Science & Industry Museum

New Warehouse

New Warehouse Re-roofing, conservation works and SEG water ingress
Design and Access Statement
September 2023

Version history

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1.0

Introduction

1.0 Introduction

1.1 Executive Summary

1.1.1 The statement has been prepared by Buttress Architects Ltd on behalf of the Science & Industry Museum (SIM). It explains our response to the work that is required to repair and improve the functionality of the New Warehouse and prevent further water ingress in the future. It has been prepared in line with the guidance document 'Design and Access Statements: How to Write, Read and Use Them,' published by CABE.

1.2 Background

1.2.1 Buttress Architects have been commissioned by the Science Museum Group (SMG) to deliver the **New Warehouse roof & fabric repairs and the Upper Yard SEG Water ingress.**

1.2.2 Following a detailed feasibility study across the New Warehouse, including the Special Exhibitions Gallery (SEG), Buttress Architects have been commissioned to further develop and prepare designs and specifications for the following:

1. Wholesale re-roofing of the New Warehouse – Including Roof covering, roof structure, insulation & ventilation
2. Safe roof access for maintenance
3. Removal of skylights and rooflights, reinstatement only to the atria
4. Improvement of Rainwater goods, gutters, and drainage
5. Improvement of windows, doors, and joinery repairs & decorations
6. Masonry: brick, stone, cills, lintels, parapets, pointing repairs
7. Waterproofing the Upper Yard SEG area including new external porch and landscaping repairs

1.2.3 The New Warehouse is under the ownership of SMG and serves as the main visitor entrance to the museum complex. The building provides a several galleries across the lower ground, ground and first floor levels and also provides accommodation for commercial meetings / conferences, a learning loft for school groups and staff quarters, which are housed at second floor level. The lower ground floor houses storage and archival materials, as well as providing a special exhibitions gallery (SEG).

1.2.4 The SEG is located at lower ground floor level, towards the west end of the New Warehouse, with the visitor entrance to the exhibition located outside of the above ground floor plate. The Upper Yard hard landscaped surfaces extend over the SEG area, to the west of the warehouse.

1.2.5 The external hard landscaped area which sits over the lower ground floor plate, is built right up to the neighbouring and shared boundaries to the North and West and is accessible from the Upper Yard to the South.

1.3 Purpose

1.3.1 Buttress Architects have prepared this Design & Access statement to support a Planning and Listed Building application for the New Warehouse roof & fabric repairs, as well as the Upper Yard SEG water ingress.

1.4 Authorship

1.4.1 The report has been prepared by Emily Green, Architect, BA (Hons), MArch under the direction of Alex Scrimshaw Associate Technologist BSc (Hons), MCIAT, CIAT-Accredited Conservationist with Buttress Architects Ltd.

1.5 Limitations

1.5.1 Existing survey information has been used to produce the drawings.

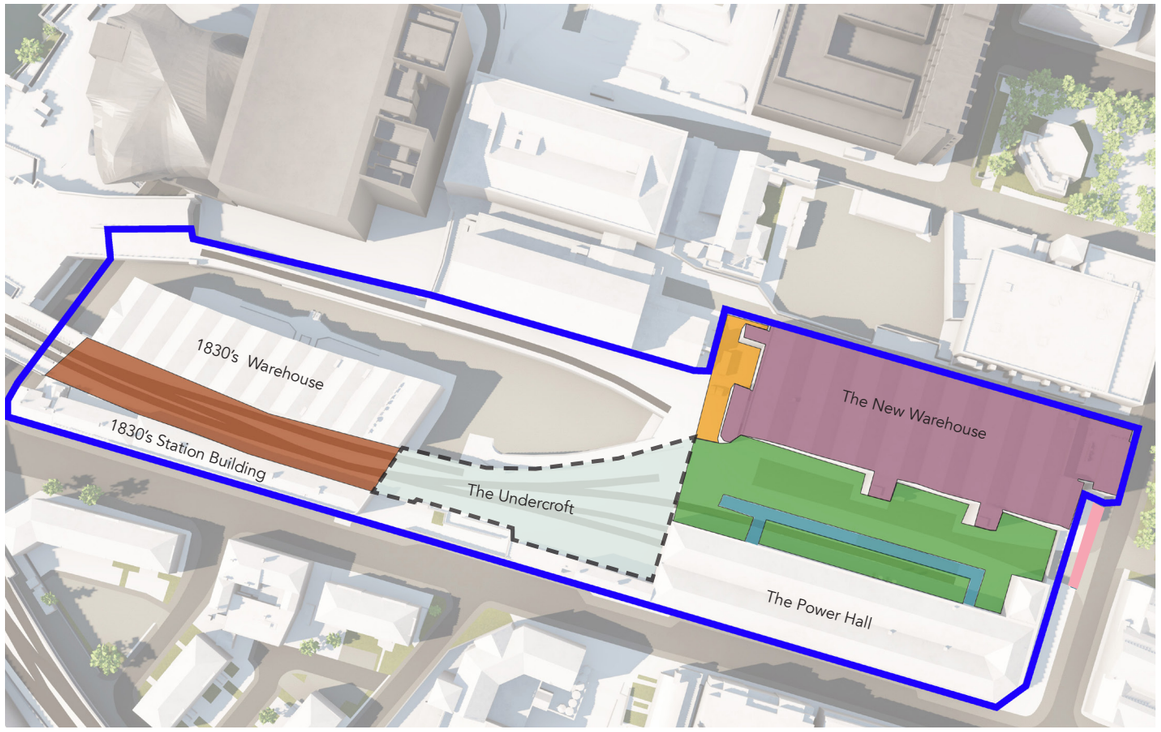
1.5.2 The content of this report is based upon inspections carried out by Buttress Architects undertaken by Alex Scrimshaw Associate Technologist BSc (Hons), MCIAT, CIAT-Accredited Conservationist, Emily Green Architect, BA (Hons), MArch and Peter Levers BSc, completed firstly on the 30th November 2022 and subsequent visits have been undertaken on an ad-hoc basic.

1.5.3 The report is based on inspections made from ground level, floor levels and other accessible safe vantage points.

1.5.4 Unless otherwise stated the inspection(s) were purely visual and no enclosed spaces or inaccessible parts have been opened up for inspection. Therefore, the arrangement and interfacing illustrated across details and GA's are purely indicative / approximate only. The accuracy of the survey data is graphically presented cannot be confirmed.

1.5.5 The report indicates the current condition of the building/ asset at the time of survey. It does not report to be wholly comprehensive but to indicate the principal areas of concern. It is a report on the condition and the findings and recommendations contained herein are subject to re-appraisal once appropriate safe access has been facilitated.

1.5.6 It should be noted that nothing within this report is intended to convey criticism of any person.



1.6 Exclusions

1.6.1 This report excludes any internal works across lower ground, ground and first floor levels unless indicated otherwise. The SEG project specifically excludes any water ingress issues across the lower ground floor

1.7 Other Specialist Reports

1.7.1 Buro Happold have been appointed to carry out a Structural, MEP and Civils reports, developing through RIBA Stages. The RIBA Stage 3 reports can be found appended to this

SIM Capital Projects

- SIM Ownership Boundary
- New Warehouse roof & fabric repairs
- Upper Yard
- Gantry
- Special Exhibitions Gallery (SEG)
- 1830's Viaduct
- Site entrance bollards & barriers

document alongside a timber and damp survey in relation to the re-roofing works.

1.8 Drawings and Other Documents

1.8.1 The drawings contained within this report and used during the surveys are based on information provided by the client and/or sourced from archival resources.

