain.org/resources/SuDS_Manual.html)

(eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways

For clarity, it is proposed that the roof area and service yard will discharge to the permeable surfacing/sub-base and the external footpath areas (considered here as being low traffic roads to be conservative) will discharge to the proposed rain gardens. It is worth noting that there may be potential to discharge runoff from roofs to the rain gardens in some locations, this will be confirmed at detailed design.

Table 4-5 below summarise the mitigation indices for runoff from each of the land uses and indicates that the SuDS included will provide sufficient mitigation against pollution from all areas of the Block B Site.

Table 4-5 SuDS Mitigation Indices for Commercial Roofs and Service Yard

	Mitigation Indices		
SuDS Component	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Surfacing (accommodating runoff from roof and service yard)	0.7	0.6	0.7
Rain Gardens (accommodating runoff from external footpaths)	0.8	0.8	0.8

4.4.4 Exceedance Routes

In the event of an extreme storm scenario or should there be a blockage in the network, exceedance flows will be directed overland to a valley created along the boundary of the building and will ultimately flow towards Upper Brook Street in the south west. As noted previously, the FFLs of the building have been set nominally above the external ground levels, minimising the potential for overland runoff to enter the building.

It is worth noting that further attenuation volume would be provided within the permeable sub-base and rain gardens proposed which has the potential to reduce the volume of overland flow routes. For clarity, the exceedance route plan is highlighted in Appendix H.

4.4.5 Maintenance Regime

The PPG and CIRIA SuDS Manual sets out the requirement for developers to consider the operation, management, and maintenance of all SuDS.

Post construction, the on-Site management company will be responsible for the SuDS included within the scheme. Table 4-6 outlines what maintenance is anticipated for the proposed SuDS features.

Table 4-6 Indicative SuDS Maintenance Schedule

SuDS and Task	Frequency
Permeable Surfacing	
Brushing	Annually or as required
Stabilise contributing adjacent areas Removal of weeds Remediation to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace any lost jointing material	As required
Inspection of main structure, pipework and filtration devices and remove any sediments	Quarterly or as required
Jetting of main structure to remove any sediment build-up	Annually or as required
Rain Gardens	
Inspect infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary Assess plants for disease infection, poor growth, invasive species etc and replace as necessary Inspect inlets and outlets for blockage. Remove litter and surface debris and weeds	Quarterly
Check operation of underdrains by inspection of flows after rainfall	Annually
Replace any plants, to maintain planting density	As required
Remove sediment, litter and debris build-up from around inlets or from forebays	Biannually
Infill any holes or scour in the filter medium, improve erosion protection if required Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium, and replacing mulch	As required
Geocellular Storage	
Inspection, identification of faults and any remedial action	Monthly for 3 months then annually
Remove debris from surface, if impeding performance	Monthly

Inspect inlets and outlet for condition and operation	Annually
Repair inlets and outlets	As required
Survey inside of tank for sediment and removal if necessary	Every 5 years or as required
Flow Controls	
Remove debris and sediments from flow control manhole.	As required
Replace malfunctioning parts or structures	As required
Visual inspection for damage and blockages	Monthly for first 3 months after fitting and thereafter at six monthly intervals. Additional inspections to be undertaken following any significant storm event

5 Levels Strategy

5.1 Setting of Finished Floor Levels

Ground levels surrounding the site vary fairly considerably, with ground levels falling from approximately 38.7m AOD in Kincardine Road in the north to 38.2m AOD in Upper Brook Street to the south.

Although the Site is not shown to be impacted by the fluvial design flood event, in line with the Environment Agency (EA) Standing Advice for Vulnerable Developments consideration of the Finished Floor Level (FFL) has been undertaken and the following items have been assessed:

- The maximum levels within the surrounding highways.
- The average ground level within the Site.
- The resultant Finished Floor Level (FFL) requirements for both should 300mm raising be provided.

The above items are summarised in the table below.

Table 5-1. Summary of Existing Ground Levels and Resultant FFL Requirements

	Level (m AOD)	FFL Requirement (m AOD)
Adjacent Highway	38.7*	39.0
On Site	38.9**	39.2

** Based on max level within Kincardine Road to the north.*

*** Average ground level within the Site, note that the artificially raised bund in the south has been excluded from the calculation as this would misrepresent the average.*

The possibility to set the FFL at the maximum level of 39.2m AOD was reviewed, however this is approximately 0.7m greater than the footway levels within Upper Brook Street to the south. These level differences are not considered feasible for the proposed building layout within the site, whilst maintaining safe gradients within the landscaping and external finishes, and level access to the building. For clarity, this is also the case for raising FFLs to 39.0m AOD (i.e., 300mm above the maximum adjacent highway level) however it is worth noting that the proposed FFL of 38.63m AOD is approximately 0.4m above carriageway levels within Upper Brook Street and is between 0.23m to 0.12m above the majority of carriageway levels within Cottenham Road. It is just the most northern part of Cottenham Street and Kincardine Road to the north which are higher and the external landscaping/service yard between the building and the highway fall away from the building in this location, as with the remainder of the site, and water will drain to channels and low points intended to be used as SuDS features.

Given the existing fall across/surrounding the site, the proposed FFL at ground level has therefore been set to be 38.63m AOD to minimise accessibility issues and ensure that level access from Kincardine Road to the north, Upper Brook Street to the south, and Cottenham Street to the East can be maintained. As noted previously, uses at

ground floor are all less vulnerable and safe evacuation routes would be provided from the Site. Furthermore, safe refuge could be provided on the upper floors if required.

Although not affected by the design fluvial or pluvial flood events, the potential for flood resilience measures can be reviewed in further detail post planning. This could include the raising of electrical sockets, flood resilient material choices (such as impermeable flooring) and non-return valves on the drainage network to prevent backflow. As set out in Section 4 of the FRA, consideration of exceedance routes has been made should a storm scenario that exceeds the design event or blockage occur, in this scenario, overland flows would be directed to a valley created along the boundary of the building and will ultimately flow towards Upper Brook Street in the southwest. Furthermore, the FFLs of the building have been set nominally above the proposed external ground levels, minimising the potential for overland runoff to enter the building.

6 Foul Water Drainage Strategy

6.1 Existing Drainage

United Utilities sewer records (Appendix F) indicate that a 590mm by 730mm public combined sewer runs along Cottenham Street to the southeast of the Block B Site, which then runs into a 600mm by 860mm public combined sewer beneath Upper Brook Street to the west of the Site. It is assumed that the Site currently discharges foul flows into the adjacent combined sewers, the exact connection will be confirmed through a CCTV survey.

6.2 Proposed Drainage Design

The proposed foul drainage will be designed in accordance with BS EN 752 – Drain and Sewer Systems Outside Buildings[14], BS EN 12056 – Gravity Drainage Systems Inside Buildings[15] and Approved Document H of Building Regulations.

Based on a review of Royal Mails address finder, there were 31 flats at the sheltered accommodation, the existing foul discharge rate from the Block B Site has been calculated to be 0.3 l/s.

Based on the proposed Gross Internal Area (GIA) of 20,039m^2 of entire development, the proposed foul drainage flow has been calculated as 5.7 l/s. It is worth noting that the total GIA includes reception, amenity and breakout areas and the foul flow rate from the Site could therefore be less. Calculations are included in Appendix J.

A Pre Development Enquiry has been submitted to United Utilities to confirm that there is sufficient capacity to accept the proposed flows.

It is assumed that a gravity outfall will be achievable, based on the proposed ground floor level and surrounding invert levels of the United Utilities sewers. The existing connections will be utilised where feasible. If the location and/or depth of these existing connection locations prohibits reuse, a new connection will be made to the adjacent public sewer network in agreement with United Utilities. The potential foul water connection is shown in Appendix H.

[14] British Standards Institution BS EN 752

[15] British Standards Institution BS EN 12056

7 Conclusion

The EA's Flood Map for Planning shows that the Block B Site is located in Flood Zone 1 and 2, indicating a low to medium probability of flooding from fluvial sources. This flood area is due to the culverted Corn Brook, an ordinary watercourse which is located approximately 100m south from the Site.

EA modelling shows that the Block B Site remains safe during the 1 in 100 year plus 35% climate change design flood event. Occupants of the Site will therefore remain safe, and there will be no displacement of fluvial flood water. As a result there will be no displacement of flood water that could otherwise increase flood risk elsewhere.

The Proposed Development is at a very low to low risk of pluvial flooding, and is located outside of the medium risk surface water flood extent. The risk of flooding from tidal, groundwater, and artificial sources has also been assessed and is considered as low.

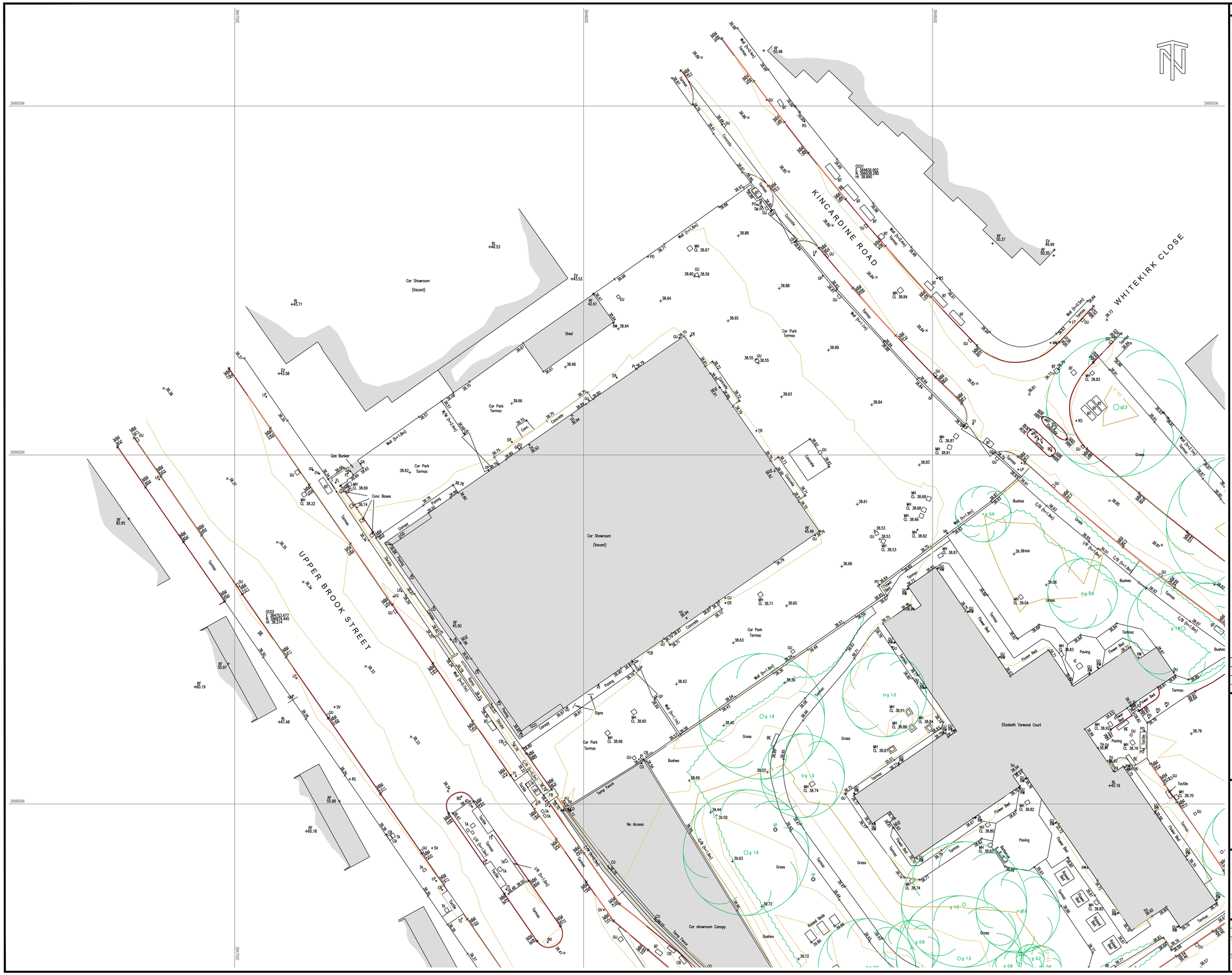
Surface water runoff from the Proposed Development will be controlled through the use of rain gardens, permeable surfacing, and geocellular storage. The rain gardens and permeable surfacing would provide conveyance, water quality, amenity and biodiversity benefits. The attenuation would be provided through the use of a geocellular attenuation tank to ensure that flows are restricted appropriately. In line with planning policy surface water runoff would be restricted to the greenfield rate of 2.5 l/s up to and including the 1 in 100 year plus 45% climate change event. This would provide a significant betterment of 93% over the existing situation.

The existing and proposed foul discharge rates have been calculated using the water consumption method to be 0.3l/s and 5.7 l/s respectively. A Pre Development Enquiry has been submitted to United Utilities to confirm that there is adequate capacity to accept the proposed flows.

The existing connections would be used for both foul and surface water runoff, discharging respectively into the public combined sewers in the surrounding highways. This will be confirmed through CCTV survey. If the existing connections cannot be reused new connections would be facilitated in consultation with United Utilities.

The Proposed Development is in accordance with national, regional and local policy and is therefore considered appropriate in terms of flood risk.

Appendix A. Topographic Survey



NOTES

KEY

Grid & Datum - Local Plane Grid related to OS National Grid & Datum
By GNSS RTK Observations

STANDARD ABBREVIATIONS

STREET FURNITURE

A/C	- AIR CONDITIONING	LC	- LIGHTING COLUMN	UTL	- UNABLE TO LIFT
AE	- AERIAL	LI	- LIGHT	VDP	- VEHICLE DETECTOR PAD
AL	- ALARM	LP	- LAMP POST	VP	- VENT PIPE
AV	- AIR VALVE	MBO	- MOORING BOLLARD	WB	- WHISTLE BLOW
BA	- BUOYANCY AID	MA	- MAST	WM	- WATER METER
BB	- BELISHA BEACON	MH	- MANHOLE	WO	- WASH OUT
BD	- BUILDING DIVIDE	MO	- MONUMENT	WP	- WASTE PIPE
BH	- BOREHOLE	MP	- MILE POST		
BL	- BASEMENT LIGHT	MR	- MOORING RING		
BO	- BOLLARD	MW	- MONITORING WELL		
BP	- BOUNDARY POST	NP	- NAME PLATE		
BR	- BUS EXIT	OH	- OVERHEAD		
BS	- BUS STOP	OSBM	- ORDNANCE SURVEY		
BU	- BUSH		BENCH MARK		
CA	- CABLE	PA	- PLAY APPARATUS		
CB	- CONTROL BOX	PB	- PILLAR BOX		
CC	- CLOSE CIRCUIT TV	PH	- PUBLIC HOUSE		
CIB	- CIGARETTE BIN	PI	- PIPE		
Col	- COLUMN	PL	- PLANT		
CT	- CLOSE CIRCUIT TV POLE	PM	- PARKING METER		
DP	- DOWN PIPE	PN	- PLANTER		
DR	- DRAIN	PO	- POST		
Dr.Ch	- DRAINAGE CHANNEL	PP	- PETROL PUMP		
DU	- DUCT	RH	- RIDGE HEIGHT		
EA	- EAR ATRC	RS	- ROAD SIGN		
EP	- ELECTRICITY POLE	RTW	- RETAINING WALL		
ER	- EARTH ROD	SAP	- SAMPLING PIPE		
FA	- FENDOR ANCHOR	SC	- STANCHION		
F/B	- FLOWER BED	SD	- SATELLITE DISH		
FH	- FIRE HYDRANT	S/F	- SAFETY FENCE		
FL	- FLOODLIGHT	SG	- SIGNAL		
FS	- FLAG STAFF	SI	- SIGN		
GA	- GAS	SMP	- SERVICE MARKER POST		
GM	- GAS METER	SS	- SECURITY SENSOR		
G	- GIRTH	ST	- STOP TAP		
GP	- GATE POST	SU	- STUMP		
GV	- GAS VALVE	SV	- STOP VALVE		
Hyd	- HYDRANT	SW	- SWITCHGEAR		
IC	- INSPECTION COVER	TA	- TAP		
IT	- TRAFFIC COVER	TBM	- TEMPORARY BENCH MARK		
JB	- JUNCTION BOX	TCB	- TELEPHONE CALL BOX		
KO	- KERB OFFLET	TE	- TELEPHONE		
LA	- LADDER	TM	- TICKET MACHINE		
LB	- LITTER BIN	TS	- TRAFFIC SIGNAL		
		TP	- TELEGRAPH POLE		

FENCE TYPES

B/W	- BARBED WIRE
C/B	- CLOSE BOARDED
C/I	- CORRUGATED IRON
F/P	- FEATHER PANEL
H/R	- HANDRAIL
I/R	- IRON RAILING
PAL	- PALISADE
P/C	- POST & CHAIN
P/P	- POST & PANEL
P/R	- POST & RAIL
PSB	- PEDESTRIAN SAFETY BARRIER
P/W	- POST & WIRE
W/M	- WIRE MESH

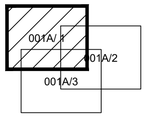
LEVELS

BL43.45	- BED LEVEL
EV43.45	- EAVE LEVEL
IL43.45	- INVERT LEVEL
SL43.45	- SPOT LEVEL
RF43.45	- ROOF LEVEL
RL43.45	- RIDGE LEVEL
SB43.45	- SOFT BED LEVEL
SF43.45	- SOFFIT LEVEL
TH43.45	- THRESHOLD LEVEL
WL43.45	- WATER LEVEL

SYMBOLS

HEDGE
GATE
BUILDING
TREE CANOPY
CONTROL STATION
TREE

SHEET LAYOUT



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A	26.10.22	JP	Contours Added	AM	NDO

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TOPOGRAPHICAL SURVEY
SHEET 1 OF 3