1.8.2 Any diagrams and illustrations provided are for information only and may not be wholly accurate or to scale.

1.8.3 The drawings provided are for Planning and Listed Building consent purposes only.

1.9 Acknowledgements

1.9.1 Buttress gratefully acknowledges the assistance provided by the SIM site staff.

1.10 Application and Project Team

Science and Industry Museum

Applicant and Client

Buttress

Lead Consultant, Architects, Heritage Consultants

Buro Happold

Structural, Mechanical, Electrical and Civil Engineers

Appleyard & Trew

Quantity Surveyors

Deloitte

Planning Consultant

Keelagher Okey Klein

Principal Designer

2.0

Background & Context

2.0 Context

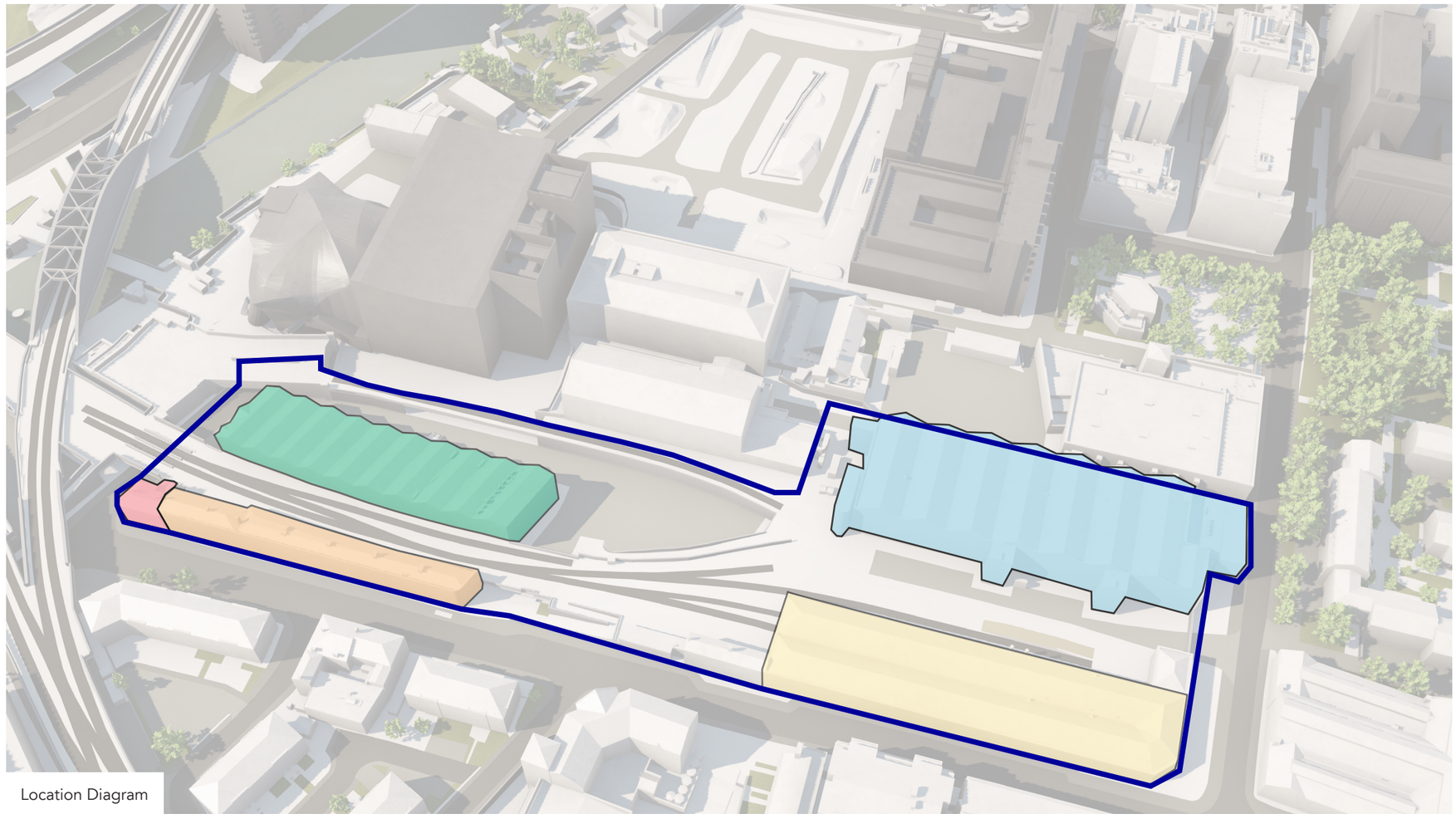
2.1 Location

2.1.1 The Science and Industry Museum is located to the north-west of central Manchester, to the east of the River Irwell and within the Castlefield Conservation Area and Castlefield Urban Heritage Park. The Science and Industry Museum includes a number of Grade I and II listed buildings and structures. This report focuses on the New Warehouse external envelope, roof, second floor and SEG water ingress.

2.1.2 The New Warehouse is Grade II Listed and is situated to the north east of the site. The SEG is situated to the West end of the New Warehouse and forms part of the lower ground floor plate. It is around 335 m² and adjoins the Upper Yard area externally.

2.1.3 The external hard landscaped area which sits over the lower ground floor plate, is built right up to the neighbouring and shared boundaries to the North and West and is accessible from the Upper Yard to the South.

2.1.4 The site is within close proximity to Deansgate, Spinningfields and the Castlefield Basin. The site is well connected with Deansgate train station and Metrolink approximately 550m away.



Location Diagram

Key

- SIM Ownership Boundary
- 1830's Warehouse
- The Liverpool Road 1830's Station Building
- Station Masters House
- The New Warehouse
- The Power Hall

2.2 Heritage & History

2.2.1 The New Warehouse, also known as Lower Byrom Street Warehouse or Great Western Railway Warehouse, was constructed between 1878 and 1880. A fireproof building, it had cast-iron columns and wrought iron girders, with hydraulic hoists on the top floor. As goods traffic declined through the twentieth century it became the main warehouse. The warehouse was sold to the museum in 1981 and converted for museum purposes in several phases between 1984 and 2000. In 2010 major redevelopment which saw the introduction of the two southern stair and lift cores including extensive internal rearrangement. It currently provides a collections and archive centre in the basement, space for permanent and visiting exhibitions, science shows, shop, café on the ground floor, with space for permanent exhibitions, meeting rooms and offices on the second floor.

2.2.2 The three-storey warehouse (with basement) is a large seven-bay rectangular building on a east-west axis with entrances for railway lines through the west end from the 1876 viaduct. The original Lower Byrom Street façade was L-shaped; this has been filled in and extended to the street edge with a modern glass structure, which opened in 2000, housing a café/shop on the ground floor and offices above. The building is of red brick with detail in blue brick and sandstone, with a pitched slate and glass roof over each bay. The southern elevation overlooks the Upper Yard and each bay has two pairs of segmentally headed windows of diminishing height. The blue brick is used for the plinth, the keystones, the bands between the floors and vertical strips extending to the windows and doors.

2.2.3 The history of the site and the Lower Byrom Street Warehouse itself are well documented both at the Museum and within the Conservation Management Plan. Below is a summary of that history.

2.2.4 Castlefield is known for its Roman history. A succession of four forts were built between AD90 and AD400. A small Roman settlement also grew up in association with the fort. A number of archaeological finds have been made close to the Museum, leading to the possibility that there is some archaeological potential for Roman finds within the Museum complex.

2.2.5 From the departure of the Roman army into the medieval period, a settlement based to the north of the Roman fort developed, eventually evolving into Manchester.

2.2.6 It was during the 18th Century when the origins of the Liverpool Road Station began to emerge. Edward Byrom, a major local landowner, began to develop an estate within Castlefield. Development was relatively slow to come forward, as at this time the estate was relatively remote from the growing Town, so by Edward Byrom's death in 1773, much of the estate was undeveloped. The husband of one of Byrom's daughters took forward the estate, although it was still largely undeveloped by 1820.

2.2.7 The development of the Bridgewater Canal, its Castlefield terminus completed in 1767 and passing through to Runcorn by 1776, had a huge economic impact on Castlefield and Manchester, halving the price of coal in Manchester and facilitating the transport of cotton directly into the Town by water. Castlefield therefore developed as a major transportation hub from this time, driving the need for storage warehouses close by, which was further exacerbated by the link between the Rochdale Canal and the Bridgewater Canal in 1805, which meant that there was now a continuous water based transportation link between Liverpool and Hull. There was increased variety of goods passing through Castlefield and a wider need for storage and distribution links.

2.2.8 By 1820, the canals had reached capacity, causing dissatisfaction amongst merchants and there had been earlier proposals for rail links between Liverpool and Manchester.

2.2.9 Eventually, George Stephenson was commissioned to plan the link, although he made a poor attempt and the proposed Act put before Parliament in 1825 was withdrawn only months later.

2.2.10 John and George Rennie were then appointed and after making several changes and smoothing opposition which had occurred during the first attempt and receiving Royal Assent in 1826. George Stephenson was re-appointed to the project and land was acquired to support the development.

2.2.11 However, there was still a need to provide a sufficient terminus within Manchester. The logical location was at the hub of transportation activity within Castlefield and only one site large enough existed, within the Byrom Estate. This was acquired by the Liverpool and Manchester Railway Company in 1829.

2.2.12 Early construction at the site focussed on creating the bridge links needed to cross the Irwell and Water Street and to access the station itself. However, once these were well underway through 1829, attention turned to the Station buildings. Plans for new buildings at the site began early in 1830, with what is now known as the '1830 Warehouse' and the passenger station completed in time for the opening on 15th September 1830.

2.2.13 Further buildings were erected on the site over the following years as the Railway Company sought to improve passenger services and increase goods capacity. Therefore, an Arrivals Station, Cotton Warehouses, Carriage Sheds and a Shipping Shed.

2.2.14 The success of Liverpool Road Station led to increased competition, with other railway companies receiving Parliamentary approval for other lines. In 1844, the Liverpool and Manchester Railway Company was able to extend its services further in to the centre of Manchester, to what is now Victoria Station, and at that point, passenger services from Liverpool Road Station ceased and it operated solely as a goods station.

2.2.15 Following the change in function of the Liverpool Road Station came changes in ownership, resulting in the formation of the London and North Western Railway by 1846, with 350 miles of track covering Liverpool, Manchester, Birmingham and London. Further construction followed including the replacement of the earlier Shipping Shed with a larger building.

2.2.16 1866 saw one of the most dramatic events in Liverpool Road Station's history, with a fire which destroyed both of the Cotton Stores and could have destroyed Warehouse 1 (the 1830 Warehouse) had it not been for the earlier installation of a cast iron water tank within the building, allowing the prompt actions of fire fighters to save the building from significant damage.

2.2.17 Further development followed this disaster, with the Colonnade constructed in 1867 and the Grape Street Bonded Warehouse built in 1869. Additional land purchases followed, allowing the New Warehouse (Great Western Warehouse/ Lower Byrom Street Warehouse) to be constructed by 1880, as a dedicated facility for the Great Western Railway.

2.2.18 The following 40 years were the peak for Liverpool Road Station, which, while its business was affected to some extent by the completion of the Manchester Ship Canal, controlled all goods traffic on the London and North Western Railway to the North and West.

2.2.19 Little built development took place after this point, although there was considerable change in the nature of the railways, with the 1921 Railways Act forcing the amalgamation of some 250 railway companies into four large organisations. The London and North Western Railway became part of the London, Midland and Scottish Railway.

2.2.20 Following this change, there appears to have been little investment in Liverpool Road Station, with decline setting in after the Second World War and the 1947 Transport Act, which formed British Railways from the four companies created in the 1921 Act. At this time, competition for freight haulage was intensifying, with the advent of container ships, requiring no storage warehousing and improvements to the road transport network, transforming the nature of goods transportation and making rail freight less important.

2.2.21 While the Beeching Report did not result in the closure of Liverpool Road Station, partly due to its focus on passenger stations rather than goods, the increased competition ultimately resulted in the closure of Liverpool Road Station in 1975.

2.2.22 At this time, Listed status applied only to the two original 1830 buildings and the viaduct. Castlefield was not yet a Conservation Area and many of the buildings were in poor condition, given the lack of investment in the site since the 1920s.

2.2.23 However, the importance of the buildings was recognised and negotiations were successfully undertaken for the fledgling North West Museum of Science and Industry to take over the site from 1978, the formal transfer not taking place until 1982, following a number of years of action, planning and negotiation involving British Rail, the local authorities, assistance from local Universities and the involvement of amenity bodies such as the Victorian Society and the newly formed Liverpool Road Station Society. A testament to their success was the holding of 150th anniversary celebrations in 1980, at the Station.

2.2.24 Restoration works started late in 1979, but it wasn't until 1983 that the Museum opened to the public, then limited to the Power Hall and Passenger Station.

2.2.25 The New Warehouse was acquired separately by the Museum in 1981 and works to this building commenced around 1984, with the basement and ground floors first to be brought into use and first and second floors following later in 1988.