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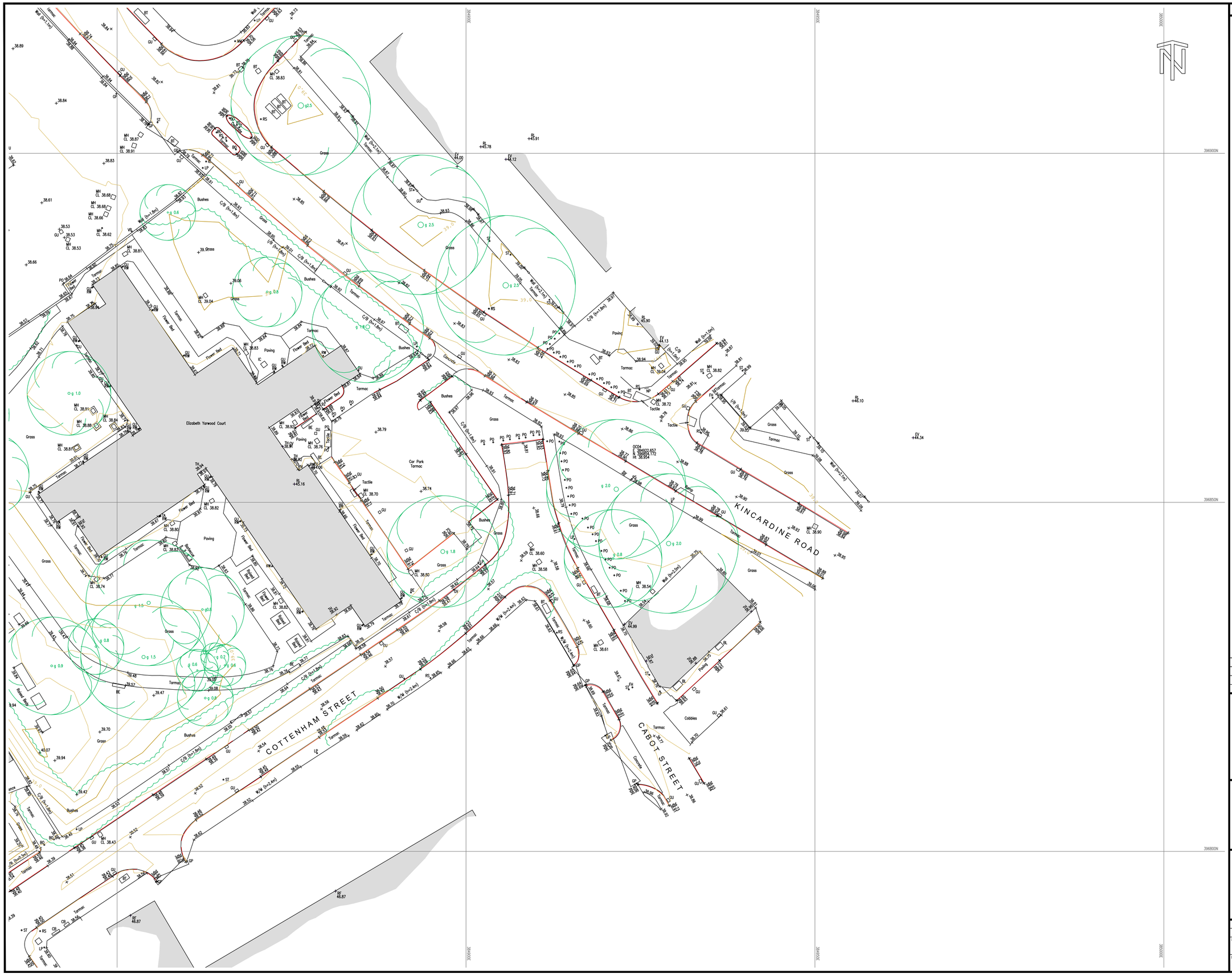

NOTES

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Grid & Datum - Local Plane Grid related to OS National Grid & Datum By GNSS RTK Observations

STANDARD ABBREVIATIONS

STREET FURNITURE

A/C - AIR CONDITIONING
AE - AERIAL
AL - ALARM
AV - AIR VALVE
BA - BUOYANCY AID
BB - BELISHA BEACON
BD - BUILDING DIVIDE
BH - BOREHOLE
BL - BASEMENT LIGHT
BO - BOLLARD
BP - BOUNDARY POST
BR - BUS RADIOR
BS - BUS STOP
BU - BUSH
CA - CABLE
CB - CONTROL BOX
CC - CLOSE CIRCUIT TV
CIB - CIGARETTE BIN
Col - COLUMN
CT - CLOSE CIRCUIT TV POLE
DP - DOWN PIPE
DR - DRAIN
Dr.Ch - DRAINAGE CHANNEL
DU - DUCT
E - ELECTRIC
EP - ELECTRICITY POLE
ER - EARTH ROD
FA - FENDOR ANCHOR
F/B - FLOWER BED
FH - FIRE HYDRANT
FL - FLOODLIGHT
FS - FLAG STAFF
GA - GAS
GM - GAS METER
G - GIRTH
GP - GATE POST
GV - GAS
GVI - GAS VALVE
Hyd - HYDRANT
IC - INSPECTION COVER
IT - TRAFFIC COVER
JB - JUNCTION BOX
KO - KERB OFFLET
LA - LADDER
LB - LITTER BIN
LC - LIGHTING COLUMN
L - LIGHT
LP - LAMP POST
MBO - MOORING BOLLARD
MA - MAST
MH - MANHOLE
MO - MONUMENT
MP - MILE POST
MR - MOORING RING
MW - MONITORING WELL
NP - NAME PLATE
OH - OVERHEAD
OSBM - ORDANCE SURVEY BENCH MARK
PA - PLAY APPARATUS
PB - PILLAR BOX
PH - PUBLIC HOUSE
PI - PIPE
PL - PLANT
PM - PARKING METER
PN - PLANTER
PO - POST
PP - PETROL PUMP
RH - RIDGE HEIGHT
RS - ROAD SIGN
RTW - RETAINING WALL
RWP - RAINWATER PIPE
SA - STANCHION
SC - SPEED CAMERA
SD - SATELLITE DISH
S/F - SAFETY FENCE
SG - SIGNAL
SI - SIGN
SMP - SERVICE MARKER POST
SS - SECURITY SENSOR
ST - STOP TAP
SU - STUMP
SV - STOP VALVE
SW - SWITCHGEAR
TA - TRAFFIC
TAP - TAP
TBM - TEMPORARY BENCH MARK
TCB - TELEPHONE CALL BOX
TE - TELEPHONE
TM - TICKET MACHINE
TS - TRAFFIC SIGNAL
TP - TELEGRAPH POLE
UTL - UNABLE TO LIFT
VDP - VEHICLE DETECTOR PAD
VP - VENT PIPE
WB - WHISTLE BLOW
WM - WATER METER
WO - WASH OUT
WP - WASTE PIPE

FENCE TYPES

B/W - BARBED WIRE
C/B - CLOSE BOARDED
C/I - CORRUGATED IRON
F/P - FOOTBALL PANEL
H/R - HANDRAIL
I/R - IRON RAILING
PAL - PALISADE
P/C - POST & CHAIN
P/P - POST & PANEL
P/R - POST & RAIL
PSB - PEDESTRIAN SAFETY BARRIER
P/W - POST & WIRE
W/M - WIRE MESH

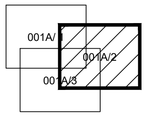
LEVELS

+ BL43.45 - BED LEVEL
+ EV43.45 - EAVE LEVEL
+ IL43.45 - INVERT LEVEL
+ 43.45 - SPOT LEVEL
+ RF43.45 - ROOF LEVEL
+ RL43.45 - RIDGE LEVEL
+ SB43.45 - SOFT BED LEVEL
+ SL43.45 - SOFFIT LEVEL
+ TH43.45 - THRESHOLD LEVEL
+ WL43.45 - WATER LEVEL

SYMBOLS

HEDGE
GATE
BUILDING
TREE CANOPY
CONTROL STATION
TREE

SHEET LAYOUT



Rev	Date	Drawn	Description	Ch'k'd	App'd
A	26.10.22	JP	Contours Added	AM	NDO

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CHARTERED GEOMATIC SURVEYORS
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Client

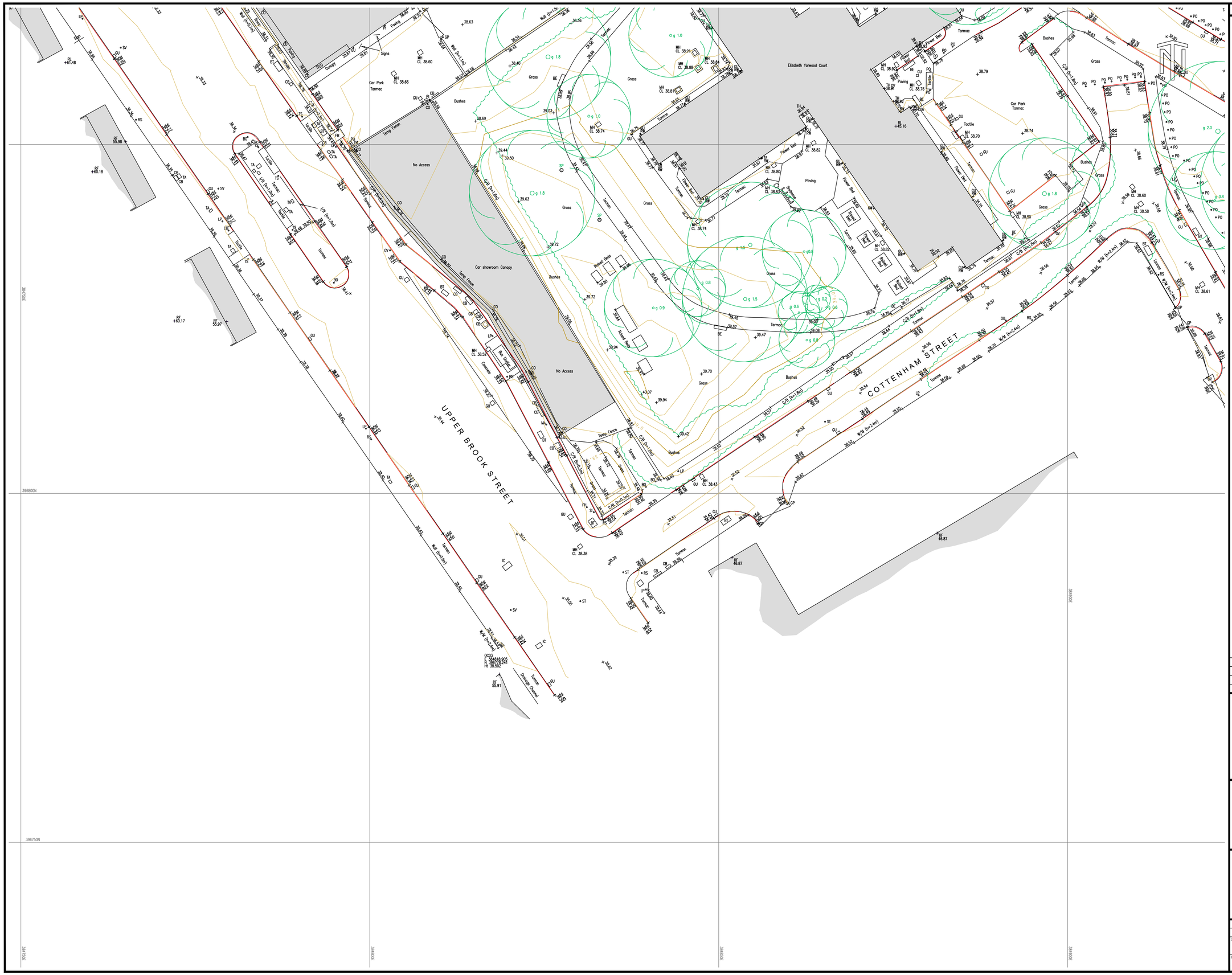
McLAREN PROPERTY
3rd FLOOR EAST
LECONFIELD HOUSE
CURZON STREET
LONDON W1J 5JA

Title

UPPER BROOK STREET
MANCHESTER
M13 9YD

TOPOGRAPHICAL SURVEY
SHEET 2 OF 3

Surveyed	PG	Drawn	PG	Drawn Date: 07/04/2022
Checked	AM	Approved	NDO	
Scale 1:250 @ A1		Project 11766		Status REV
		CAD File \\NDO-SBS\Projects\ZDRAWINGS\ZE_XE.DWG		
Drawing No 11766/ 001A / 2				Rev A



NOTES

KEY

Grid & Datum - Local Plane Grid related to OS National Grid & Datum By GNSS RTK Observations

STANDARD ABBREVIATIONS

STREET FURNITURE

A/C	- AIR CONDITIONING	LC	- LIGHTING COLUMN	UTL	- UNABLE TO LIFT
AE	- AERIAL	LI	- LIGHT	VDP	- VEHICLE DETECTOR PAD
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BA	- BUOYANCY AID	MA	- MAST	WM	- WATER METER
BB	- BELISHA BEACON	MH	- MANHOLE	WO	- WASH OUT
BD	- BUILDING DIVIDE	MO	- MONUMENT	WP	- WASTE PIPE
BH	- BOREHOLE	MP	- MILE POST		
BL	- BASEMENT LIGHT	MR	- MOORING RING	**FENCE TYPES**	
BO	- BOLLARD	MW	- MONITORING WELL	B/W	- BARBED WIRE
BP	- BOUNDARY POST	NP	- NAME PLATE	C/B	- CLOSE BOARDED
BR	- BUS ROOF	OH	- OVERHEAD	C/I	- CORRUGATED IRON
BS	- BUS STOP	OSBM	- ORDNANCE SURVEY	H/P	- HEAVY DUTY PANEL
BU	- BUSH		BENCH MARK	H/R	- HANDRAIL
CA	- CABLE	PA	- PLAY APPARATUS	I/R	- IRON RAILING
CB	- CONTROL BOX	PB	- PILLAR BOX	PAL	- PALISADE
CC	- CLOSE CIRCUIT TV	PH	- PUBLIC HOUSE	P/C	- POST & CHAIN
CIB	- CIGARETTE BIN	PI	- PIPE	P/P	- POST & PANEL
Col	- COLUMN	PL	- PLANT	P/R	- POST & RAIL
CT	- CLOSE CIRCUIT TV POLE	PM	- PARKING METER	PSB	- PEDESTRIAN SAFETY BARRIER
DP	- DOWN PIPE	PN	- PLANTER	P/W	- POST & WIRE
DR	- DRAIN	PO	- POST	W/M	- WIRE MESH
Dr.Ch.	- DRAINAGE CHANNEL	PP	- PETROL PUMP		
DU	- DUCT	RH	- RIDGE HEIGHT	**LEVELS**	
E	- ELECTRIC	RS	- ROAD SIGN	BL43.45	- BED LEVEL
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ER	- EARTH ROD	SA	- SANITARY PIPE	IL43.45	- INVERT LEVEL
FA	- FENDOR ANCHOR	SC	- SPEED CAMERA	43.45	- SPOT LEVEL
F/B	- FLOWER BED	SD	- SATELLITE DISH	RF43.45	- ROOF LEVEL
FH	- FIRE HYDRANT	S/F	- SAFETY FENCE	RL43.45	- RIDGE LEVEL
FL	- FLOODLIGHT	SG	- SIGNAL	SB43.45	- SOFT BED LEVEL
FS	- FLAG STAFF	SI	- SIGN	SL43.45	- SOFFIT LEVEL
GA	- GAS	SMP	- SERVICE MARKER POST	TH43.45	- THRESHOLD LEVEL
GM	- GAS METER	SS	- SECURITY SENSOR	WL43.45	- WATER LEVEL
G	- GIRTH	ST	- STOP TAP		
GP	- GATE POST	SU	- STUMP		
GV	- GAS	SV	- STOP VALVE		
GVV	- GAS VALVE	SW	- SWITCHGEAR		
HyP	- HYDRANT	TA	- TAP		
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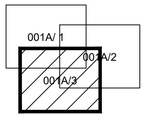
KO	- KERB OFFLET	TM	- TICKET MACHINE		
LA	- LADDER	TS	- TRAFFIC SIGNAL		
LB	- LITTER BIN	TP	- TELEGRAPH POLE		

SYMBOLS

HEDGE · GATE · BUILDING · TREE CANOPY · CONTROL STATION · TREE

SHEET LAYOUT



Rev	Date	Drawn	Description	Ch'k'd	Aps'd
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Title

UPPER BROOK STREET
MANCHESTER
M13 9YD

TOPOGRAPHICAL SURVEY

SHEET 3 OF 3

Surveyed	PG	Drawn	PG	Drawn Date: 07/04/2022
Checked	AM	Approved	NDO	
Scale 1:250 @ A1	Project 11766			Status REV
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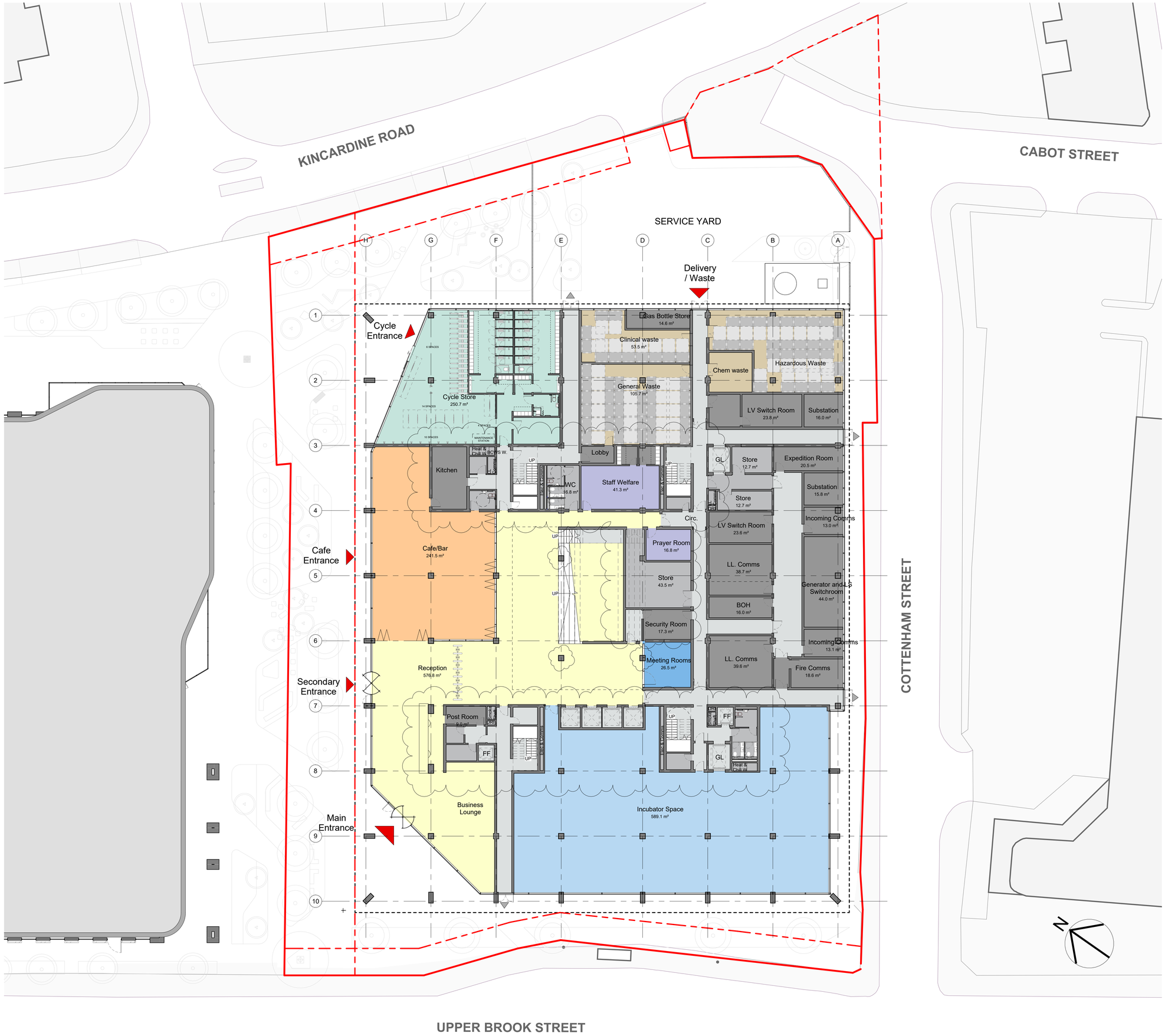
Drawing No 11766/ 001A / 3				Rev A