2.2.26 Further historic information regarding the site can be found in the CMP by Kathryn Sather & Associates.

2.3 Historic Images



New Warehouse South Elevation before restoration



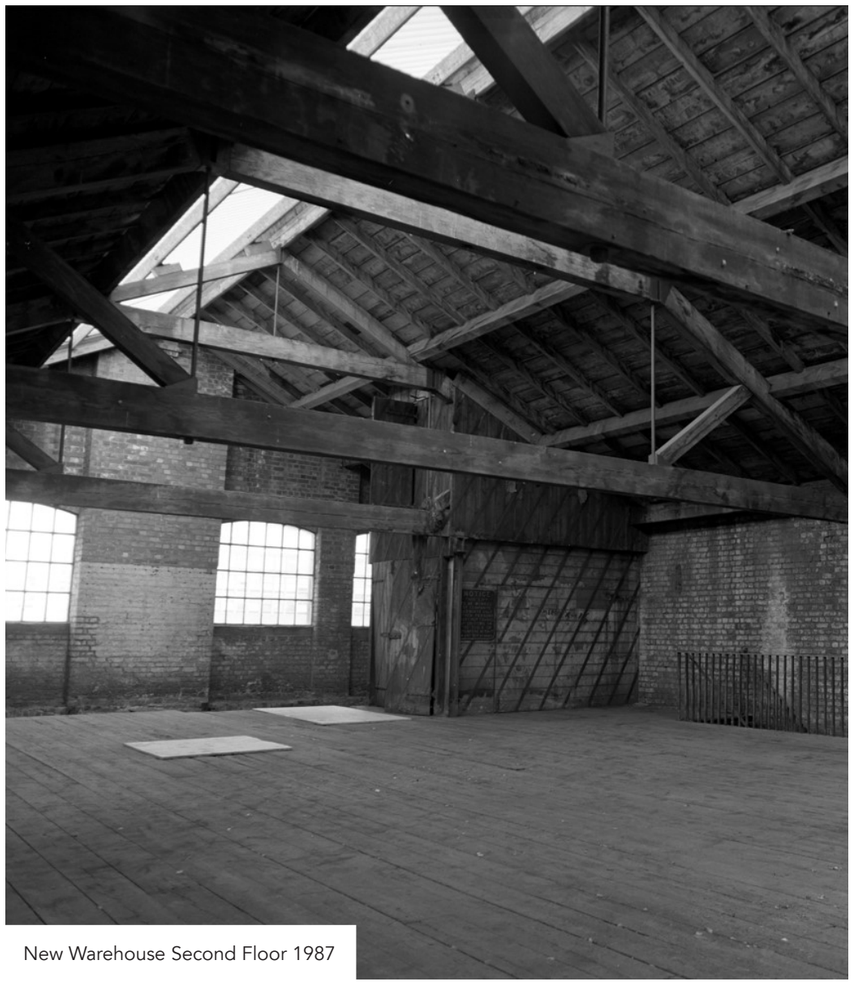
New Warehouse 1983



New Warehouse Second Floor 1987



New Warehouse First Floor 1987



New Warehouse Second Floor 1987



New Warehouse Second Floor 1987



New Warehouse- view from Lower Byrom Street 1985

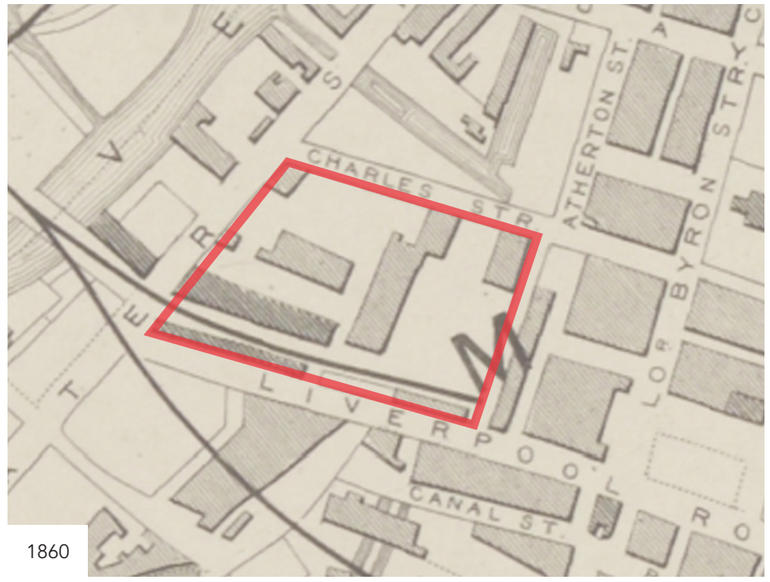
2.4 Historical Maps

2.4.1 In 1824, much of the site between Liverpool Street and Charles Street lay empty up until the development of Liverpool Road Station in 1830. The 1808 Station Master's House is the only building that can be seen to the left of the highlighted image.

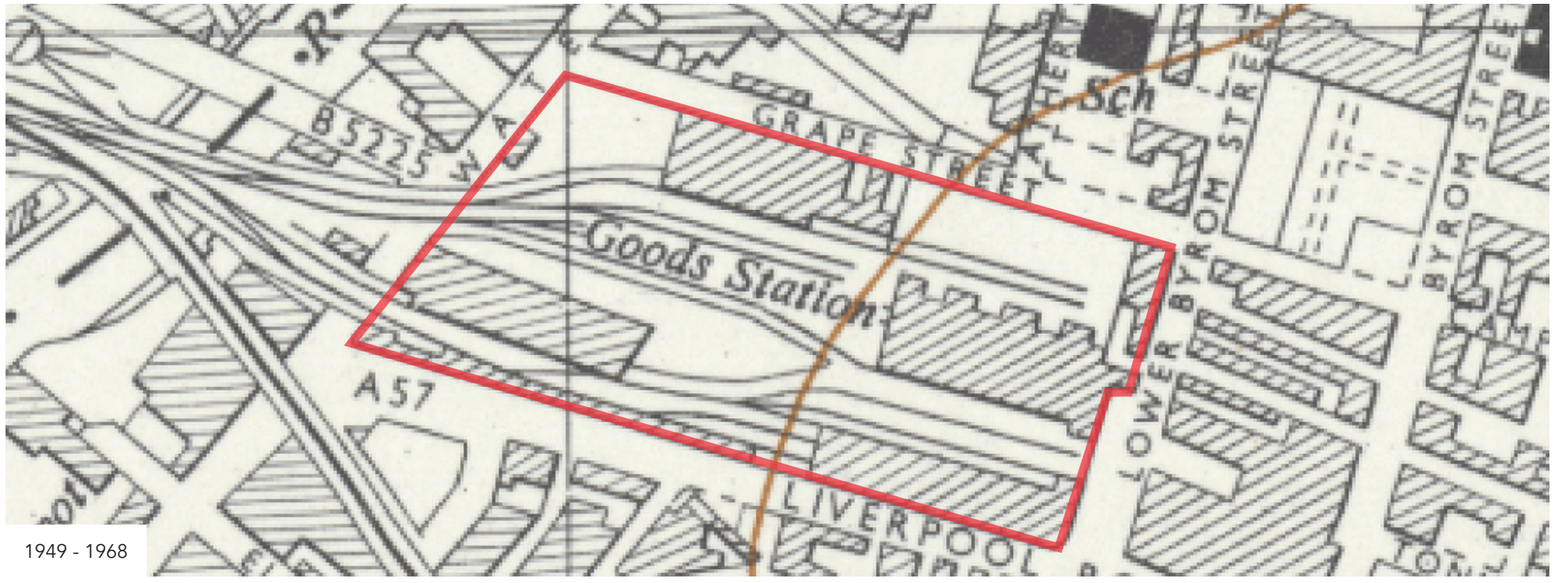
2.4.2 In 1860, the site of the Science & Industry Museum was now occupied by Liverpool Road Station and the 1830 goods warehouse. In the right image, the New Warehouse has a different position to its current day, and the Shipping Shed was a new addition.



1824



1860



1949 - 1968

2.5 Planning Context

2.5.1 019724 | GMC DEVELOPMENT Change of use to museum of science and industry of Lower Byrom Street warehouse and the provision of a car park and picnic area at upper level | The Greater Manchester Museum of Science and Industry Liverpool Road Station, Liverpool Road, City CENTRAL.

2.5.2 029573 | Elevational alterations to the Museum Building | Lower Byrom Street warehouse, Lower Byrom Street, City CENTRAL

2.5.3 031891 | Conversion of part of warehouse into a museum with a shop, reception area, store and toilet facilities, with elevational alterations | Lower Byrom Street Warehouse, Lower Byrom Street, City CENTRAL

2.5.4 032265 | Individual letter name sign on front elevation of museum illuminated by floodlights | Lower Byrom Street Warehouse Lower Byrom Street, City CENTRAL

2.5.5 089530/FO/2009/C1 | Reconfiguration of existing Lower Byrom Street Warehouse to include removal of existing modern ramps, staircases and partitions, provision of new partition walls to form altered layout, internally, and addition of new external vertical circulation cores and new roof lights | Museum Of Science And Industry Liverpool Road Castlefield Manchester M3 4FP.

2.5.6 107646/LO/2014/C1 | LISTED BUILDING CONSENT for structural investigation works, involving trial pits/opening up works and material samples. | Railway Viaduct Over River Irwell Leading To Lower Byrom Street Warehouse Manchester M3 4AN

2.5.7 115687/LO/2017 | LISTED BUILDING CONSENT Replacing modern plastic downpipes with cast iron of same dimensions | Museum Of Science And Industry Lower Byrom Street Manchester M3 4FP

2.5.8 19810/LO/2018 | LISTED BUILDING CONSENT for rooflight replacement and roof safety improvement works including Installation access hatch / ladder from existing plant room, freestanding PVC walkways to gutters and up and over freestanding stepped walkways with handrails to both sides over pitched roof slopes. | Manchester Museum Of Science & Industry Great Western Warehouse Lower Byrom Street Manchester M3 4FP

2.5.9 122773/LO/2019 | LISTED BUILDING CONSENT for alterations to the Science and Industry Museum New Warehouse building and Colonnaded Viaduct including internal and external alterations to create a new Special Exhibitions Gallery and associated access, hard landscaping, lighting and other associated works.

2.5.10 122772/FO/2019 | External alterations to the New Warehouse at basement level and two existing ground floor louvres, landscaping, feature lighting and associated works to facilitate adaptation to the special exhibition gallery.

2.6 Listing Description

2.6.1 **Heritage Category:** Listed Building

2.6.2 **Grade:** II

2.6.3 **List Entry Number:** 1283016

2.6.4 **Date first listed:** 06-Jun-1994

2.6.5 **Statutory Address** 1: MANCHESTER MUSEUM OF SCIENCE AND INDUSTRY, FORMER LOWER BYROM STREET WAREHOUSE, LOWER BYROM STREET

2.6.6 **Location**

2.6.7 **Statutory Address:**

2.6.8 MANCHESTER MUSEUM OF SCIENCE AND INDUSTRY, FORMER LOWER BYROM STREET WAREHOUSE, LOWER BYROM STREET

2.6.9 The building or site itself may lie within the boundary of more than one authority.

2.6.10 **District:** Manchester (Metropolitan Authority)

2.6.11 **Parish:** Non Civil Parish

2.6.12 **National Grid Reference:** SJ 83172 97868

2.6.13 **Details**

2.6.14 MANCHESTER

2.6.15 SJ8397NW LOWER BYROM STREET 698-1/30/230 (West side) Manchester Museum of Science and Industry, former Lower Byrom Street warehouse

2.6.16 GV II

2.6.17 Formerly known as: Lower Byrom Street Warehouse of Liverpool Road Station LOWER BYROM STREET. Railway goods warehouse, now part of museum complex. 1880, altered. Red brick with dressings of red brick and some sandstone, slate and glass roof. Large rectangular plan on east-west axis with entrances for railway lines through west end. Three storeys and basement, with south facade of 7 gabled bays, each bay having 2 pairs of windows; blue brick plinth and bands between floors with vertical strips extended to the windows; segmental-headed windows diminishing in the height, with stone imposts and blue brick keystones and arch-bands, iron-framed small-pane glazing; large segmental-headed wagon archways to the 2nd, 3rd and 5th bays, 2-stage loading slot to the upper floors of the 3rd bay. Eight-window west end, with 2 large square train entrances at ground floor; staggered east end with 4-window main facade, altered entrance at ground floor.

2.6.18 Listing NGR: SJ8317297868

2.6.19 Legacy

2.7 Heritage Assessment

2.7.1 Conclusion and Justification Statement

2.7.2 The below is an extract from the Heritage Assessment by Buttress Architects Heritage Consultancy Team, the full document is included within the application:

2.7.2.1 The proposals will result in a significant enhancement to the status and condition of the New Warehouse building, serving to provide a wind and watertight external envelope which would protect the warehouse structure, its interior and exhibits and collections nestled within, as well as incorporating essential upgrades and fabric repairs, securing its future for years to come.

2.7.2.2 The scheme will respond appropriately and sensitively to the character and fabric of the Grade II listed asset with minimal visual impact to the museum estate, whilst also providing numerous benefits to the building. Where negligible harm may occur, this will be outweighed by the following benefits, in accordance with Para 202 of Chapter 16 of the NPPF:

2.7.3 Project Benefits

- *A wind and watertight external envelope, restricting further degradation.*
- *Removal of existing, unsympathetic and inappropriate details and fittings.*
- *Protect and secure heritage asset for years to come.*
- *Building fabric repaired including structural enhancements.*
- *Significant thermal performance enhancements, to make a more sustainable asset.*
- *Appropriate ventilation requirements provided where necessary.*
- *Upgrades to provide safe ready access to the roof to ensure frequent maintenance tasks can be undertaken.*
- *Aesthetic enhancement across the external*
- *appearance of the New Warehouse building.*
- *Increased performance of surface water management system.*
- *Widening roof gutters to increase capacity and flow rates, which in turn will improve access for routine maintenance.*
- *Visual warning system, identifying potential blockages provided over outlet locations.*
- *Introduction of access / rodding points across rainwater goods to improve maintenance tasks.*
- *Replacement of inferior / poor quality weathering's, flashings, and coverings with more suitable and robust products.*
- *Leadwork installed to appropriate standards.*
- *Improved detailing and interfacing.*
- *Access to carry out timber and/or other repairs across areas not previously accessible or visible.*

2.8 Building Form

2.8.1 Description of Structure

2.8.2 The New Warehouse takes the form of a large rectangular plan on an east-west axis with former shutter door entrances connected to the tracks to the west end. The building is three stories with a lower basement with 7 gabled bays to the facades with an extra shortened bay to the east end. The elevations are red brick with dressings of red brick and some sandstone with a blue brick plinth and blue bands between floor with vertical strips extended to the windows. Each bay typically has 2 pairs of segmental headed windows per floor level which diminish in height with stone imposts and blue brick keystones and arch-bands. Metal framed windows with opening lights, single glazed. Modern single storey main entrance projection to the east elevation with a series of modern glazed additions to the south and west elevations providing vertical access across floor levels with a larger modern glazed structure to the east, extending to the street edge which houses a cafe at ground floor level.

2.8.3 The total roof area (3,600m² (inclusive of modern additions)) consists of 7 up and overs typically of the same size with a smaller up and over, above the main entrance to the east end. The slate pitched roofs are connected by valley gutters running north to south with parapet gutters at the east and west elevations. A masonry parapet wall extends around the full perimeter of the roof, raked to roof pitches with a concrete coping generally with a small area of stone copings towards the northeast corner.

2.8.4 A shallow strip of the roof is glazed towards the south, with Georgian wire glass and lead flashings. Timber duck boards provide access between glazed pitches. The roof is also penetrated by a series of modern velux rooflights generally located to the centre over the staff quarters.

2.8.5 Access onto the roof is gained via a number of access portals within valley gutters, with up and over ladders.

2.8.6 The roofs across the various modern additions are flat with an assumed single ply type membrane covering.



2.9 New Warehouse Key External Views

1. Site entrance - Lower Byrom Street
2. New Warehouse - Part South Elevation
3. New Warehouse - Part South Elevation
4. View westerly of the New Warehouse, south elevation and Upper Yard
5. View easterly of the New Warehouse, south elevation and Upper Yard
6. New Warehouse, upper yard and Stair core A
7. Recessed downpipe and hopper.
8. New Warehouse - North Elevation
9. New Warehouse - Part South Elevation and entrance gates
10. New Warehouse - North Elevation and private access road



1



2



3



4



5



6



7



8



9



10

2.10 New Warehouse Key Internal Views

11. New Warehouse roof - internal view at second floor - staff offices
12. New Warehouse roof- internal view at second floor - staff offices
13. New Warehouse roof - internal view at second floor - staff offices
14. New Warehouse roof - internal view at second floor - staff offices
15. New Warehouse roof - internal view at second floor - plant room
16. New Warehouse roof - internal view at second floor -learning hub
17. New Warehouse roof - internal view at second floor -learning hub
18. New Warehouse roof - internal view at second floor - meeting room
19. New Warehouse roof - internal view at second floor - plant room



11



12



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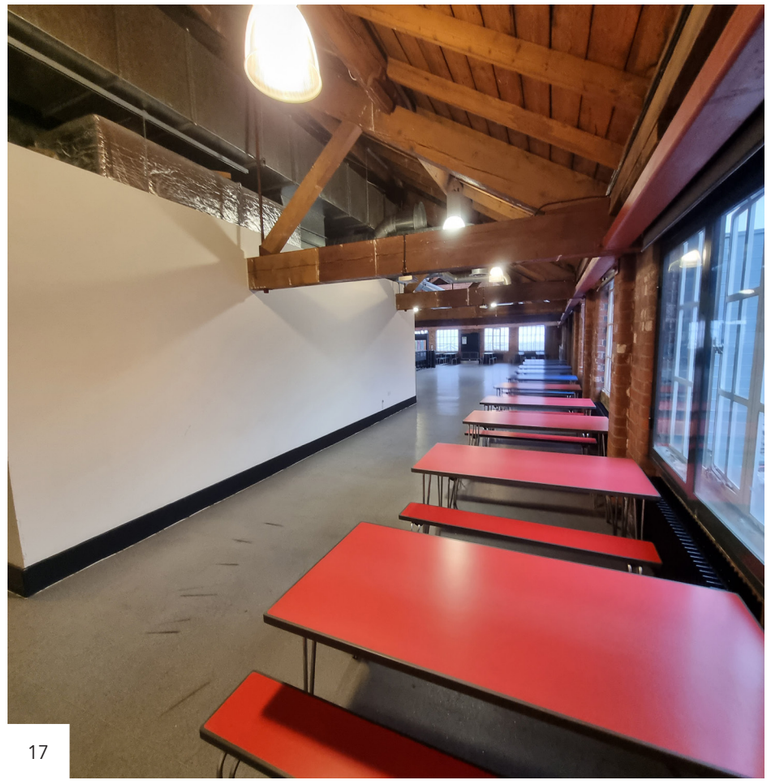
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2.11 New Warehouse Roof Views