Appendix B. Development Proposals



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PROJECT
Upper Brook Street - Block B

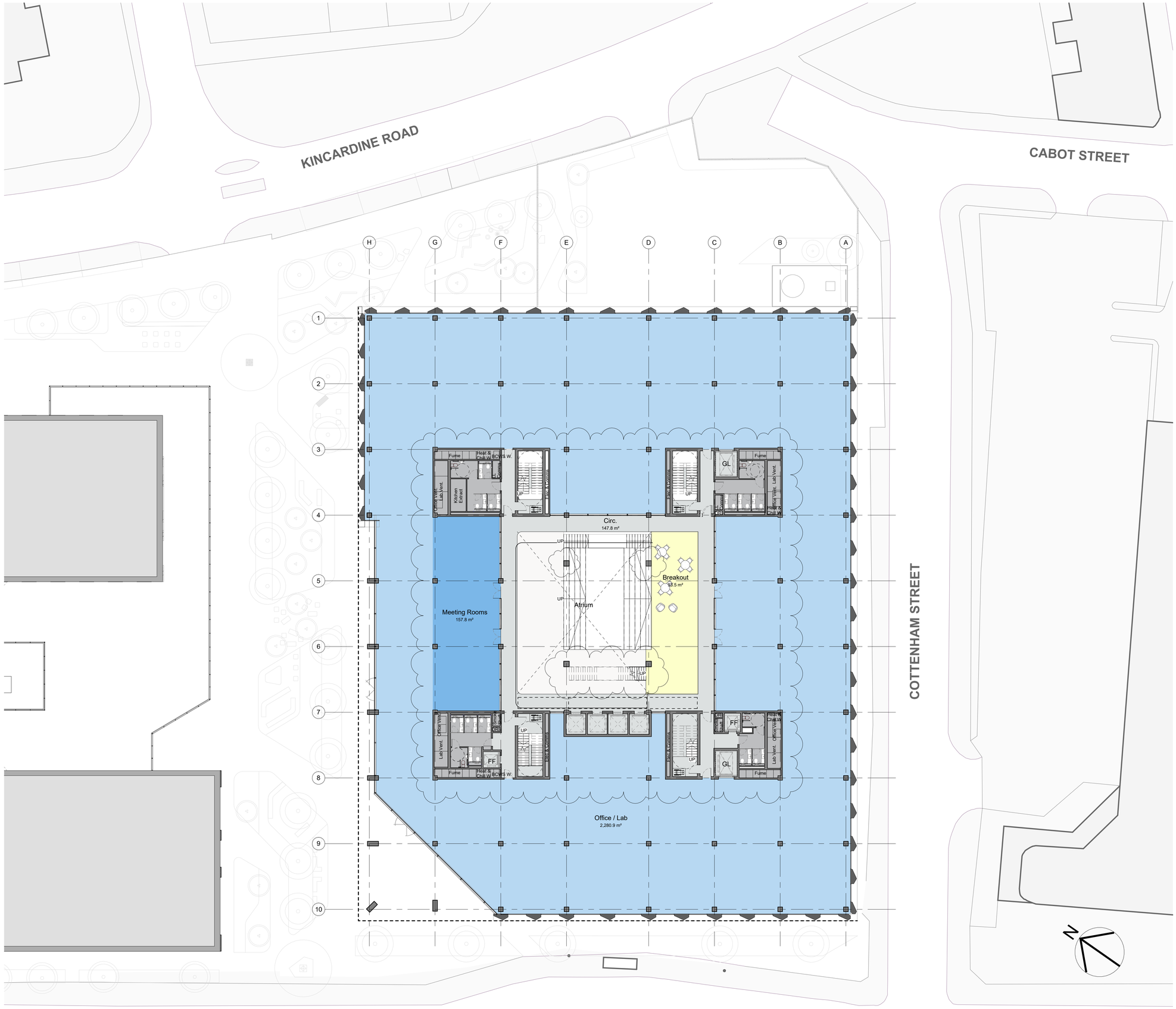
SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
Ground Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - 00 - DR - A - 20100	P03



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PROJECT
Upper Brook Street - Block B

SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
First Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

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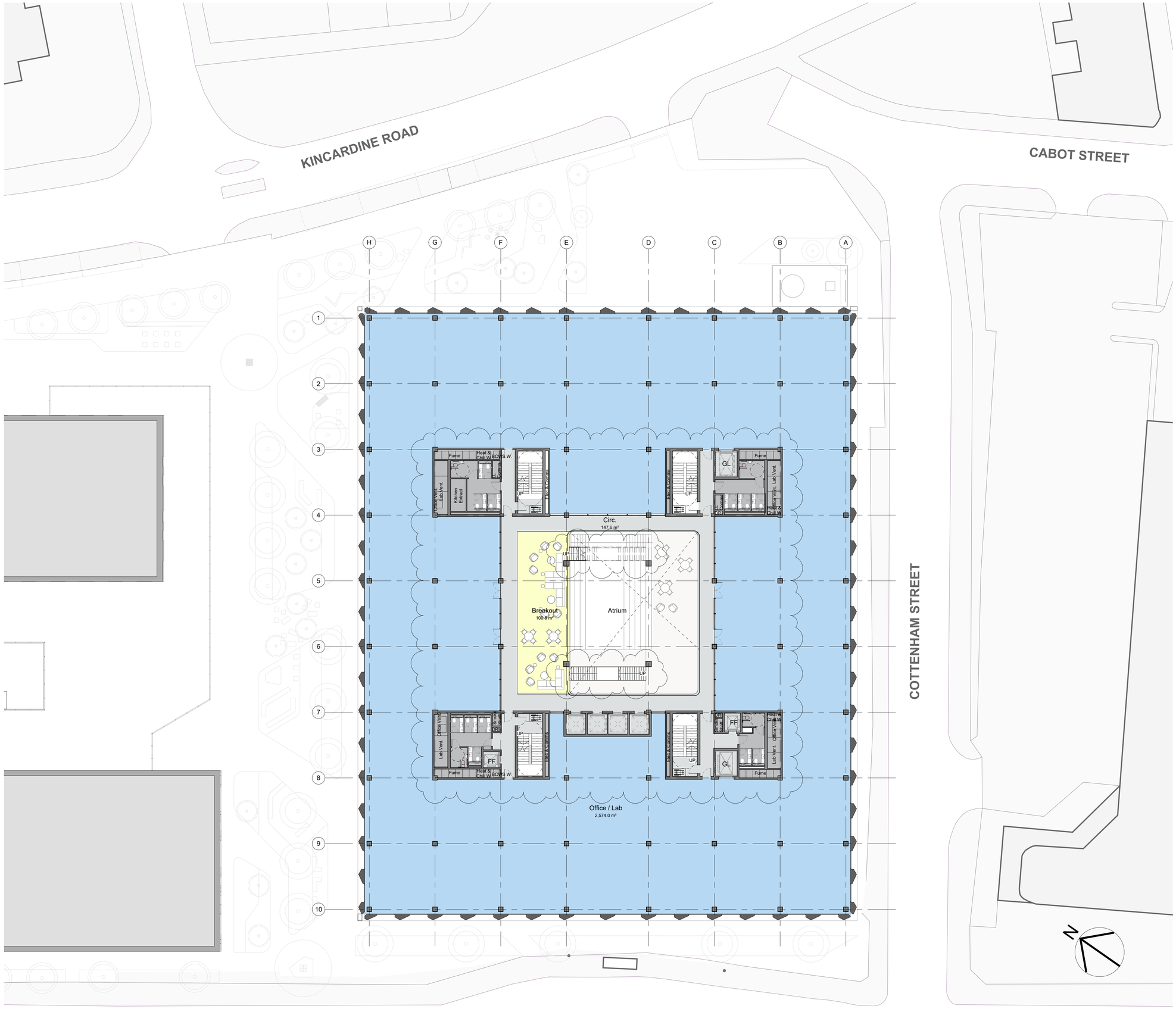
7025 - SRA - ZZ - 01 - DR - A - 20101	P03



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PROJECT
Upper Brook Street - Block B

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General Arrangement
Second Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
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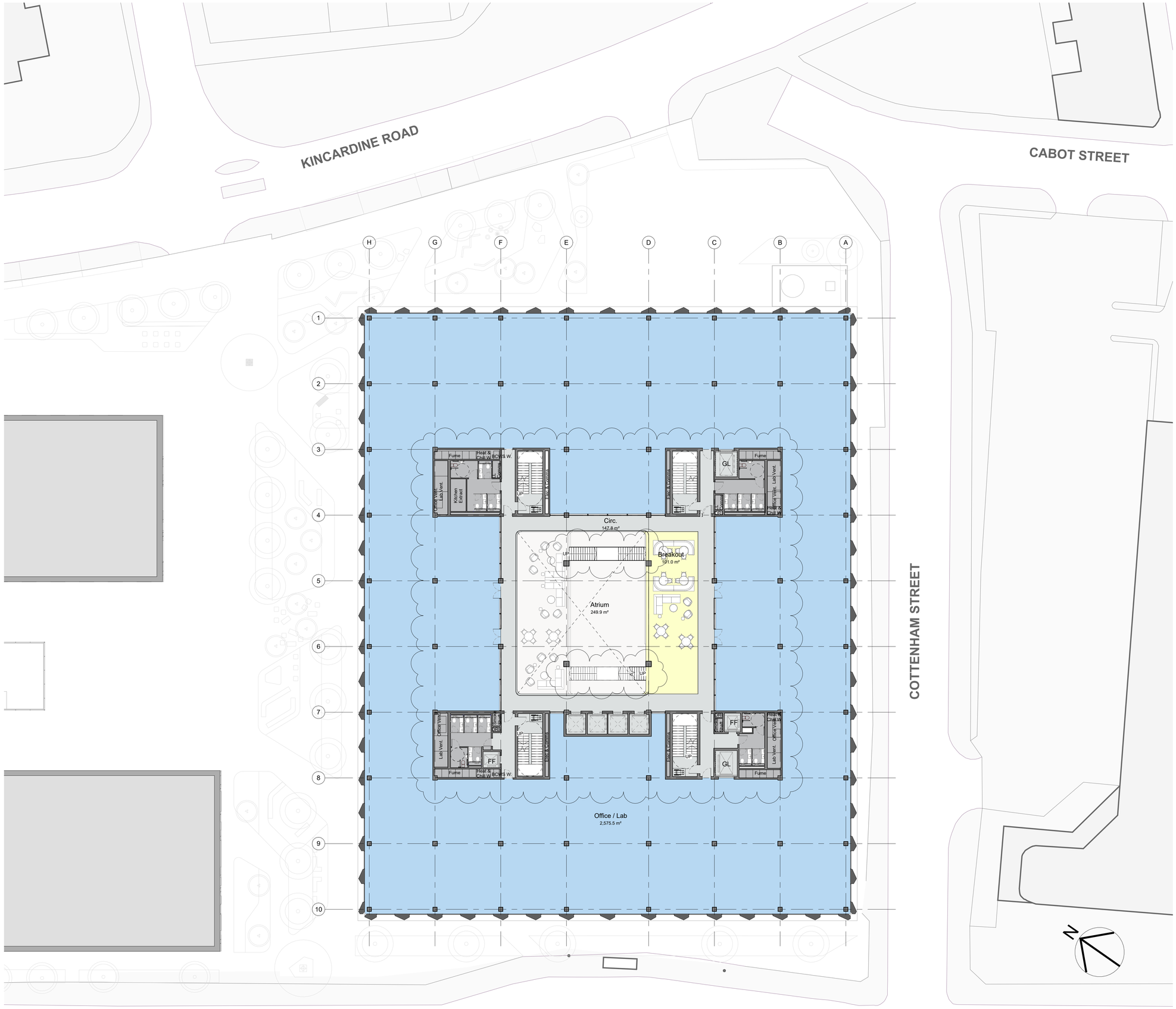

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P03	28.03.23	Design Freeze Rev.A

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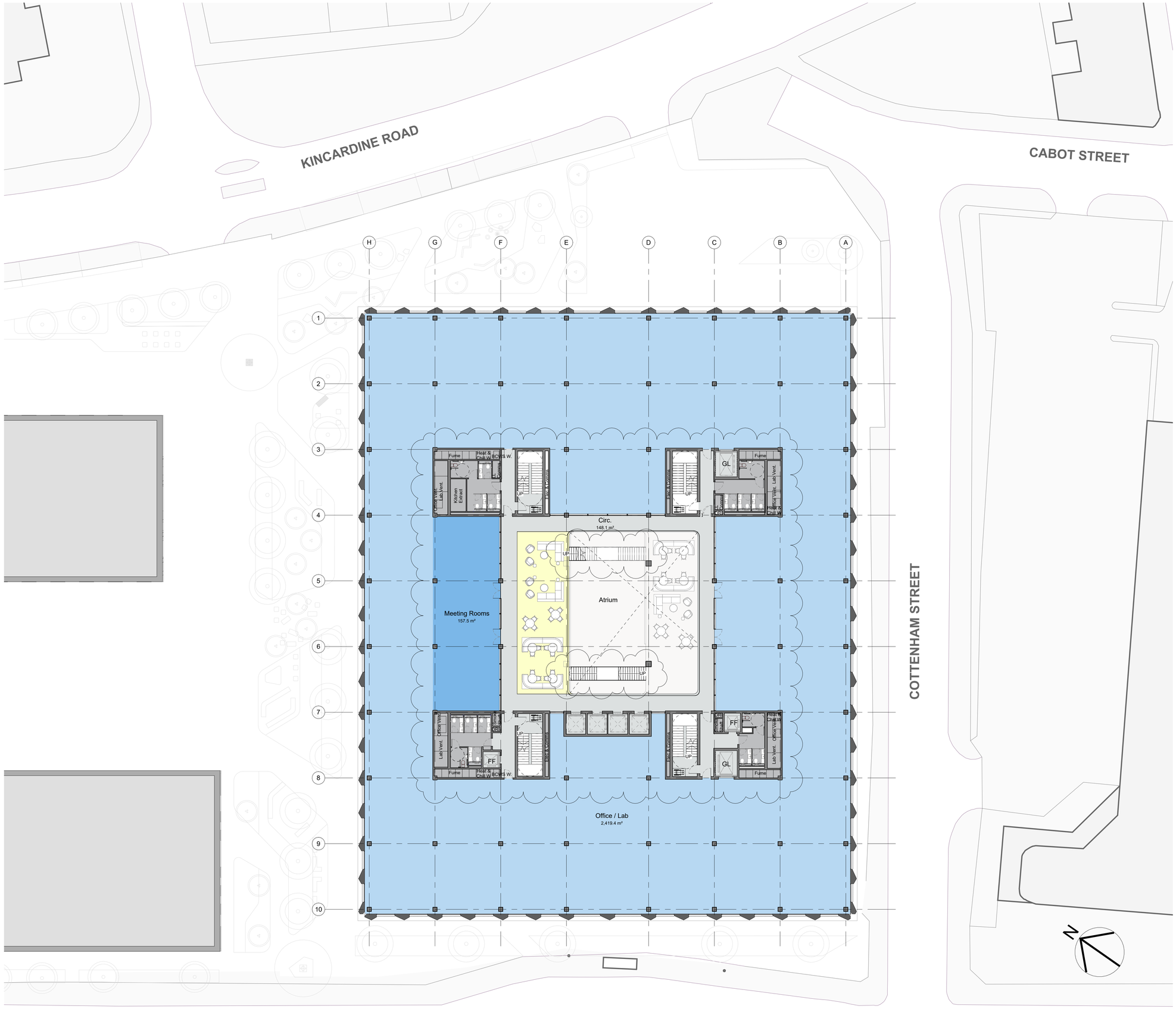
General Arrangement
Third Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - 03 - DR - A - 20103	P03



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PROJECT
Upper Brook Street - Block B