20. Access ladder
21. Parapet and gutter
22. Typical Valley gutter
23. Typical Access hatch



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21



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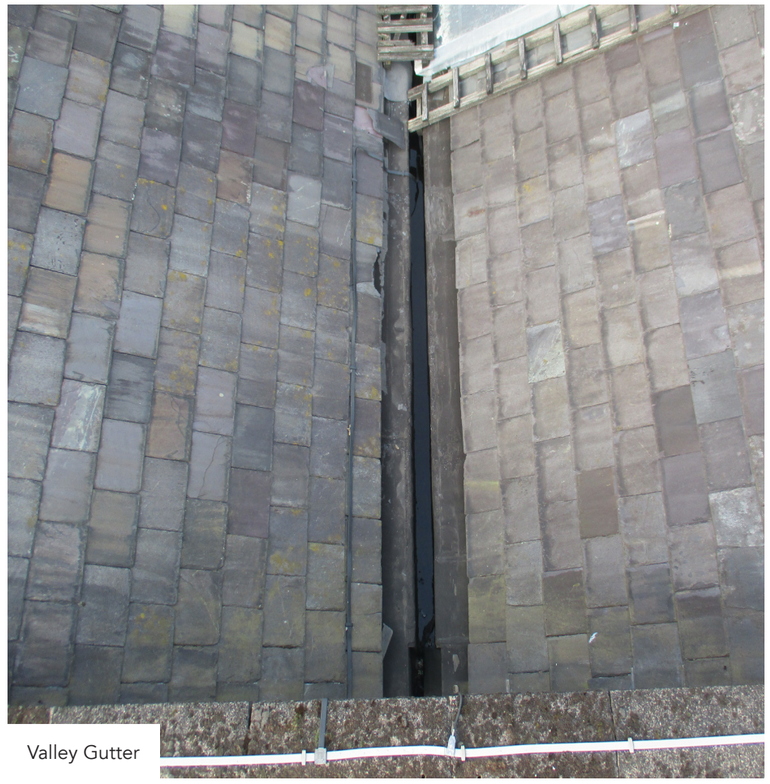
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Internal View of the Sky lights



Concrete Coping



Valley Gutter



View of Sky lights from above



Crash deck above atrium



Stair core roof

2.12 SEG Key External Views

1. View looking south adjacent the west elevation of the New Warehouse
2. View looking north at the main entrance to Staircore C
3. View looking west across the concrete raft and plant
4. View looking east at the main entrance to Staircore C



1



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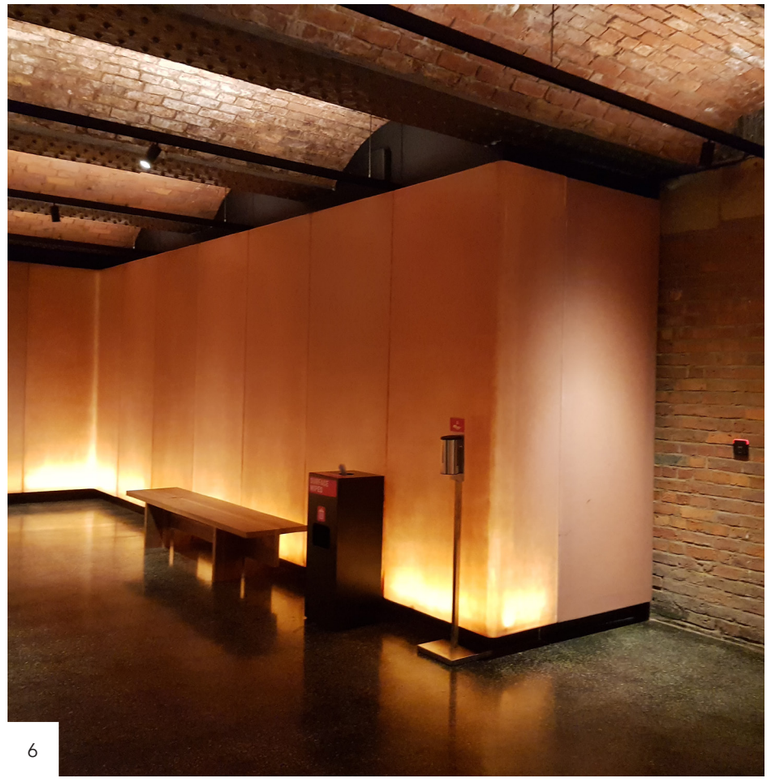
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2.13 SEG Key Internal Views

5. View looking west towards the main entrance of Stair core C
6. View looking towards the lined out services corridor, access door
7. View looking at the saturated masonry wall within the services corridor
8. View looking at the high level guttering below the main entrance doors



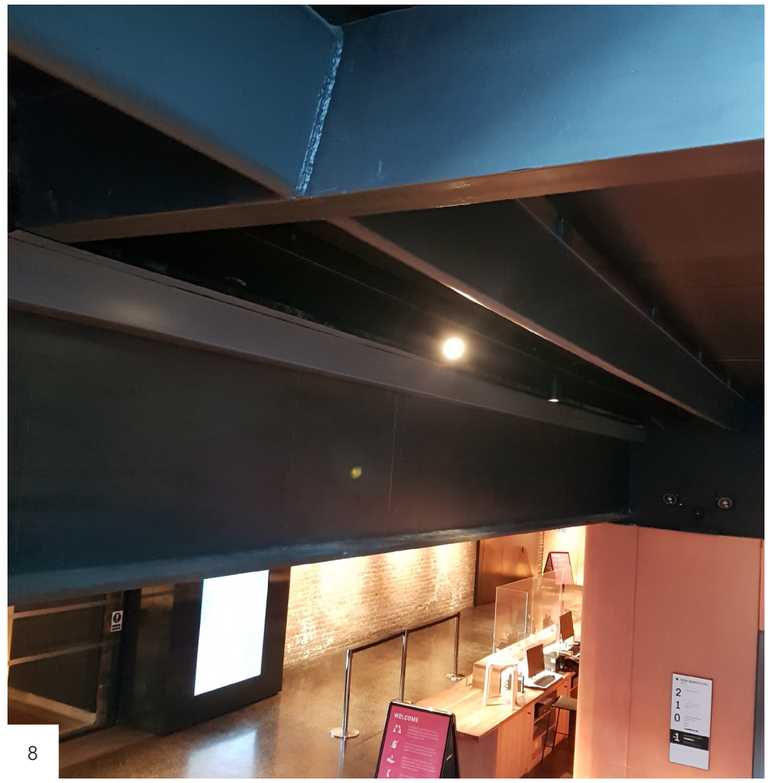
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6



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3.0

Summary of findings

3.0 Summary of findings

3.1 New Warehouse

3.1.1 For the purposes of this document, the following have been inspected and reported upon only:

- Exterior elevations
- Roofscape
- Interior second floor plate in association with re-roofing works only
- West external yard atop of SEG
- Lower ground floor area within SEG, below west yard only

3.2 Current Issues

3.2.1 Current issues can be attributed to the following:

- Poor original detailing
- Poor retrospective / temporary repairs
- Vegetation / silt and detritus
- Leaking rainwater, drainage goods
- Access limitations, failing access provisions, areas inaccessible
- Failing, aging materials, finishes and flashings, beyond service life
- General fabric repairs

3.3 Exterior Elevations

3.3.1 The exterior elevations can be described as being in a fair condition. The principal structure of the building is red brick with blue brick detailing across vertical and horizontal banding, keystones and plinth, supplemented by sandstone imposts and window cills.