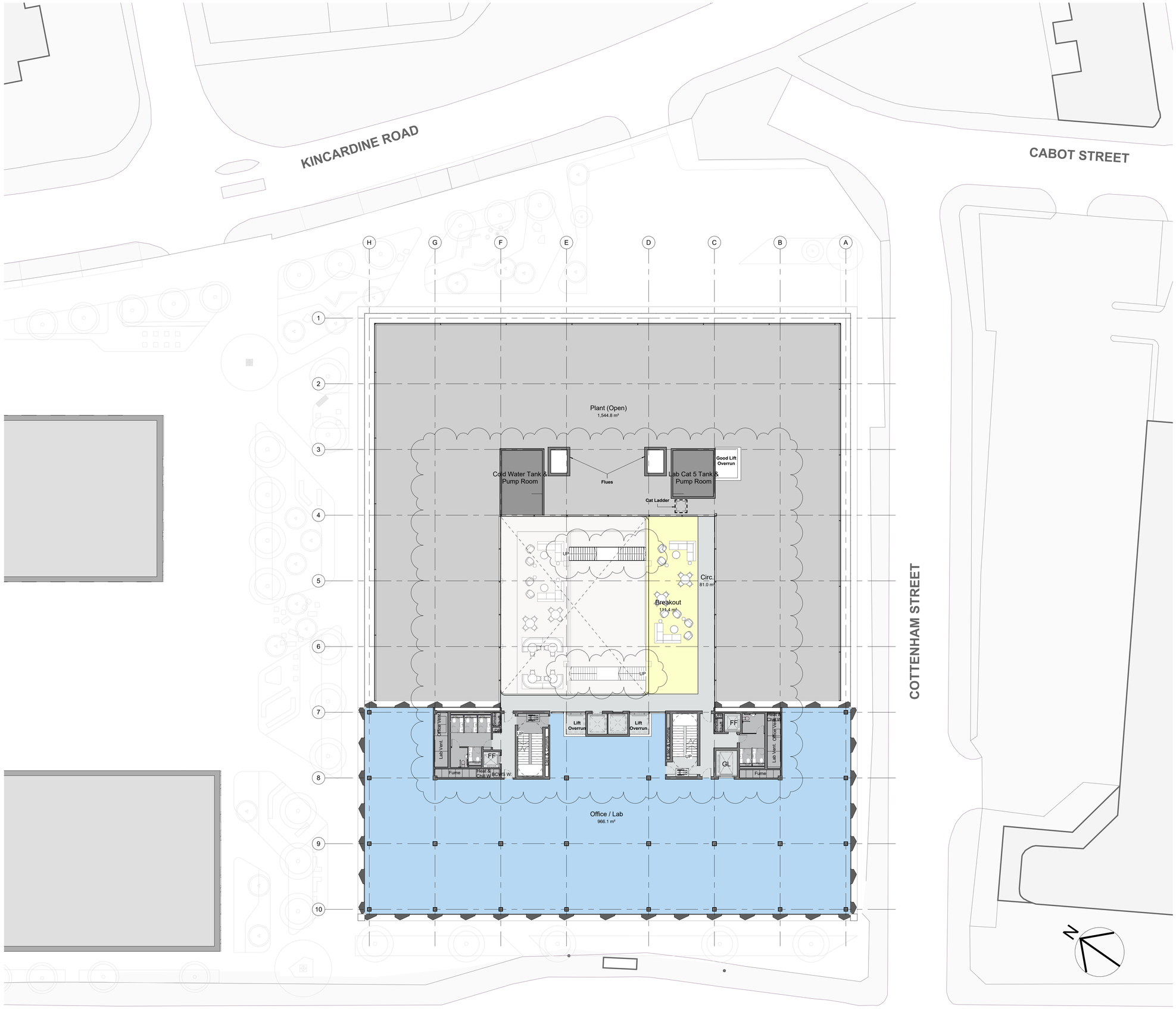
SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
Fourth Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - 04 - DR - A - 20104	P03



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PROJECT
Upper Brook Street - Block B

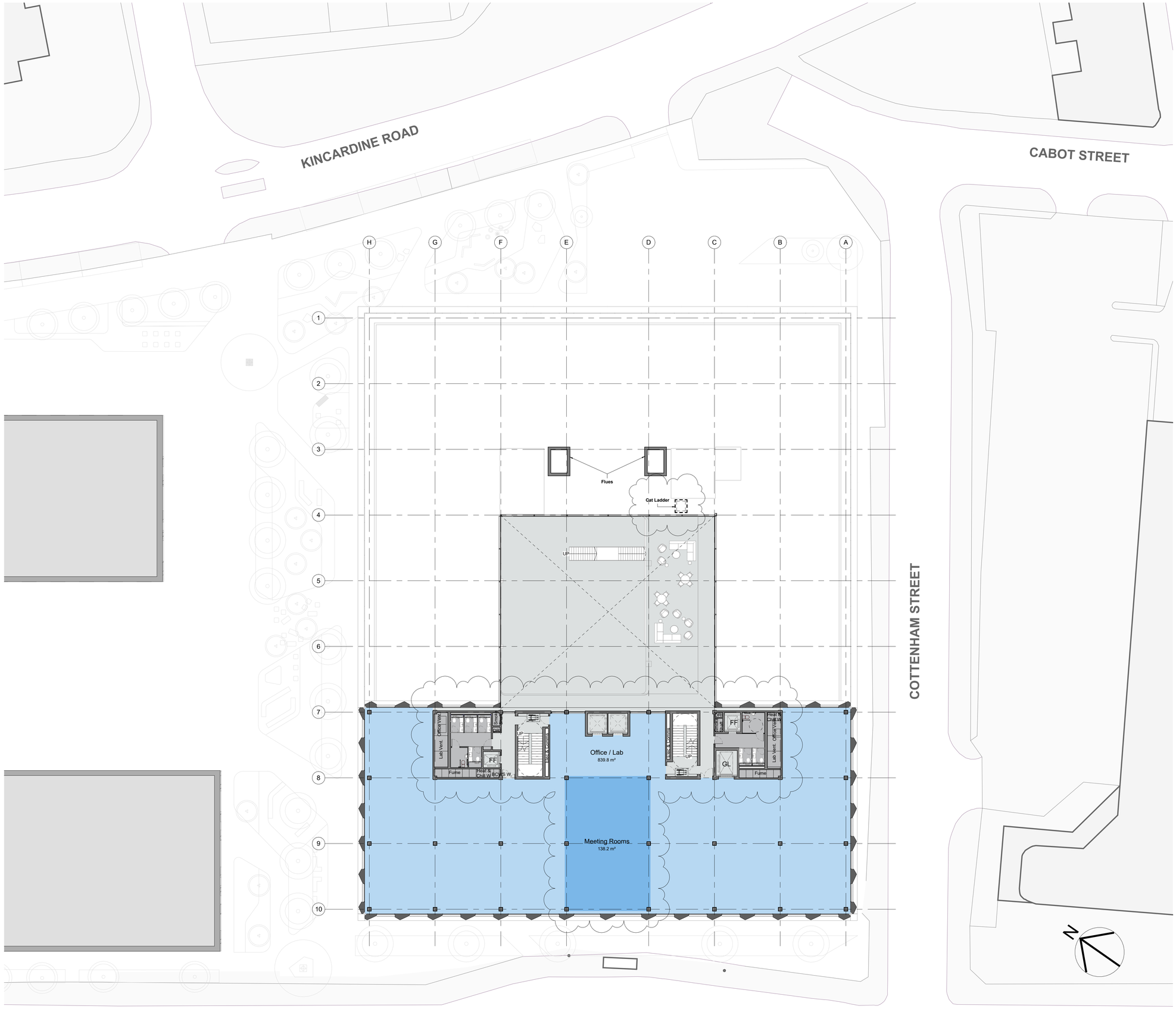
SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
Fifth Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - 05- DR- A- 20105	P03



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PROJECT
Upper Brook Street - Block B

SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
Sixth Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

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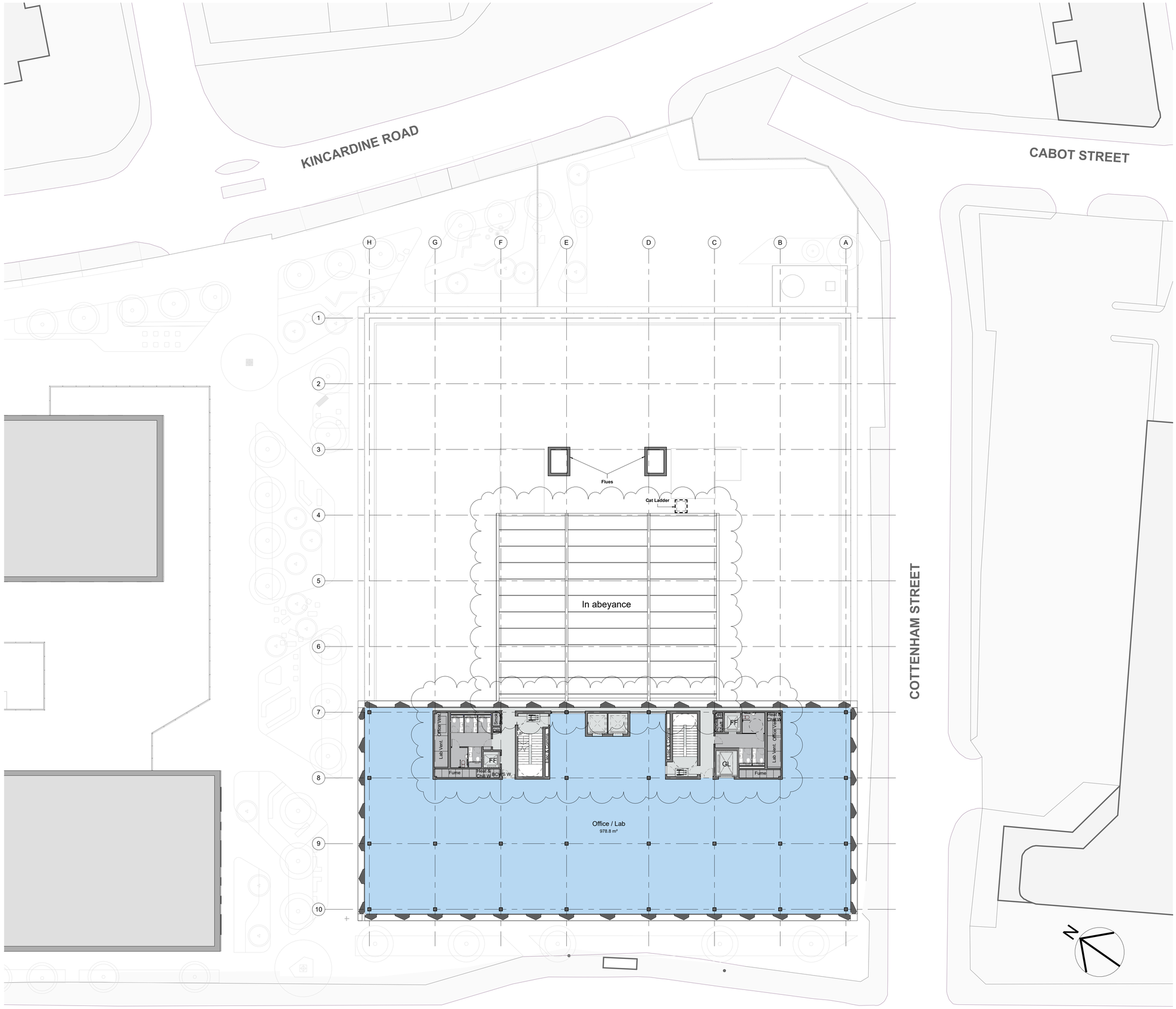
REV. P03



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PROJECT
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General Arrangement
Seventh Floor Plan

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

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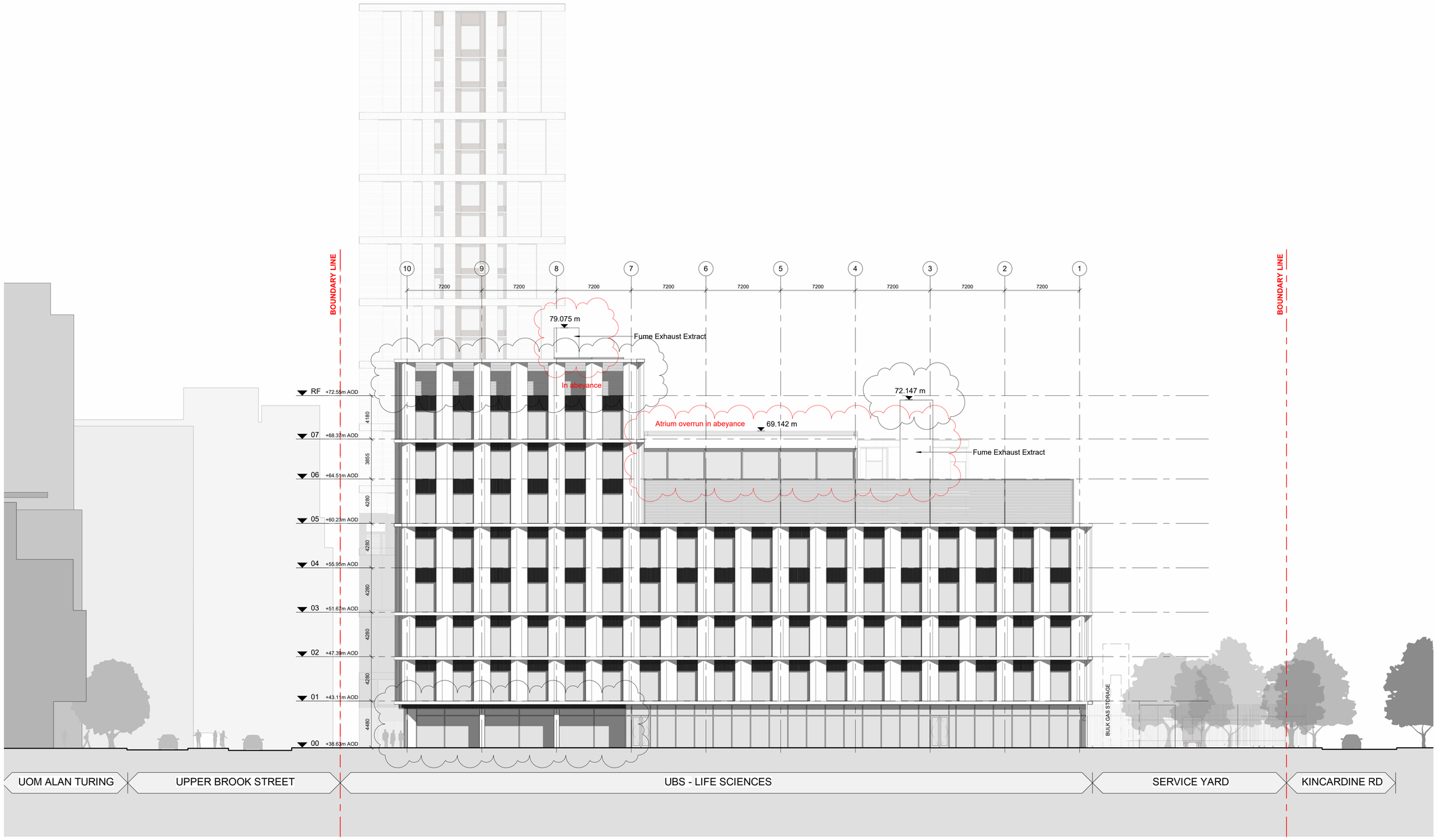

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P02	28.03.23	Design Freeze Rev.A

KEYPLAN

Kadans

KADANS
SCIENCE PARTNER

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PROJECT
Upper Brook Street - Block B

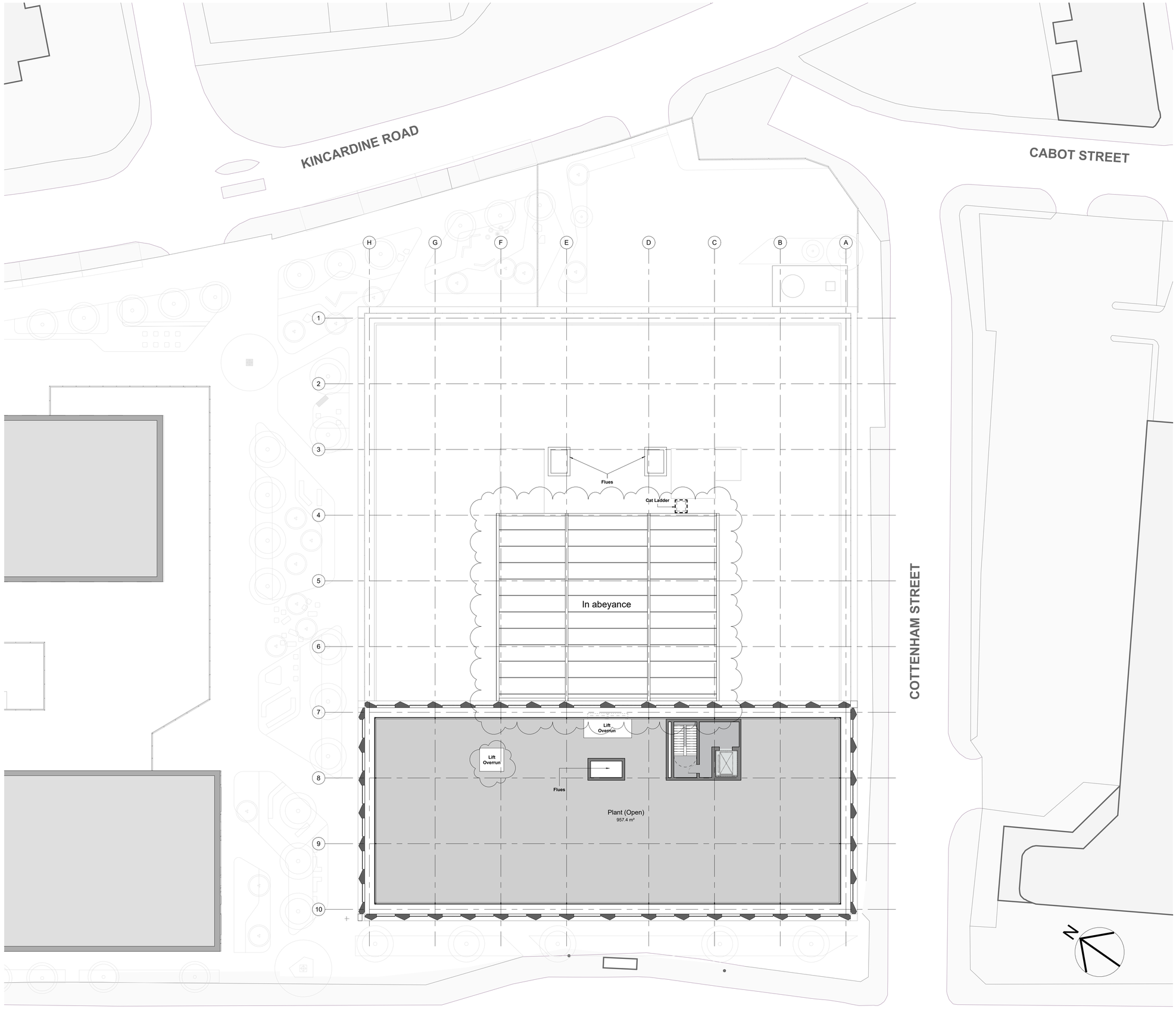
SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	SN	JW	ES

General Arrangement
East Elevation

Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - EE- DR - A - 20201	P02



A1

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The contractor shall check and verify all dimensions on site and report any discrepancies in writing to Sheppard Robson before proceeding work

FOR ELECTRONIC DATA ISSUE
Electronic Data / drawings are issued as "read only" and should not be interrogated for measurement. All dimensions and levels should read, only from those values stated in text on the drawing.