3.3.2 The blue bricks face measures approximately 210x70mm and the red bricks between 210-225x65-70mm.

3.3.3 The facing masonry and stonework has typically been pointed with cementitious mortars of varying compositions, with respect to binders, colours and texture. Defective and poor-quality pointing is generally localised to weathering's, rainwater downpipes, copings, parapet and plinth.

3.3.4 There is a high quantity of bricks which have spalled resulting in loss of facing material and washed-out joints, these are typically located below the coping stones at roof level, likely due to poor drip detailing and sporadically below weathering's and plinth level. There is a visible darkening of the masonry surface below weathering's and within a handful of downpipe locations, likely as a result of persistent and sustained wetting due to both poor drip detailing and defective elements.

3.3.5 A number of sandstone cills are heavily spalled, delaminated, with drip and edge profiles missing, similarly this is also evident across the stone imposts. Window cills are soiled, 'greening' with moss and algae growths across the surface. This continued moisture source has led to the outbreak of soft woody vegetation in localised areas, with some well-established woody growths observed to the north elevation.

3.3.6 The downpipes to the façades are at regular intervals, set within a brick recessed detail. The pipes are generally aligned and centred with the valley gutters at roof level beyond, dispersing to both the north and the south. The recesses are poorly formed within localised areas with loss of arises, likely due to retrospective replacement of original downpipes in the recent past.

3.3.7 The majority of downpipes are modern black uPVC with a handful of what appear to be cast aluminium, typically to the south elevation. Most of the downpipes do not have rodding access at the base with all pipes connected directly into the below ground drainage system. However, likely due to blockages, access points have been poorly formed and/or broken into, to provide an access point at the base. In a handful of instances, during heavy rainfall, water can be seen dispersing down the outer face of the pipework, indicating potential blockages at the head / hopper, outlet or defective pipes and connections.

3.3.8 Each of the recessed downpipes are capped with a recessed, slightly projecting rectangular hopper with simple mouldings and detailing. The hoppers appear to be constructed of potential asbestos containing materials. The units are also noted to be potentially unsecured, with no physical fixings to the masonry visible with a handful of locations. Lead chutes are dressed down into the hoppers, from valley gutters.

3.3.9 The windows extend across all four elevations, are in pairs, with two sizes across ground to second floor levels. The first and second floor windows are six-by-four metal framed windows and the ground floor windows are six-by-six metal framed windows, with a mix of modern glazing across the ground floor. The windows are inset within masonry segmental arches with bullnose bricks to the head and jambs. The metal framed windows have opening lights, both in single and paired arrangements, with fixed lights also.

3.3.10 Predominantly, the windows are metal framed with single paned glazing, putty fixed externally. Decorations are in poor condition, with surface blistering, corrosion visible with defective putty, seals and open mortar joints at the interfaces.

3.3.11 There are noticeable gaps in a number of instances, between the head of metal framed windows and the masonry arch, where seals are missing as well as open mortar joints, defective mortar in general. This may be following window replacements in the past where works have been left incomplete.

3.3.12 A handful of 'original' windows have been replaced, with aluminium of varying colours to provide louvres to aid ventilation.

3.3.13 The basement lightwell windows that remain are six-by-two metal framed. Where they have been replaced, they are now either timber or metal louvres with original ferrous security grillage fixed directly into the masonry to the front. The decorations across timber louvres are poor, with blistered and flaking surfaces with localised decay/rot.

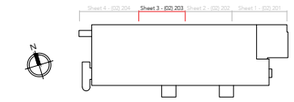
3.3.14 The larger, former shutter door openings have been filled with large timber framed windows, again with poor decorations.

3.3.15 There is a high quantity of ferrous objects scattered across the facing masonry and stonework, many of which are now redundant fixings, brackets etc.

3.3.16 The modern interventions and extensions to the perimeter of the main masonry envelope to the east and west were introduced between 1999-2000. The elevations appear to be in good condition, though surface decorations are in a poor condition, particularly across the eastern glazed extension with exposed steel framing, which hosts the café at ground floor level. The remaining extensions provide vertical circulation, 3 of which can be used by visitors, with access to passenger lifts. The fourth is used as an emergency fire escape stair only.

3.3.17 The steel frame and glazed lift cores to the south elevation were introduced and constructed in 2010.





Key Plan
NTS



North Elevation as Existing Current Condition - Sheet 3

KEY

	Open Mortar Joints	B1	Lead Chute	B8	Evidence of Injected DPC	B15	Corroded Ferrous Brackets	B22	Vertical Boarding
	Defective Masonry / Stonework	B2	Hopper	B9	Missing Brick	B16	Decayed & Rotten Bumper Cill	B23	Defective Decorations
	Open Mortar Joints Across Copings	B3	UPVC Downpipe	B10	Defective Bricks	B17	Opening	B24	Graffiti
	Cementitious Render	B4	Rodding Point	B11	Loss of Detail Across Cill	B18	Defective Decorations to Ferrous Plate / Angle	B25	Aluminium Louvres
	Defective Steel Decorations	B5	Spalled & Delamination Across Cill	B12	Fracture Through Cill	B19	Defective Decorations Across Doorsets	B26	Heavily Soiled & Saturated Fabric
D	Delamination	B6	Split / Defective Timber Louvre	B13	Hole	B20	Vegetation	B27	Moss on Cills
X	Ferrous / Steel Embedded Fixing Elements	B7	Iron Railings with Timber Louvres Beyond With Softwood Frame & Mesh to Front	B14	Cast Aluminium Downpipe	B21	Spalling to Soffit of Lintel	B28	Stepped Vertical Crack



Example of condition drawings - refer to separate marked up elevation for further information

3.4 Roofscape

3.4.1 The roofscape across the main New Warehouse roof can be described as being in a very poor condition. A patchwork quilt so to speak, which has been reactively repaired with temporary measures or quick fixes to stem a problem or issue at the time.

3.4.2 Access onto the roof is limited to a couple of maintained roof access portals, the others have been closed up and are now redundant. Access to openable portals is somewhat tricky and precarious internally, with no permanent, secure ladder access and the need to climb up, onto and over fixed MEP plant. The access hatches protrude from the pitched roofs like dormers with a flat roof and cheeks. A small access door / panel provides access into the valley gutters. The portal is constructed from timber with sheathing to the roof and cheek. The portals are currently encapsulated with a bitumen membrane.

3.4.3 Access across the roofs is provided by a series of up and over ladders and duck boards, the majority of which are timber and now well beyond their serviceable life.

3.4.4 At least two access portals appear to have been removed, with remnants of flashings, scarring still evident.

3.4.5 There is a large quantity of slipped, dislodged and unsecured slates and ridge tiles extending across all roof slopes. Most of the slates that remain insitu are visibly cracked, split with delamination evident or are inferior materials. The ridge tiles are unbedded, dislodged in areas with extensive points for rainwater to bypass the slates and gain entry to the membrane and sarking boards.

3.4.6 The flashings / weathering's at the abutment with the gables and interfaces are a mix of lead, bitumen and single ply membranes and in some instances, have been over-painted with a liquid waterproofer. There are many examples where flashings are detached, insecure or simply defective.

3.4.7 The bituminous type flashings are typically brittle and cracked.

3.4.8 It is understood that a handful of the valley gutters have recently undergone temporary waterproofing improvement works, in the form of fiberglass, being applied, over existing surfaces, as a means to provide a watertight solution. This is evident within at least 3 full gutter lengths and then sporadically applied in front of two access portals / gutters sumps, outlets. This is considered to be a temporary repair only.