REV.	DATE	AMENDMENT
P01	06.03.23	For information
P02	17.03.23	Design Issue
P03	28.03.23	Design Freeze Rev.A

KEYPLAN

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PROJECT
Upper Brook Street - Block B

SCALE@A1	DATE	ORIGINATOR	CHECKED	AUTHORISED
1 : 200	28.03.23	PC	JW	ES

General Arrangement
Roof Plan

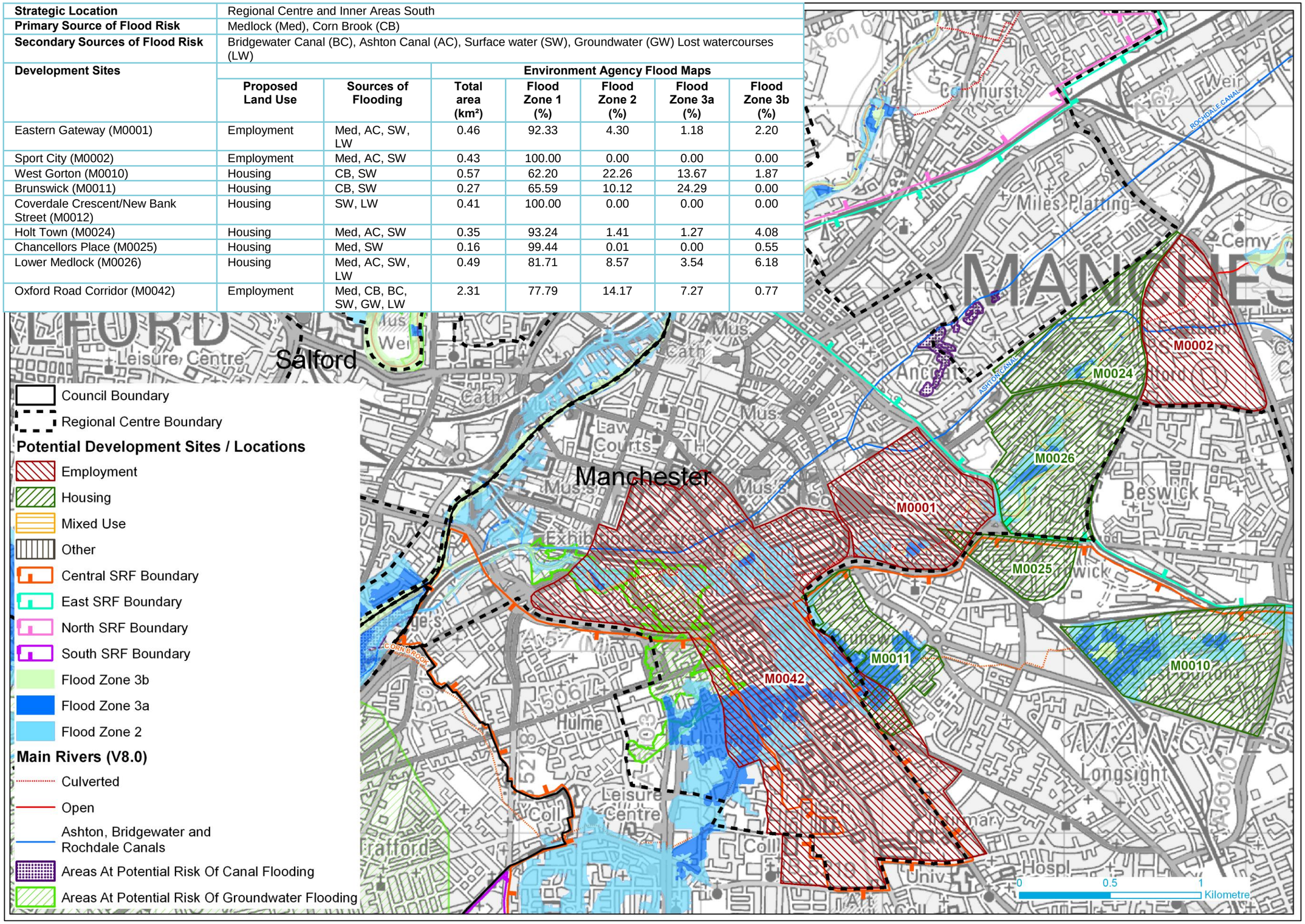
Stage 2

STATUS	PURPOSE FOR ISSUE	SR NO.
S2	INFORMATION	7025

DRAWING NO.	REV.
7025 - SRA - ZZ - RF- DR - A - 20108	P03

Appendix C. Manchester City, Salford City and Trafford Level 1 SFRA Figures

Strategic Location	Regional Centre and Inner Areas South						
Primary Source of Flood Risk	Medlock (Med), Corn Brook (CB)						
Secondary Sources of Flood Risk	Bridgewater Canal (BC), Ashton Canal (AC), Surface water (SW), Groundwater (GW) Lost watercourses (LW)						
Development Sites			**Environment Agency Flood Maps**				
	Proposed Land Use	**Sources of Flooding**	**Total area (km²)**	**Flood Zone 1 (%)**	**Flood Zone 2 (%)**	**Flood Zone 3a (%)**	**Flood Zone 3b (%)**
Eastern Gateway (M0001)	Employment	Med, AC, SW, LW	0.46	92.33	4.30	1.18	2.20
Sport City (M0002)	Employment	Med, AC, SW	0.43	100.00	0.00	0.00	0.00
West Gorton (M0010)	Housing	CB, SW	0.57	62.20	22.26	13.67	1.87
Brunswick (M0011)	Housing	CB, SW	0.27	65.59	10.12	24.29	0.00
Coverdale Crescent/New Bank Street (M0012)	Housing	SW, LW	0.41	100.00	0.00	0.00	0.00
Holt Town (M0024)	Housing	Med, AC, SW	0.35	93.24	1.41	1.27	4.08
Chancellors Place (M0025)	Housing	Med, SW	0.16	99.44	0.01	0.00	0.55
Lower Medlock (M0026)	Housing	Med, AC, SW, LW	0.49	81.71	8.57	3.54	6.18
Oxford Road Corridor (M0042)	Employment	Med, CB, BC, SW, GW, LW	2.31	77.79	14.17	7.27	0.77



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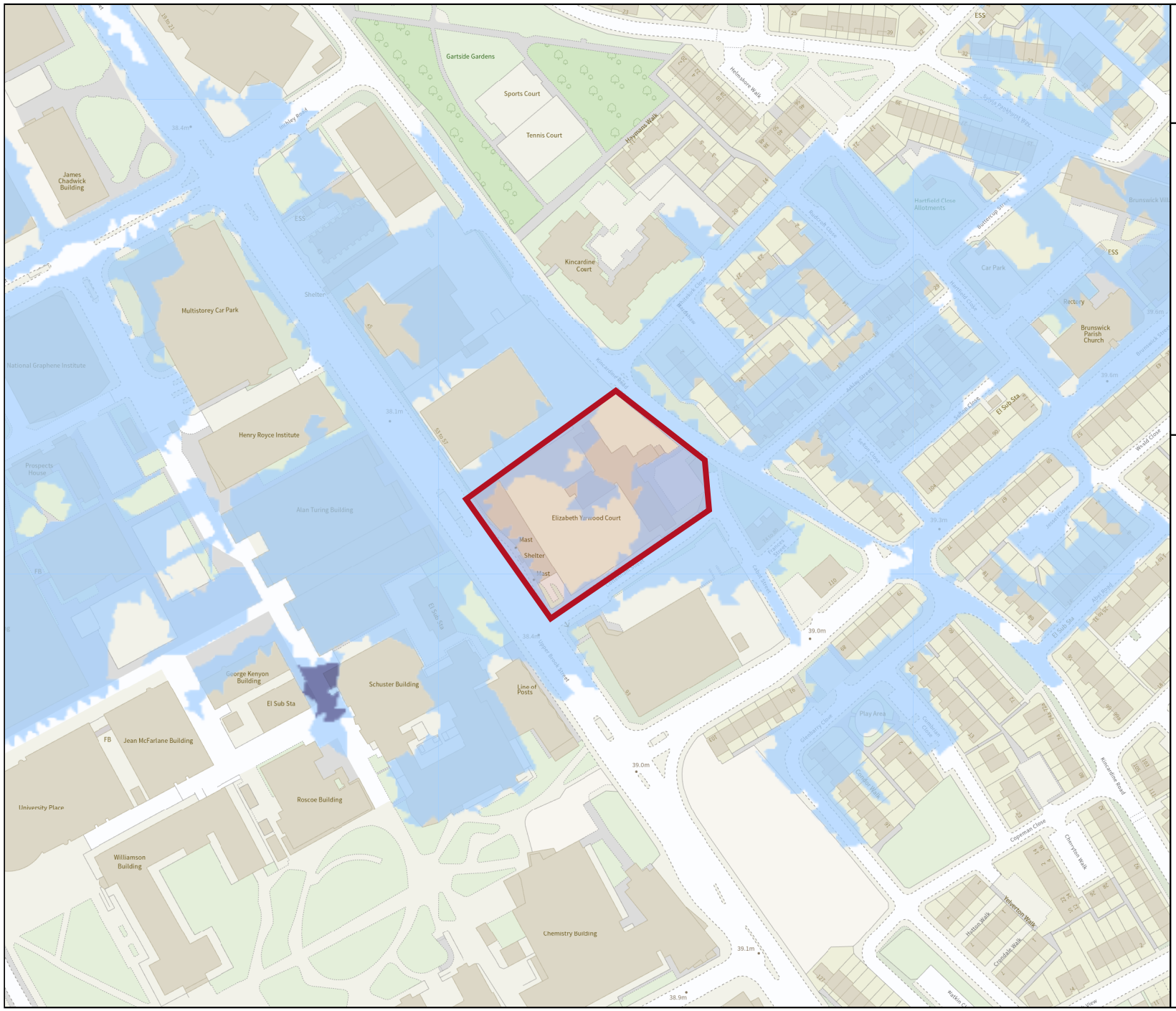
Appendix D. Environmental Agency Consultation

Upper Brook Street Site **384850/396844** **13 Dec 2022 9:46**



Environment Agency

Flood map for planning

Your reference
Upper Brook Street Site

Location (easting/northing)
384850/396844

Scale
1:2500

Created
13 Dec 2022 9:46

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

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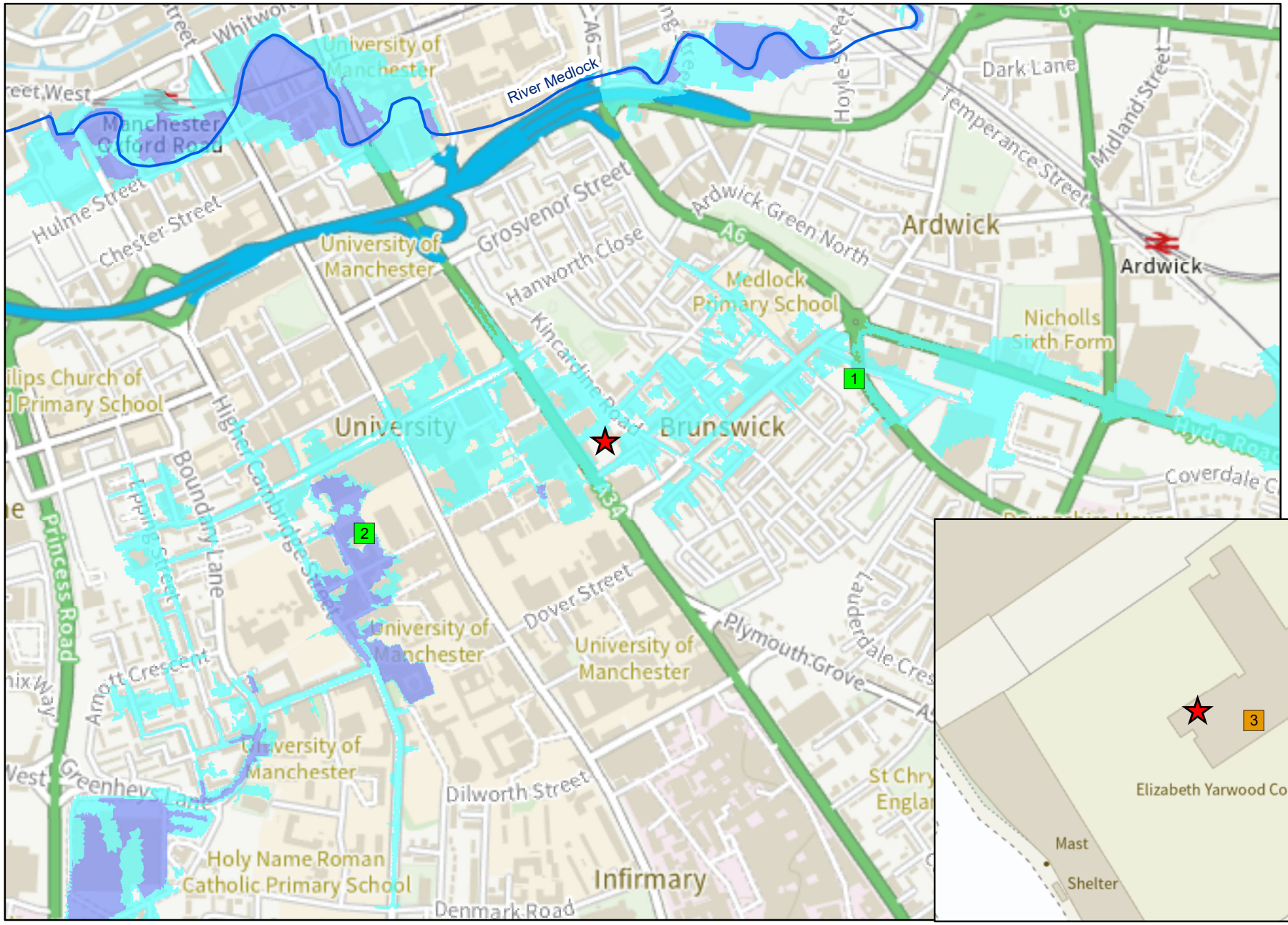
Detailed Flood Map Centred on Kincardine Road, Manchester, M13 9SY.
Created 19/12/2022 [GMMC291819AB]



Environment Agency

1:10,001

N

Legend

- Site Location
- Model Measurements
- 2D Level
- Main River
- Flood Zone 3
- Flood Zone 2

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					Undefended													
Map Reference	Model Node Reference	Easting	Northing	Data	50 % AEP (1 in 2 year)	20 % AEP (1 in 5 year)	10 % AEP (1 in 10 year)	5 % AEP (1 in 20 year)	4 % AEP (1 in 25 year)	2 % AEP (1 in 50 year)	1.33 % AEP (1 in 75 year)	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + 30% increase in flow	1 % AEP (1 in 100 year) + 35% increase in flow	1 % AEP (1 in 100 year) + 70% increase in flow	0.5 % AEP (1 in 200 year)	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
1	ea013_0249_corn5676	385305	396961	Modelled Water Level (m aodN)	38.62	38.70	38.75	38.80	38.83	39.03	39.65	40.33	40.73	40.76	40.94	40.80	41.42	41.65
				Modelled Flow (cumecs)	0.46	0.66	0.81	0.95	1.09	1.78	2.26	2.66	3.46	3.59	4.52	3.78	7.77	10.10
2	ea013_0249_corn4653	384397	396684	Modelled Water Level (m aodN)	34.75	34.99	35.19	35.44	35.77	36.89	37.13	37.27	37.38	37.39	37.47	37.41	37.66	37.77
				Modelled Flow (cumecs)	0.28	0.39	0.48	0.57	0.67	1.20	1.56	1.84	2.40	2.49	3.13	2.65	5.49	7.13

					Undefended	
Map Reference	Model Node Reference	Easting	Northing	Data	0.1 % AEP (1 in 1000 year)	0.1 % AEP (1 in 1000 year) + 30% increase in flow
3	2D Level	384855	396851	Modelled Water Level (m aodN)	38.96	39.13

Model data taken from Corn Brook 2017

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

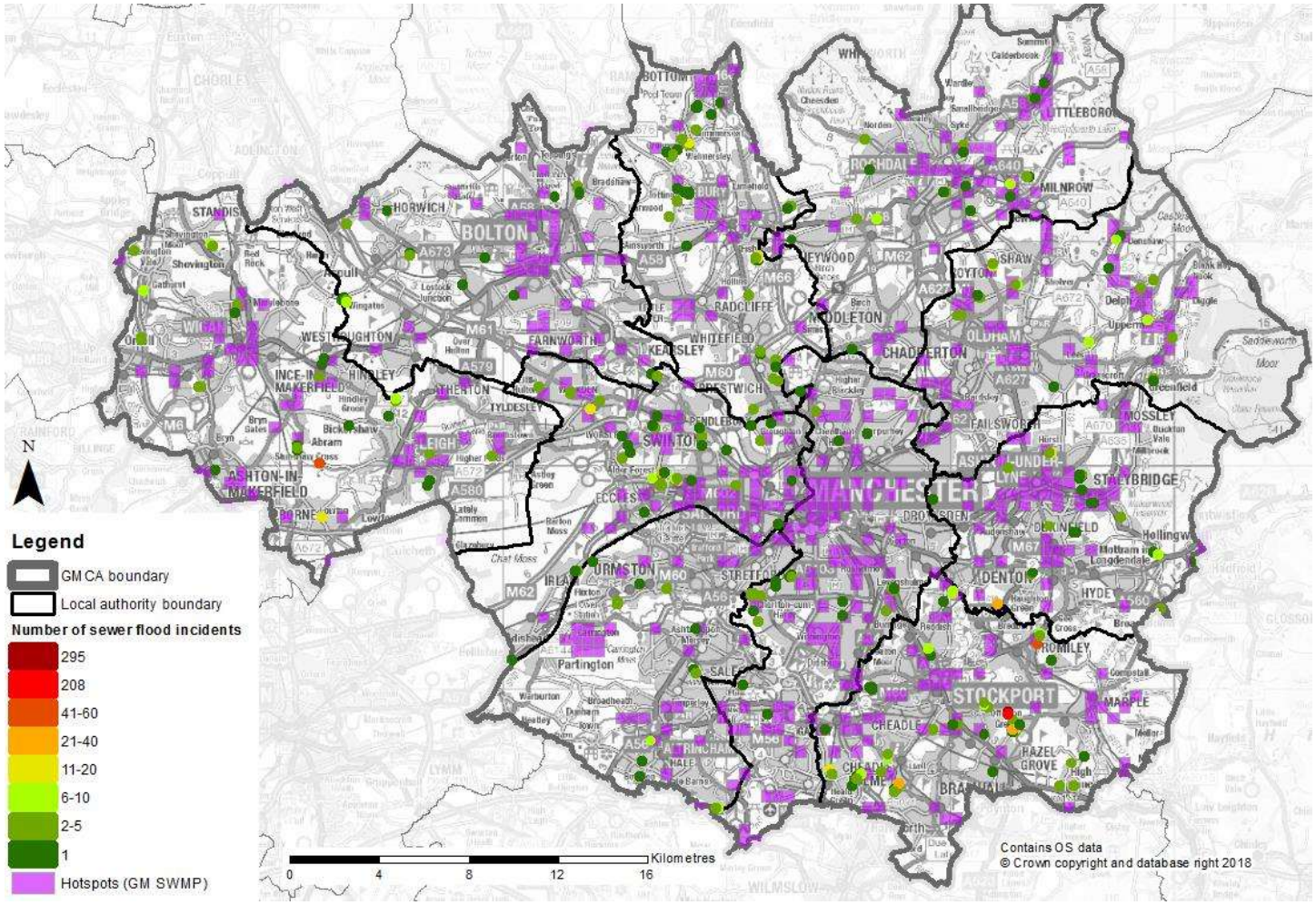
cumecs - cubic metres per second

Notes:

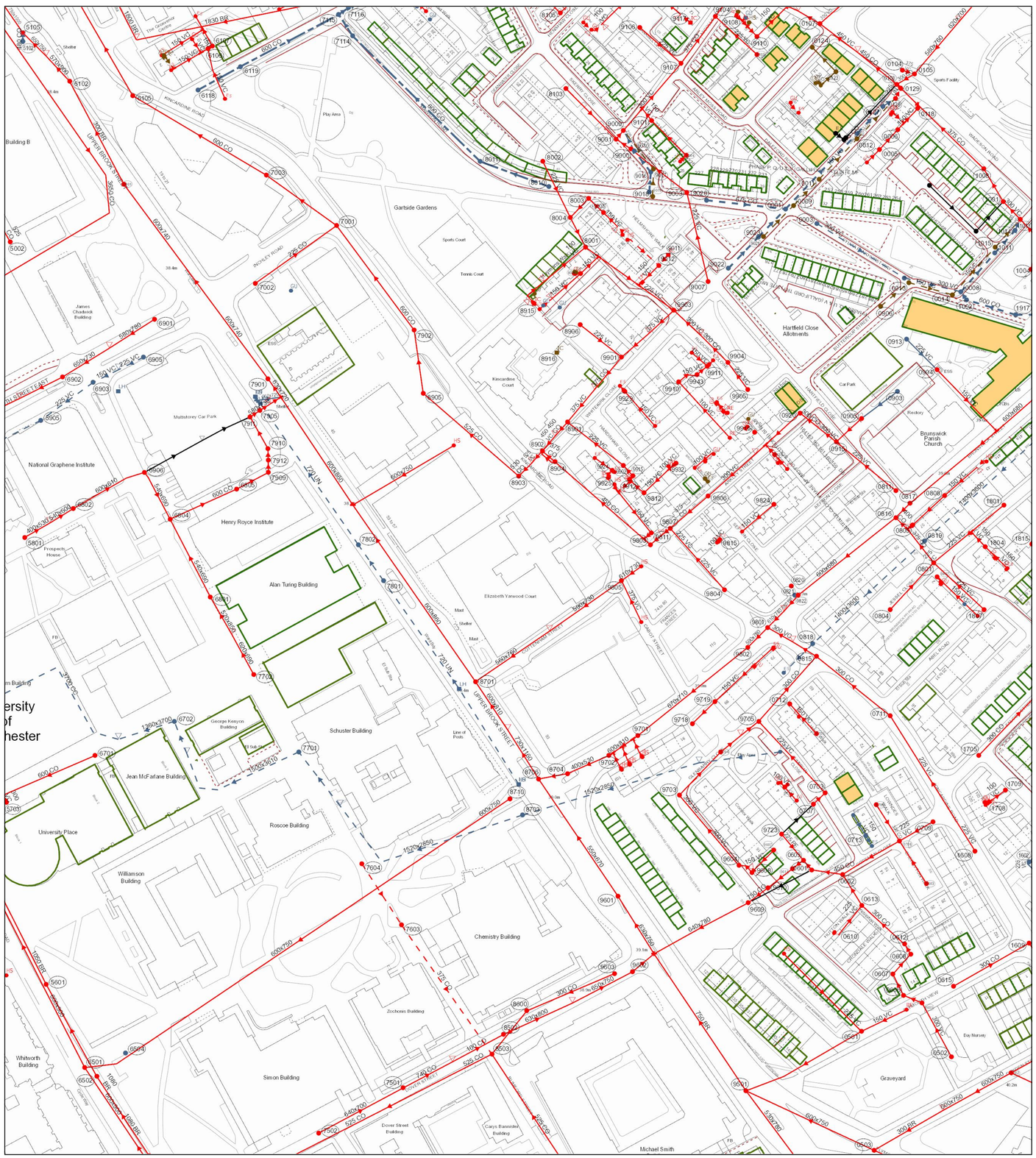
*Climate Change Scenario - 30%, 35% and 70% increases in flow calculated for the 2080's (2070 - 2115). Please see https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances for more information regarding the new climate change guidance. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.

Appendix E. Manchester City, Salford City and Trafford Level 2 SFRA Figures

Figure 6-8: UU historic sewer flooding incidents and GM SWMP Hotspots



Appendix F. Sewer Asset Plan



The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
5801	37.53	CO	34.01	400			BR	16.12452	1 in 81
7501	38.19	CO	0	740			CO	31.01685	
7802	38.03	SW		720			UN	94.86833	
0819	39.54	SW	37.08	1400			CO	84.21995	1 in 281
0612	39.53	CO	36.21	300			CO	31.94306	1 in 118
0502	39.93	CO	36.81	300			VC	34.11977	1 in 70
8600		CO	0	375			CO	30.90375	
9602	38.97	CO	32.65	630			BR	15.6205	
0817	39.46	CO	34.53	600			BR	11.31371	1 in 113
8703	38.87	SW	35.94	1520			CC	120.81870	
8006		CO		150			VC	13.8111	
9807	38.92	CO	0	375			CO	6.403124	
0611	39.45	CO	35.07	750			CO	17.23244	1 in 47
9912		CO		150			VC	2.748913	
8903	38.73	CO	35.35	525			CO	70.17834	
8003		CO		150			VC	14.72389	
7701	38.03	SW	35.22	1500			CC	79.95717	
8904	38.78	CO	35.44	375			CO	10.77713	
6702	37.89	SW	35.19	1350			CC	32.57299	
7801	38.03	SW		720			UN	24.41311	
0706	39.39	CO	36.33	300			CO	23.88246	1 in 88
9811		CO		150			VC	5.248927	
8701	38.29	CO	31.87	600			BR	191.2363	
0607	40	CO	36.35	300			VC	14.81987	1 in 296
9723	39.28	CO	37.81	225			PE	18.81261	1 in 99
9604	39.2	CO	37.3	300			VC	51.08816	1 in 106
9911		CO		150			VC	4.549471	
1502	40.12	CO	36.29	600			BR	43.41659	1 in 128
8011	39.74	SW	37.55	600			CO	99.3138	1 in 397
9910		CO		150			VC	11.72358	
7115	39.4	SW	36.68	600			CO	6.561014	1 in 328
6902	38.08	CO	34	650			BR	26.83282	1 in 149
0707		CO		225			VC	9.139158	
6901	38.28	CO	34.28	580			BR	29.68164	1 in 297
8105	39.44	CO	35.78	600			CO	48.79549	1 in 25
6001	38.47	CO	29.35	300			BR	64.41273	1 in 81
6106		CO		150			VC	2.875601	
5105	38.44	CO	28.42	750			BR	39.41649	1 in 188
6801	37.81	CO	34.19	540			BR	48.60859	
9703	38.81	CO	36.75	300			VC	33.24154	1 in 237
0915	39.27	CO	37.07	300			VC	12.80625	1 in 256
0709	39.47	CO	37.65	225			VC	21.40466	1 in 61
5102	38.51	SW	33.18	480			CO	3	
9801	39.28	CO	33.66	590			BR	15.55635	1 in 21
7909	38.91	CO		600			CO	6.832462	
6501	37.82	CO	31.99	600			BR	190.562	1 in 836
1807	39.24	CO	37.59	225			VC	38.20995	1 in 26
9803	38.8	CO	35.83	450			CO	70.17834	1 in 369
9607		CO		150			VC	15.52432	
8103	39.64	CO	37.42	225			VC	39.59222	1 in 264
9000		CO		225			VC	9.878549	
9824		CO		150			VC	23.20842	
1917	40.1	SW	38	600			CO	28.60264	1 in 409
0906	39.61	FO	38.35	150			VC	20.50872	1 in 79
1002	40	SW	37.93	600			CO	5.311175	1 in 17
0013	39.75	FO	38.09	150			VC	25.2135	1 in 158
0014	39.85	FO	37.93	150			VC	35.5273	1 in 148
0004	39.82	SW	38.36	300			VC	32.26187	1 in 44
0008	39.86	SW	37.62	900			CO	28.52389	1 in 407
0003	40.07	SW	38.59	300			CO	57.13577	1 in 248
1011	39.97	SW	37.55	900			CO	16.88864	1 in 422
1015	40	FO	37.69	150			VC	20.77086	1 in 72
9021	39.8	SW	37.58	675			CO	21.61141	1 in 432
9023	39.8	FO	38.17	150			VC	23.89604	1 in 80
1014	39.88	SW		0			UN	0.2848779	
0001	40.11	SW	37.53	675			CO	57.80459	1 in 385
0009	40.1	FO	37.87	150			VC	20.27092	1 in 145
0011	39.96	FO	37.73	150			VC	30.78201	1 in 154
0012	39.81	FO	37.53	150			VC	30.94646	1 in 111
0002	39.8	SW	37.38	675			CO	20.6047	1 in 412
7603	39.05	SW	30.52	375			CO	87.41487	1 in 4.23318557
9701	39.04	CO	32.9	600			BR	19.41649	1 in 971
0521	39.24	CO	0	680			BR	12.04159	
7002		CO	0	225			CO	55.21775	
8710	38.9	CO	35.55	600			BR	280.6945	
8943		CO		150			VC	7.53592	
8906	39.13	CO	36.6	225			VC	29.20616	1 in 86
6903	38	SW	36.31	225			VC	35.80503	1 in 358
7001	38.81	CO	34.46	600			CO	48.01041	
1804		CO		150			VC	11.40648	
8002		CO	0	225			VC	18.4707	
9804	39.08	CO	37.14	225			VC	45.34314	
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9104	39.96	CO	36.55	375			CO	23.60085	1 in 472
7912		CO		600			CO	6.408573	
0818	39.31	SW	36.76	1400			CO	22.62742	
9103	39.85	CO	37.69	225			VC	31.14482	1 in 82
0005		CO		150			VC	15.1566	
9702	39	CO	0	400			BR	25.07987	
0708	39.38	CO	35.91	450			CO	36.60371	
9902	38.38	CO	35.77	225			VC	39.20459	1 in 245
7502	37.83	CO	33.23	640			BR	53.10831	
7114	39.48	SW	37.3	600			CO	14.18748	1 in 23
6107		CO		150			VC	19.06054	
0805		CO		150			VC	3.845346	
7901	38.33	CO	30.21	600			BR	134.4024	1 in 168
9924		CO		150			VC	1.493705	
6102	38.45	CO	28.51	570			BR	19.10497	1 in 637
6801	37.81	CO	34.17	540			BR	29.59608	
0501	39.77	CO	36.7	225			VC	72.21152	
6119	39.04	SW	36.83	600			CO	61.70521	1 in 411
5905	37.9	SW	36.19	225			VC	64.84597	1 in 171
0123		FO		150			VC	18.82178	
0703	39.34	CO	37.32	225			VC	54.22697	1 in 60
9606	39.5	CO	35.29	640			BR	59.45259	
9005		CO		150			VC	11.38533	
8704	38.94	CO	32.65	400			BR	16.27882	1 in 74
5703	38.18	CO	35.03	300			VC	4.472136	1 in
0705		CO		150			VC	22.07774	
0006		CO		150			VC	16.18041	
9603	38.95	CO	32.74	300			CO	52.71384	1 in 2
8502	38.62	CO	32.84	630			BR	41.85296	1 in 465
8902	38.82	CO	35.37	525			VC	9.219544	1 in 922
0815	39.25	CO	35.36	300			CO	15.26434	1 in 49
8905	39.01	CO	35.46	600			CO	35.35534	1 in 59
0601	39.57	CO	35.42	750			CO	7.115277	1 in 40
9904	38.94	CO	36.04	300			CO	21.2132	1 in 354
9812		CO		150			VC	10.95775	
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6502	37.65	CO	27.39	1050			BR	58.18075	
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9915		CO		150			VC	7.834312	
9901	38.96	CO	35.66	375			CO	23.43075	1 in 1172
6105	19.38	CO	0	600			CO	60.03333	
0613	39.51	CO	35.92	300			CO	20.21742	
7604	39.09	CO	31.01	375			CO	40.49691	1 in 1.79986283
0602		CO		450			CO	17.29331	
1608	39.7	CO	37.76	225			VC	88.50989	1 in 98
0713		SW		150			PE	6.579141	
0503	39.97	CO	34.07	600			BR	78.29432	
7116	39.48	SW	36.66	225			CO	0.2844062	1 in 9
9932		CO		100			VC	4.805931	
7702	37.98	CO	34.49	620			BR	25.05993	1 in 93
6118	38.77	SW	36.9	600			CO	26.91296	1 in 384
0804	39.21	CO	37.2	225			VC	35.38361	1 in 32
9806	39.05	CO	36.38	375			CO	27.65863	
5002	38.21	CO	32.32	525			CO	40.31129	1 in 183
0903	39.28	SW	37.42	225			VC	25	1 in 147
9905	38.72	CO	37	225			VC	18.60108	1 in 20
1602	40	SW	38.28	225			VC	21.2132	1 in 32
6805	38.51	CO	33.89	600			CO	19.96632	1 in 69
9110		CO		150			VC	23.89208	
9802	39.26	CO	0	670			BR	78.24321	
8002		CO		225			VC	34.76073	
9805	38.53	CO	32.81	590			BR	48.82622	1 in 128
6802	37.6	CO	33.61	600			BR	44.47657	
9605	39.94	CO	36.44	300			VC	11.09906	1 in 222
8503		CO	0	525			CO	128.116	
0609	39.54	CO	35.24	750			CO	7.578931	1 in 45
5601	37.97	CO	0	1050			BR	113.1459	
1801	39.78	CO	37.85	225			VC	50.44799	1 in 29
9929		CO		150			VC	4.060181	
9936		CO		100			VC	7.39864	
0610	39.68	CO	38.3	225			VC	20.99258	1 in 20
9705	38.86	CO	36.32	300			CO	48.16638	1 in 58
1705	39.58	CO	37.6	300			CO	65.06919	1 in 342
6905		SW		225			VC	15.65248	
7902	38.74	CO	34.82	600			CO	72.20111	1 in 206
9501	39.64	CO	0	750			BR	91.52596	
8010	39.49	SW	37.65	600			CO	40.53977	1 in 405
1609	39.87	CO	37.55	375			CO	58.5235	1 in 103
9704	38.67	CO	36.51	300			VC	14.21267	1 in 158
9004		CO		150			VC	27.10985	
7910	38.92	CO	33.57	600			CO	20.13492	1 in 96
8706	38.88	CO	32.41	730			BR	31.90611	1 in 128
6701	38.08	CO	32.63	600			CO	55.54278	
8901	38.91	CO	35.55	450			CO	10.63015	1 in 213
9719		CO		150			VC	17.51218	
0920	39.16	CO	36.95	300			CO	33.97058	1 in 126
6804		CO		600			CO	40.39967	
0811	39.3	CO	37.48	225			VC	42.63801	1 in 118
7911	38.98	CO	34.52	600			BR	6.523717	1 in 6
9610	39.49	CO	34.7	750			CO	13.78139	1 in 32
0816	39.43	CO	34.23	600			BR	69.02898	
9601	39.12	CO	0	550			BR	78.49203	
9608		CO		150			VC	8.962052	
9012		CO		150			VC	15.57166	
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7905	38.14	CO	33.49	580			BR	7.070638	
7003		CO	0	600			CO	86.09297	
0606	40	CO	36.39	300			VC	13.08134	1 in 327
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0808		CO		150			VC	23.99167	
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0118		CO		150			VC	1.873294	
0127	39.75	SW		0			UN	0.263447	
0128	39.78	CO	37.25	225			UN	6.305847	1 in 27
0129	39.8	CO	37.02	375			CO	3.124056	1 in 35
0103	39.73	CO	36.77	450			CO	27.908	
9017	39.58	FO	37.7	150			VC	27.1504	1 in 55
9003	41.29	CO	39.22	225			VC	39.22121	
9010	39.73	SW		0			UN	0.2975983	
9016	39.58	SW	37.4	600			CO	14.86561	1 in 372
9106	39.97	CO	38.07	225			VC	30.4795	1 in 68

Refno	Cover	Func	Invert	Size x	Size y	Shape	Matl	Length	Grad
9101		CO		150			VC	8.529122	
9019	39.52	SW	37.42	600			CO	10.90529	1 in 545
9018	39.6	FO	37.9	150			VC	15.11795	1 in 76
9107	39.97	CO	36.68	375			CO	32.20248	1 in 358
9007	40.75	CO	39.03	225			VC	50.81679	1 in 141
9020	39.61	SW	37.63	675			CO	44.16507	1 in 442
9022	39.41	SW	37.64	675			CO	24.05621	1 in 401
9001	39.72	CO	37.27	300			VC	6.276586	1 in 105
9009	39.66	CO	37.21	300			VC	49.04075	1 in 104
0105	39.76	CO	37.09	300			CO	11.38527	1 in 44
1008		CO		375			CO	64.07944	
0104	39.78	CO	36.93	375			VC	6.98957	1 in 44
1001	39.8	CO	37.2	375			CO	21.135	
1013	39.89	CO	37.27	300			VC	13.63931	1 in 195
1004	40.06	CO	37.44	225			VC	17.42356	1 in 249

LEGEND

Abandoned | Foul | Surface Water | Combined

- Public Sewer
- Private Sewer
- Section 104
- Rising Main
- Sludge Main
- Overflow
- Water Course
- Highway Drain

All point assets follow the standard colour convention:
red - combined, blue - surface water, brown - foul, purple - overflow

- Manhole
- Head of System
- Extent of Survey
- Rodding Eye
- Inlet
- Discharge Point
- Vortex
- Penstock
- Washout Chamber
- Valve
- Air Valve
- Non Return Valve
- Soakaway
- Gully
- Cascade
- Flow Meter
- Hatch Box
- Oil Interceptor
- Summit
- Drop Shaft
- Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- Inspection Chamber
- Bifurcation Chamber
- Lamp Hole
- T Junction / Saddle
- Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- Ww Treatment Works
- Ww Pumping Station
- Septic Tank
- Control Kiosk
- Change of Characteristic

MANHOLE FUNCTION

- FO Foul
- SW Surface Water
- CO Combined
- OV Overflow

SEWER SHAPE

- CI Circular
- EG Egg
- OV Oval
- FT Flat Top
- RE Rectangular
- SQ Square
- TR Trapezoidal
- AR Arch
- BA Barrel
- HO HorseShoe
- UN Unspecified

SEWER MATERIAL

- AC Asbestos Cement
- BR Brick
- PE Polyethylene
- RP Reinforced Plastic Matrix
- CO Concrete
- CSB Concrete Segment Bolted
- CSU Concrete Segment Unbolted
- CC Concrete Box Culverted
- PSC Plastic / Steel Composite
- GRC Glass Reinforecd Plastic
- DI Ductile Iron
- PVC Polyvinyl Chloride
- CI Cast Iron
- SI Spun Iron
- ST Steel
- VC Vitrified Clay
- PP Polypropylene
- PF Pitch Fibre
- MAC Masonry, Coursed
- MAR Masonry, Random
- U Unspecified

Address or Site Reference:

Elizabeth Yarwood Court Elizabeth Yarwood Court
Kincardine Road,
Manchester,
M13 9SY

Scale: 1:1250 **Date:** 01/03/2023

Sheet: 1 of 1

Printed by: Property Searches

SEWER RECORDS

United Utilities
Water for the North West

Appendix G. Surface Water Catchment Areas

GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE SUBJECT TO DETAILED DESIGN.
3. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

KEY

- SITE BOUNDARY (AREA = 0.562ha)
- EXISTING PERMEABLE AREA (AREA = 0.263ha)
- EXISTING IMPERMEABLE AREA (AREA = 0.299ha)

Revision	Date	Description	By	Chk
02	11.05.23	MINOR AMENDMENTS	TK	CT
01	17.03.23	FIRST ISSUE	TK	CT

Blackfriars Office
240 Blackfriars Road
London
SE1 8NW
United Kingdom

T: +44 (0)20 7429 3333
hdrinc.com/follow-us
www.hdrinc.com

Project:
Upper Brook Street

Drawing Title:
Existing Drainage Catchment

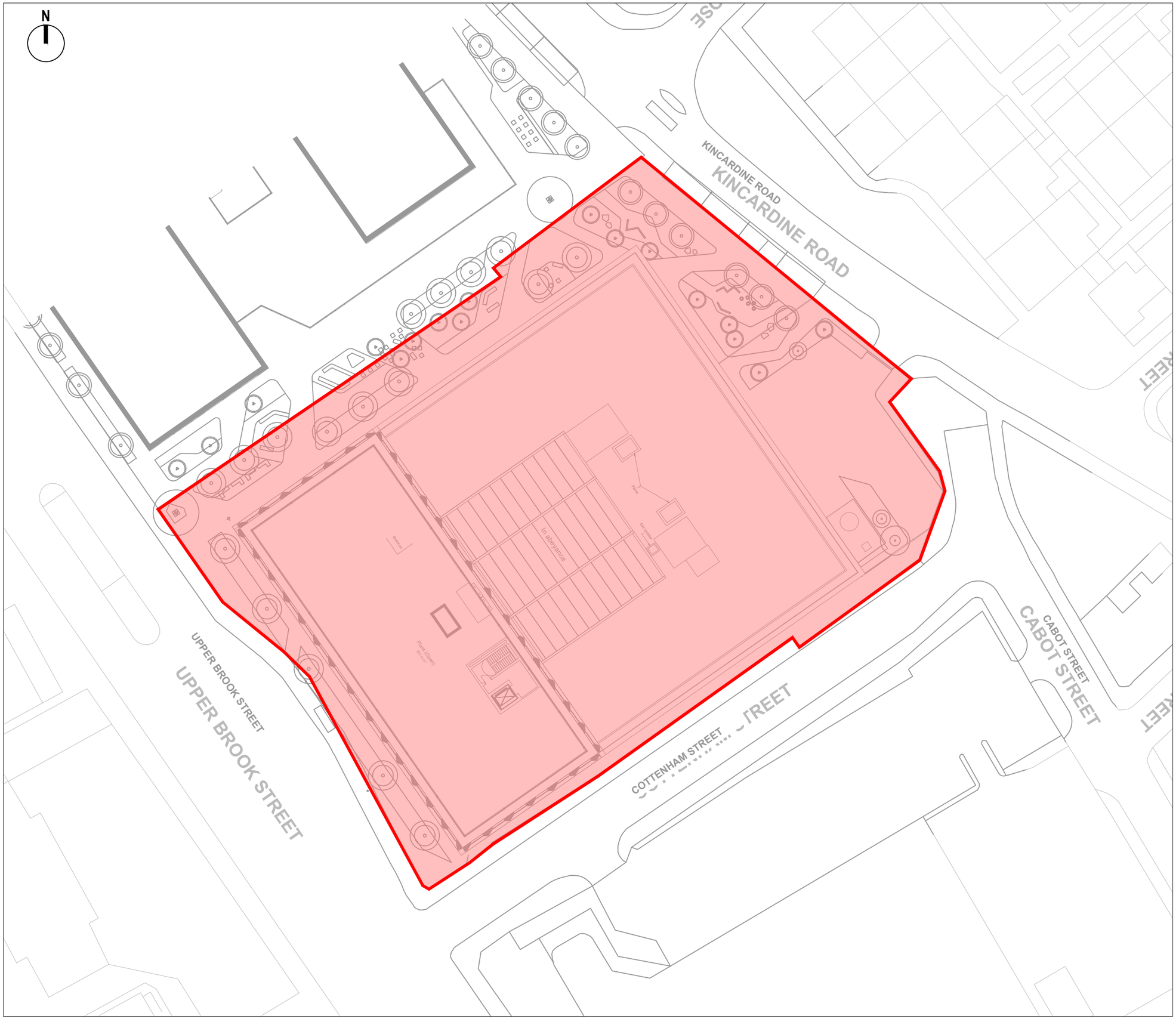
Client:
Kadans Science Partner

Status:
Preliminary

Drawn By:	TK
Designed By:	TK
Checked By:	CT
Date:	APRIL 2023
Project Reference:	14216A
Scale:	1:500

Drawing Number: 14216A-30-C50

Revision: 02



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE SUBJECT TO DETAILED DESIGN.
3. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

KEY

SITE BOUNDARY (AREA = 0.562ha)

PROPOSED IMPERMEABLE AREA (AREA = 0.562ha)

Revision	Date	Description	By	Chk
02	11.05.23	MINOR AMENDMENTS	TK	CT
01	17.03.23	FIRST ISSUE	TK	CT

HDR

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SE1 8NW
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Project:
Upper Brook Street

Drawing Title:
Proposed Drainage Catchment

Client:
Kadans Science Partner

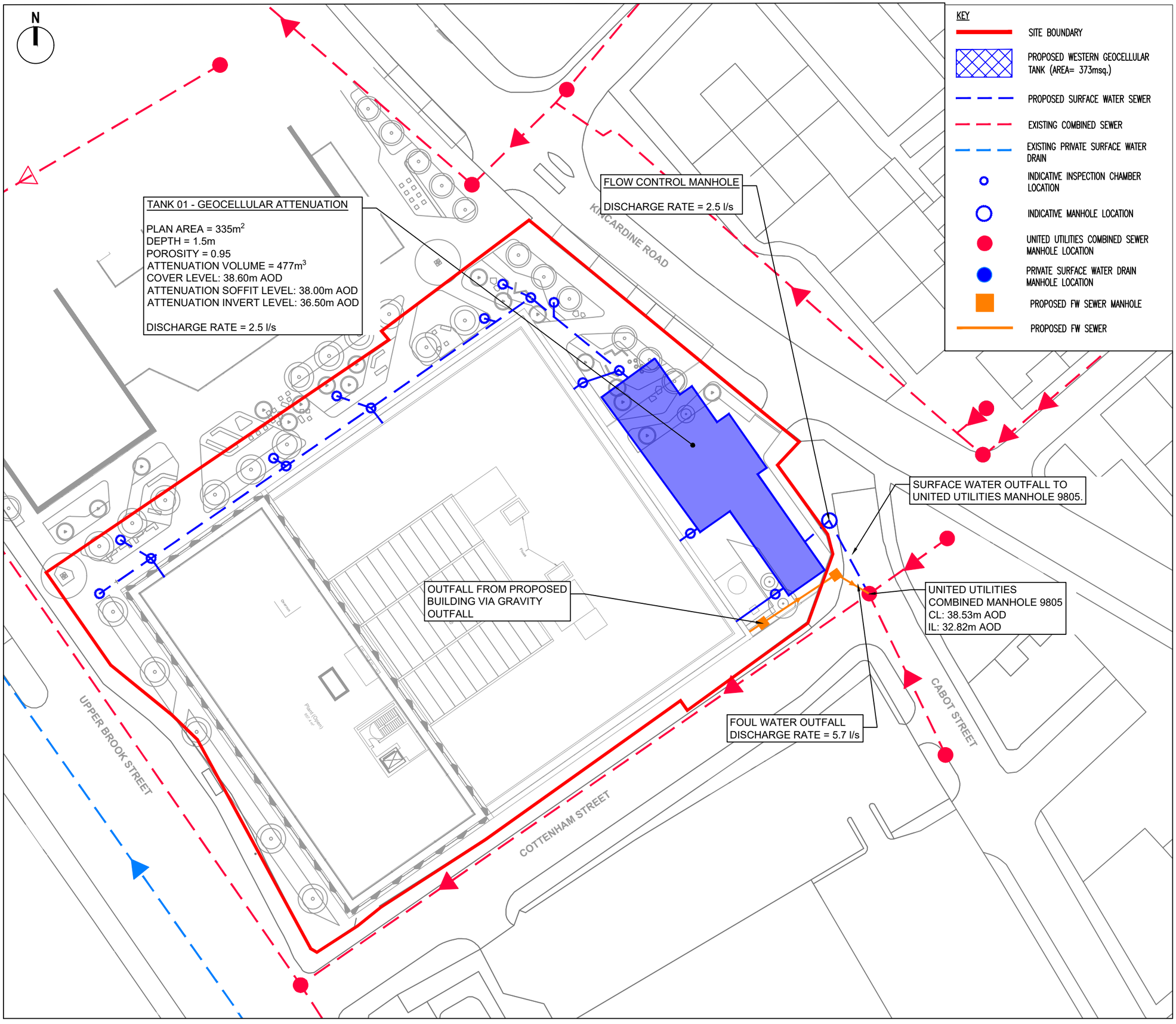
Status:
Preliminary

Drawn By:	TK
Designed By:	TK
Checked By:	CT
Date:	April 2023
Project Reference:	14216A
Scale:	1:500

Drawing Number: 14216A-30-C51

Revision: 01

Appendix H. Proposed Drainage Strategy Plans



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE SUBJECT TO DETAILED DESIGN.
3. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

Revision	Date	Description	By	Chk
01	11.05.23	FIRST ISSUE	TK	CT

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Project:
Upper Brook Street

Drawing Title:
Proposed Drainage Layout

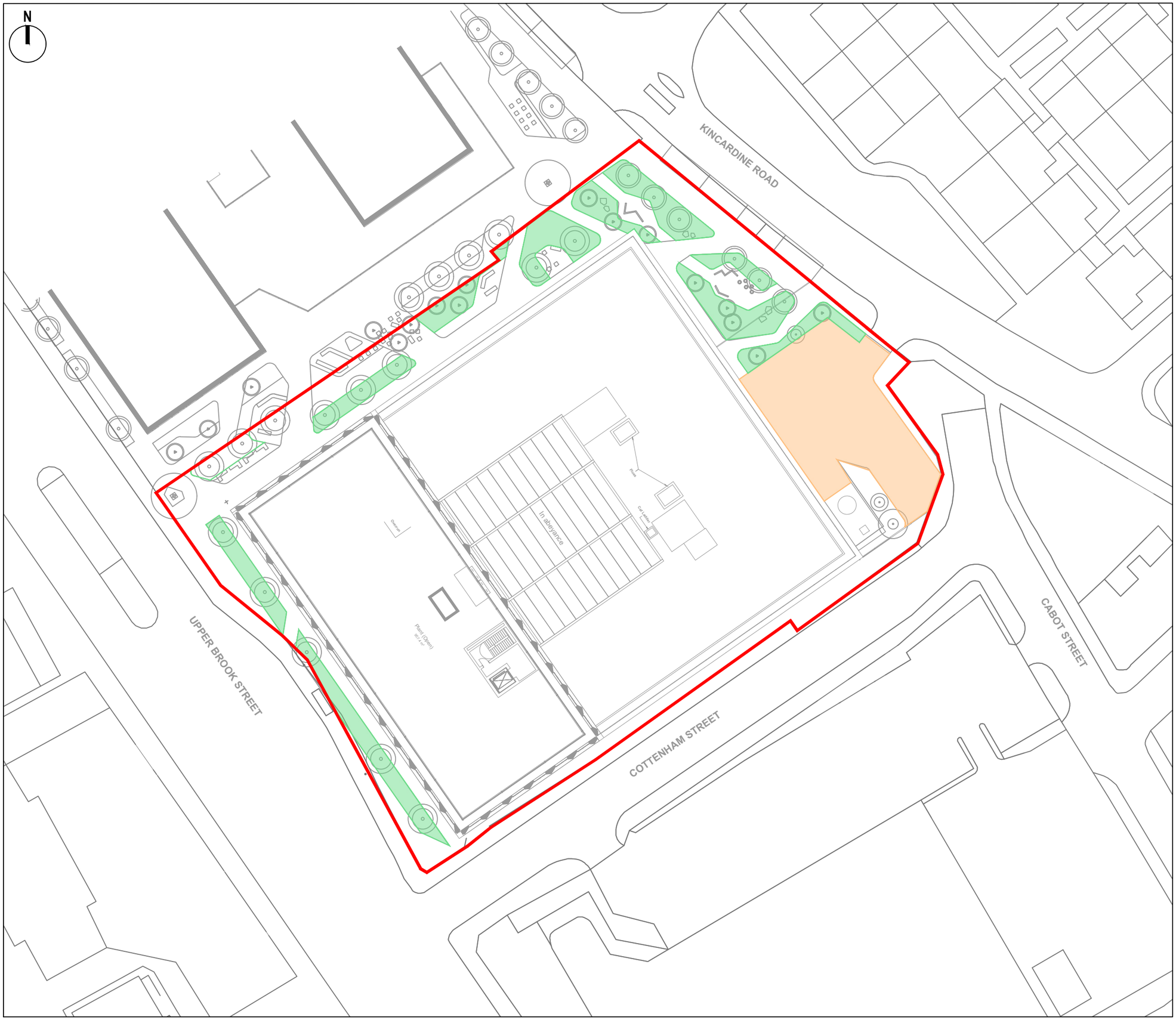
Client:
Kadans Science Partner

Status:
Preliminary

Drawn By:	TK
Designed By:	TK
Checked By:	CT
Date:	April 2023
Project Reference:	14216A
Scale:	1:500

Drawing Number: 14216A-30-C53

Revision: 01



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE SUBJECT TO DETAILED DESIGN.
3. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

KEY

- SITE BOUNDARY
- PROPOSED PERMEABLE SURFACING
- PROPOSED RAINGARDENS

Revision	Date	Description	By	Chk
01	11.05.23	FIRST ISSUE	TK	CT

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Project:
Upper Brook Street

Drawing Title:
Proposed SuDS Layout

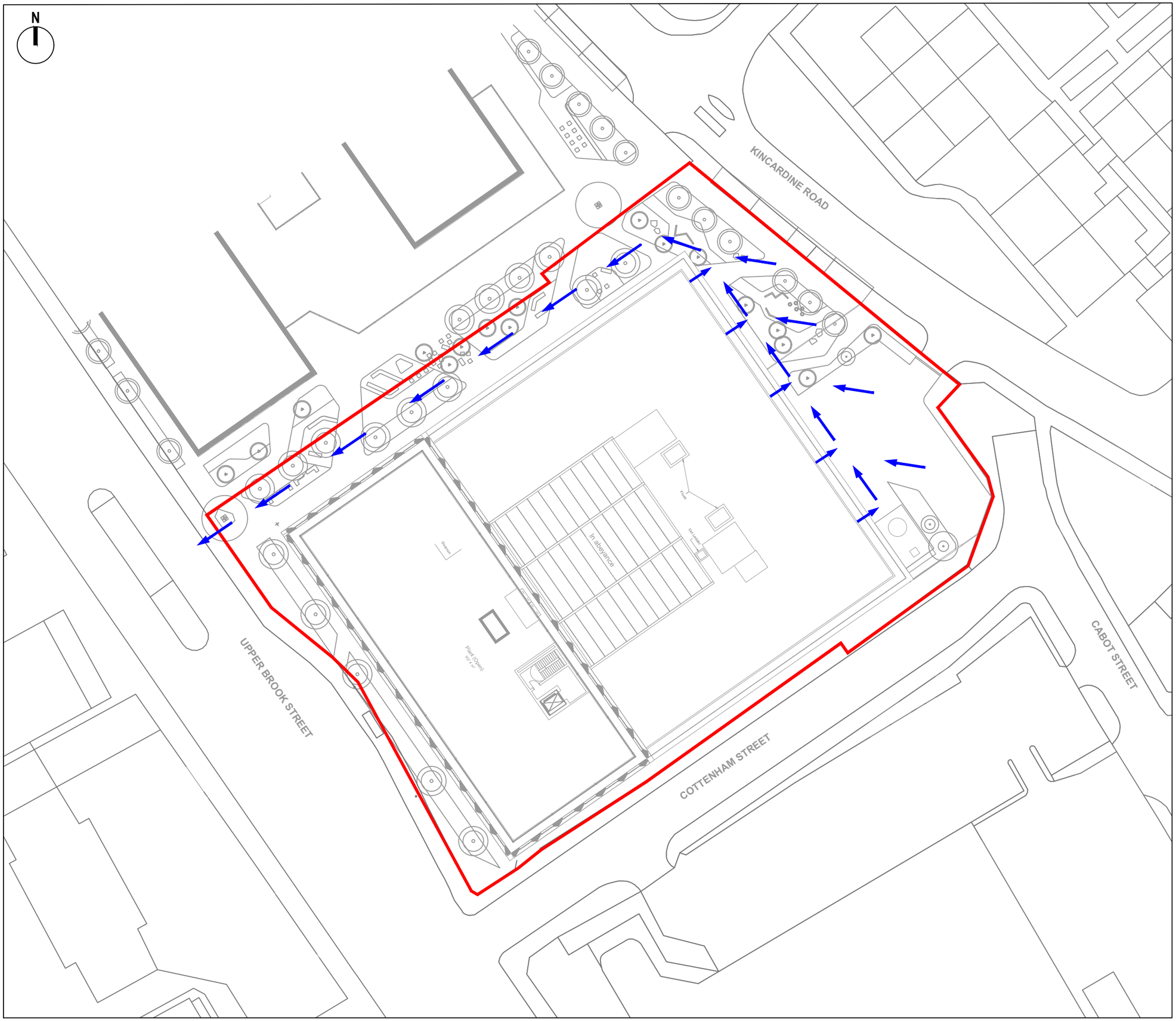
Client:
Kadans Science Partner

Status:
Preliminary

Drawn By:	TK
Designed By:	TK
Checked By:	CT
Date:	April 2023
Project Reference:	14216A
Scale:	1:500

Drawing Number: 14216A-30-C54

Revision: 01



GENERAL NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEER'S, ARCHITECT'S OR OTHER RELEVANT DRAWINGS AND SPECIFICATIONS.
2. ALL DIMENSIONS AND LEVELS ARE SUBJECT TO DETAILED DESIGN.
3. ALL WORK IS TO BE CARRIED OUT IN COMPLIANCE WITH THE REQUIREMENTS OF THE RELEVANT STATUTORY AUTHORITIES AND REGULATIONS.

KEY

SITE BOUNDARY

PROPOSED OVERLAND EXCEEDANCE FLOW ROUTE

Revision	Date	Description	By	Chk
01	11.05.23	FIRST ISSUE	TK	CT

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SE1 8NW
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Project:
Upper Brook Street

Drawing Title:
Proposed Overland Exceedance Route

Client:
Kadans Science Partner

Status:
Preliminary

Drawn By:	TK
Designed By:	TK
Checked By:	CT
Date:	April 2023
Project Reference:	14216A
Scale:	1:500

Drawing Number: 14216A-30-C55

Revision: 01

Appendix I. Surface Water Run-off Calculations

A9.1 Existing Surface Water Runoff Rate

Surface Water Calculations
Existing Surface Water Runoff Rate

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United Kingdom

T: +44 (0)20 7429 3333
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www.hdrinc.com

Project: Upper Brook Street, Manchester
Project Number: 14216

Calculated: T Kearsey Date: 11.05.23
Checked: C Thwaites Date: 11.05.23

Notes	Calculations		
	Calculations based on: Design and Analysis of urban storm drainage. The Wallingford Procedure, Volume 1 Principles methods and practice.		
	User Input Data		
	Existing Impermeable Area	0.299	ha
	SAAR (From FEH)	877	
	Rainfall Intensity (From FEH)	45.2	
	PIMP (% impervious)	100	%
	Soil Type	0.40	
	Very Low Runoff (well drained sandy, loamy or earthy peat soils)	0.15	
	Low Runoff (Very permeable soils (e.g. gravel, sand)	0.30	
	Moderate (Very fine sands, silts and sedimentary clays)	0.40	
	High Runoff (Clayey or loamy soils)	0.45	
	Very High Runoff (Soils of the wet uplands)	0.50	
Fig. 9.7	UCWI (From Figure 9.7 of Wallingford Method)	97	
Eqn. 13	Qp (peak discharge) = 2.78 Cv CR i A		
	Where: Qp (Peak Discharge) i = rainfall intensity A = Total Area		
From FEH	Average rainfall Intensity (i)		
	M100_60 is: 45.2 mm		
Eqn 7.20	Cv = PR/PIMP		
Eqn 7.3	PR = (0.829 PIMP) + (25.0 SOIL) + (0.078 UCWI) - 20.7		
	PIMP (Percentage of catchment which is impervious)	100	%
Page 52	Note: PIMP can not be less than 40%	10	%
	Thus value of PIMP to be used	100	%
	Soil: 0.40 UCWI: 97		
	PR =	79.79	
	Thus Cv =	0.80	
Sec 7.10	CR (Recommended for simulation and design)	1.3	
	Qp for 1 in 100 year 60 minute duration =	**38.9 l/s** or	130.2 l/s/ha

A9.2 Greenfield Runoff Rate

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.562	Urban	0.000
SAAR (mm)	877	Region Number	Region 10

Results	**l/s**
QBAR Rural	2.5
QBAR Urban	2.5
Q100 years	5.2
Q1 year	2.2
Q30 years	4.2
Q100 years	5.2

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A9.3 MicroDrainage source Control Calculations – Attenuation

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 1855 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	37.006	0.506	0.0	2.0	2.0	160.9	O K
30 min Summer	37.171	0.671	0.0	2.0	2.0	213.7	O K
60 min Summer	37.346	0.846	0.0	2.0	2.0	269.3	O K
120 min Summer	37.495	0.995	0.0	2.1	2.1	316.6	O K
180 min Summer	37.580	1.080	0.0	2.1	2.1	343.7	O K
240 min Summer	37.637	1.137	0.0	2.2	2.2	361.7	O K
360 min Summer	37.706	1.206	0.0	2.3	2.3	383.9	O K
480 min Summer	37.746	1.246	0.0	2.3	2.3	396.7	O K
600 min Summer	37.770	1.270	0.0	2.3	2.3	404.2	O K
720 min Summer	37.783	1.283	0.0	2.3	2.3	408.5	O K
960 min Summer	37.791	1.291	0.0	2.3	2.3	410.9	O K
1440 min Summer	37.764	1.264	0.0	2.3	2.3	402.4	O K
2160 min Summer	37.715	1.215	0.0	2.3	2.3	386.7	O K
2880 min Summer	37.671	1.171	0.0	2.2	2.2	372.7	O K
4320 min Summer	37.597	1.097	0.0	2.2	2.2	349.2	O K
5760 min Summer	37.535	1.035	0.0	2.1	2.1	329.5	O K
7200 min Summer	37.484	0.984	0.0	2.1	2.1	313.0	O K
8640 min Summer	37.436	0.936	0.0	2.0	2.0	297.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	155.039	0.0	152.1	27
30 min Summer	103.122	0.0	164.7	41
60 min Summer	65.481	0.0	270.4	72
120 min Summer	39.095	0.0	315.9	130
180 min Summer	28.721	0.0	329.8	190
240 min Summer	23.005	0.0	332.5	248
360 min Summer	16.745	0.0	333.6	368
480 min Summer	13.338	0.0	333.7	486
600 min Summer	11.171	0.0	333.7	606
720 min Summer	9.661	0.0	333.7	724
960 min Summer	7.682	0.0	334.3	962
1440 min Summer	5.551	0.0	335.2	1344
2160 min Summer	4.014	0.0	602.6	1692
2880 min Summer	3.197	0.0	629.4	2080
4320 min Summer	2.334	0.0	588.8	2904
5760 min Summer	1.877	0.0	757.9	3752
7200 min Summer	1.596	0.0	805.1	4552
8640 min Summer	1.401	0.0	847.9	5440

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Summer	37.390	0.890	0.0	2.0	2.0	283.3	O K
15 min Winter	37.067	0.567	0.0	2.0	2.0	180.5	O K
30 min Winter	37.253	0.753	0.0	2.0	2.0	239.7	O K
60 min Winter	37.450	0.950	0.0	2.0	2.0	302.3	O K
120 min Winter	37.618	1.118	0.0	2.2	2.2	355.9	O K
180 min Winter	37.716	1.216	0.0	2.3	2.3	386.9	O K
240 min Winter	37.782	1.282	0.0	2.3	2.3	407.8	O K
360 min Winter	37.864	1.364	0.0	2.4	2.4	434.1	O K
480 min Winter	37.913	1.413	0.0	2.4	2.4	449.8	O K
600 min Winter	37.945	1.445	0.0	2.5	2.5	459.7	O K
720 min Winter	37.964	1.464	0.0	2.5	2.5	465.9	O K
960 min Winter	37.982	1.482	0.0	2.5	2.5	471.5	O K
1440 min Winter	37.968	1.468	0.0	2.5	2.5	467.3	O K
2160 min Winter	37.906	1.406	0.0	2.4	2.4	447.4	O K
2880 min Winter	37.853	1.353	0.0	2.4	2.4	430.5	O K
4320 min Winter	37.749	1.249	0.0	2.3	2.3	397.3	O K
5760 min Winter	37.653	1.153	0.0	2.2	2.2	367.0	O K
7200 min Winter	37.569	1.069	0.0	2.1	2.1	340.3	O K
8640 min Winter	37.491	0.991	0.0	2.1	2.1	315.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Summer	1.257	0.0	886.9	6248
15 min Winter	155.039	0.0	163.8	27
30 min Winter	103.122	0.0	161.6	41
60 min Winter	65.481	0.0	300.2	70
120 min Winter	39.095	0.0	332.3	128
180 min Winter	28.721	0.0	336.4	186
240 min Winter	23.005	0.0	338.2	244
360 min Winter	16.745	0.0	341.0	362
480 min Winter	13.338	0.0	343.6	478
600 min Winter	11.171	0.0	346.5	594
720 min Winter	9.661	0.0	349.9	708
960 min Winter	7.682	0.0	354.7	936
1440 min Winter	5.551	0.0	355.0	1374
2160 min Winter	4.014	0.0	666.3	1760
2880 min Winter	3.197	0.0	662.3	2200
4320 min Winter	2.334	0.0	620.7	3152
5760 min Winter	1.877	0.0	848.9	4040
7200 min Winter	1.596	0.0	901.6	4968
8640 min Winter	1.401	0.0	949.4	5800

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Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
10080 min Winter	37.417	0.917	0.0	2.0	2.0	291.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
10080 min Winter	1.257	0.0	992.2	6664

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 384856 396856 SJ 84856 96856
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+45

Time Area Diagram

Total Area (ha) 0.561

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.188	4	8	0.187	8	12	0.187

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Model Details

Storage is Online Cover Level (m) 38.600

Cellular Storage Structure

Invert Level (m) 36.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	335.0	0.0	1.501	0.0	0.0
1.500	335.0	0.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0068-2500-1500-2500
Design Head (m)	1.500
Design Flow (l/s)	2.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	68
Invert Level (m)	36.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	2.5	Kick-Flo®	0.609	1.7
Flush-Flo™	0.300	2.0	Mean Flow over Head Range	-	2.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.7	1.200	2.3	3.000	3.4	7.000	5.1
0.200	2.0	1.400	2.4	3.500	3.7	7.500	5.3
0.300	2.0	1.600	2.6	4.000	3.9	8.000	5.4
0.400	2.0	1.800	2.7	4.500	4.2	8.500	5.6
0.500	1.9	2.000	2.9	5.000	4.4	9.000	5.8
0.600	1.7	2.200	3.0	5.500	4.6	9.500	5.9
0.800	1.9	2.400	3.1	6.000	4.8		
1.000	2.1	2.600	3.2	6.500	4.9		

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Appendix J. Foul Drainage Calculations

Foul Calculations
Existing Rate

Blackfriars Office
240 Blackfriars Road
London
SE1 8NW
United Kingdom

T: +44 (0)20 7429 3333
hdrinc.com/follow-us
www.hdrinc.com

Project: Upper Brook Street, Manchester
Project Number: 14216

Calculated: T Kearsey Date: 11.05.2023
Checked: C Thwaites Date: 11.05.2023

	Dry Weather Flow Rate (per day)	Number	Factor	Profile (hours)	Peak Flow Rate (litres/second)
Residential[1]			2.12	24	
Existing property 160 l/person/day	376.0 l/ unit	31 existing units			0.3
New property = 125 l/person/day	293.8 l/ unit	0 proposed units			0.0
Occupancy = 2.35 persons					
Hotel[2]	500.0 l/ room	0 rooms	3		0.0
Student Accommodation[1]	200.0 l/ bed	0 beds	3		0.0
Offices[3]	750.0 l/ 100m^2	0 m^2	3		0.0
Retail[3]	400.0 l/ 100m^2	0 m^2	3		0.0
Cinema[3]	10.0 l/ seat	0 seats*	3		0.0
Health Club/Sports Centre[2]	50.0 l/ customer	0 customers**	3		0.0
Day School[2]	90.0 l/ pupil	0 pupils	3		0.0
Boarding School[2]	175.0 l/ pupil	0 pupils	3		0.0
Hospital[3]	750.0 l/ bed	0 beds	3		0.0
Nursing Home[2]	350.0 l/ bed	0 beds	3		0.0
Restaurant/Café[2]	30.0 l/ cover	0 covers****	3		0.0
Pub/Club[4]	15.0 l/ customer	0 customers***	3		0.0
Warehouse[3]	150.0 l/ 100m^2	0 m^2	3		0.0
Manufacturing[3]	550.0 l/ 100m^2	0 m^2	3		0.0
Commercial[3]	300.0 l/ 100m^2	0 m^2	3		0.0
SUB TOTAL					0.3
Infiltration percentage 10%					0.0
TOTAL					**0.3**

* Foul flow rate calculated based on number of seats, 4m^2 allowed for each seat.
Floor area = 0 m^2 4 m^2 per person

** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
Floor area = 0 m^2 4 m^2 per person

*** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
Floor area = 0 m^2 4 m^2 per person

**** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
Floor area = 0 m^2 4 m^2 per person

Source:
[1] Thames Water Guidelines (2016)
[2] British Water (2013)
[3] Jones (1992)
[4] Butler and Davies (2004)

Foul Calculations
Proposed Rate

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Project: Upper Brook Street, Manchester
Project Number: 14216

Calculated: T Kearsey Date: 23.05.2023
Checked: C Thwaites Date: 23.05.2023

	Dry Weather Flow Rate (per day)	Number	Factor	Profile (hours)	Peak Flow Rate (litres/second)
Residential[1]			2.12	24	
Existing property 160 l/person/day	376.0 l/ unit	0 existing units			0.0
New property = 125 l/person/day	293.8 l/ unit	0 proposed units			0.0
Occupancy = 2.35 persons					
Hotel[2]	500.0 l/ room	0.0 rooms	3		0.0
Student Accommodation[1]	200.0 l/ bed	0.0 beds	3		0.0
Offices[3]	750.0 l/ 100m^2	20039.0 m^2	3		5.2
Retail[3]	400.0 l/ 100m^2	0.0 m^2	3		0.0
Cinema[3]	10.0 l/ seat	0.0 seats*	3		0.0
Health Club/Sports Centre[2]	50.0 l/ customer	0.0 customers**	3		0.0
Day School[2]	90.0 l/ pupil	0.0 pupils	3		0.0
Boarding School[2]	175.0 l/ pupil	0.0 pupils	3		0.0
Hospital[3]	625.0 l/ bed	0.0 beds	3		0.0
Nursing Home[2]	350.0 l/ bed	0.0 beds	3		0.0
Restaurant/Café[2]	30.0 l/ cover	0.0 covers****	3		0.0
Pub/Club[4]	15.0 l/ customer	0.0 customers***	3		0.0
Warehouse[3]	150.0 l/ 100m^2	0.0 m^2	3		0.0
Manufacturing[3]	550.0 l/ 100m^2	0.0 m^2	3		0.0
Commercial[3]	300.0 l/ 100m^2	0.0 m^2	3		0.0000
SUB TOTAL					5.2185
Infiltration percentage 10%					0.5218
TOTAL					**5.7**

* Foul flow rate calculated based on number of seats, 4m^2 allowed for each seat.
Floor area = 0 m^2 4 m^2 per person

** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
Floor area = 0 m^2 4 m^2 per person

*** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
Floor area = 0 m^2 4 m^2 per person

**** Foul flow rate calculated based on number of customers, 4m^2 has been allowed for each customer.
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Source:
[1] Thames Water Guidelines (2016)
[2] British Water (2013)
[3] Jones (1992)
[4] Butler and Davies (2004)