3.4.9 The valley gutters are otherwise covered with a bituminous type of membrane, which has been extensively repaired.

3.4.10 The gutters appear to be stepped, discharging to both the north and south, though there is evidence of standing water within a number of locations, either caused by defective (slumped) substrates or copious amounts of silt and detritus, this extended towards gutter outlets.

3.4.11 The copings stones are generally concrete, with a small length of stone copings (original?) with alternate profile to the northeast corner. The units are butt jointed with no laps. There does not appear to be a DPM/DPC installed to the underside.

3.4.12 The outer skin of masonry across the parapets is masonry, with a number of spalled bricks with loss of facings and open mortar joints.

3.4.13 There is localised soft vegetation growth, located to the underside of the copings with light soiling, discolourisation and saturation. Moss and algae growth is also rampant, across areas of the perimeter copings. There is some well-established woody vegetation growth evident, across copings, with further sprouting visible.

3.4.14 There is a heap of loose detritus, redundant materials lay strewn across the roofscape, ranging from broken slates, to mortar, silt, decayed and rotten timber. Potentially dangerous in high winds.

3.4.15 There is a large array of metal framed patent glazing (skylights) to the south side of the roof, thought to have been introduced between 1987-1988, extending east to west, with access beyond provided via a series of loose precarious timber duck boards. Two areas of the patent glazing were removed in circa 2010 and over slated towards the east end of the warehouse. The patent glazing is fixed within the timber rafters with intermediate support provided from the purlins. The abutments with adjacent slated roofs are flashed with lead, including a solid wood roll to the ridge, also clad in lead sheets. The glazing is in a 7-panel arrangement (north>south) with each panel length, then sub-divided by 3 individual overlapping panes. A number of the glazed panels have slipped, projecting into the valley gutters. The glazing has an applied surface film, presumably to control UV / solar gain into the building. The films are in a poor condition, with loss of adhesion, air bubbles and discolourisation. A number of the opening lights appear to have actuators installed, though it is unknown if these are operational and/or linked to a BMS.

3.4.16 The patent glazing is further supplemented by 10 modern velux rooflights, which provide daylight into the central areas of the floor plate as well as a single rooflight provided over the commercial meeting spaces.

3.4.17 MEP is scattered across the roofscape, with aerials, ventilation ducts and wiring looms evident. The major plant and equipment are predominantly located to the north side of the roof.

3.4.18 The roofs across the modern extensions to the perimeter are flat likely laid to shallow falls.. The lift core roofs to the south elevations discharge back onto the main pitched roof via a single piped outlet. The outlets to the remaining roofs either discharge direct to ground or via internal outlets and downpipes.

3.4.19 There are remnants of existing chimney stacks, which have now been reduced in height and are not active. There is a mix of capped and uncapped.

3.4.20 The modern flat roofs appear to be covered with a single ply type membrane with internal downpipes. It is not known at this time where the outlets discharge. All of the modern roofs appear to be capped with a metal coping system with lead flashings used at the abutment with masonry elevations.

3.5 Interior (in relation to roofscape)

3.5.1 The roof structure is exposed internally, masked or hidden only where modern partitions and ceilings have been installed.

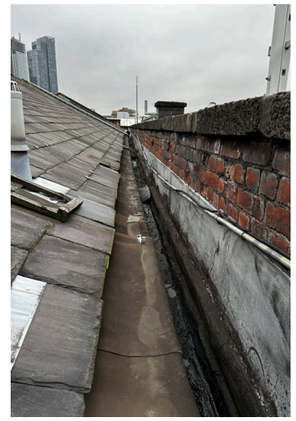
3.5.2 There is evidence of historic water ingress, staining and streaks still visible across the roof structure, as well as the exposed masonry external walls. With areas of more recent exposure to moisture also evident, with efflorescence, spores, and surface soiling.

3.5.3 There are instances where residue from the bituminous felt has worked its way through to the interior, through penny gaps, during a previous phase of roofing works.

3.5.4 Timber purlins are built in and embedded into the external masonry walls, with evidence of previous quite invasive stabilization and replacement works, having been carried out in the past, with the splicing of timbers and installation of robust visible steel plates and fixings.

3.5.5 There are a number of areas where the existing sarking boards have either been replaced due to being defective or have been installed following the removal of sky lights, involving infilling of apertures.

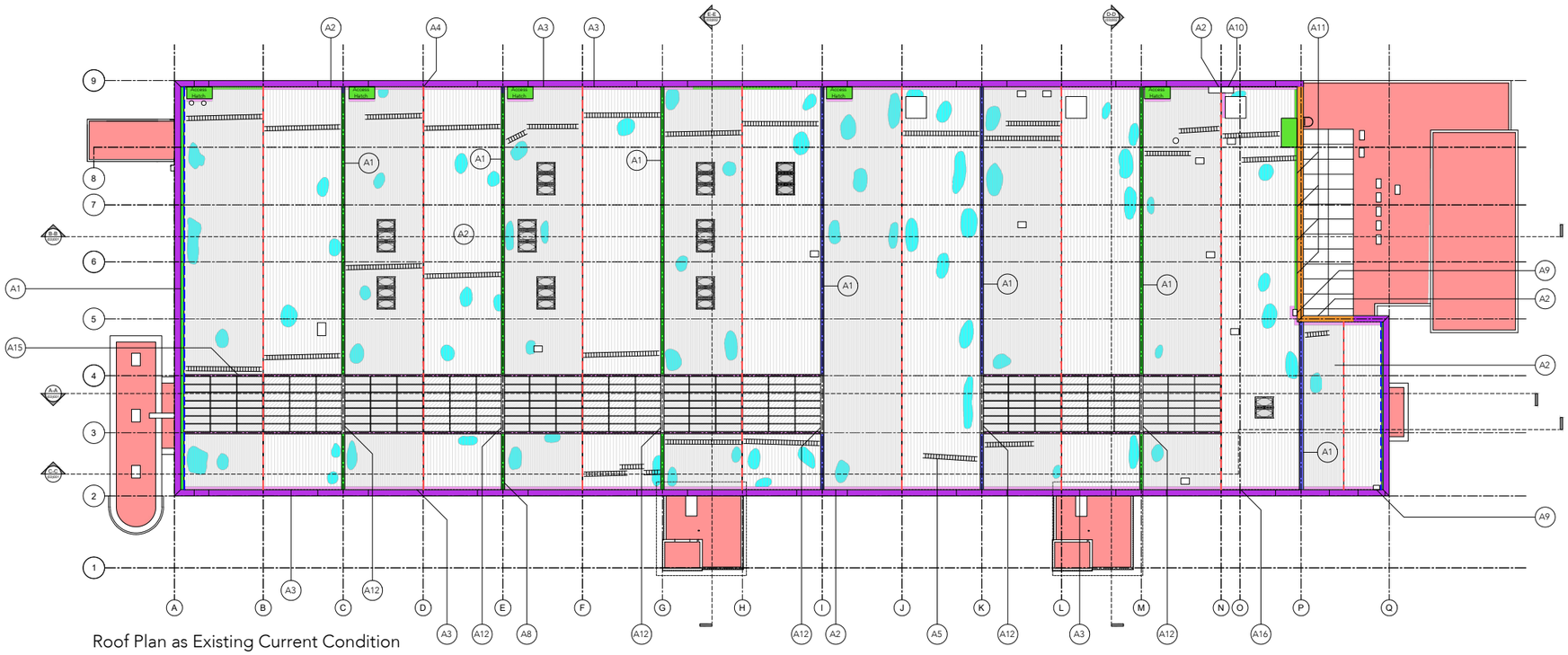












Roof Plan as Existing Current Condition

KEY

Slipped, Damaged, Dislodged Slates	Fibreglass Covering to Gutter	A1	Pools of Standing Water	A8	Slate Tills Stacked & Shored Within Valley Gutter	A15	Lead Cappings Across Rooflights Have Slipped/Are Dislodged
Felt Flashing/Covering	Bitumous Felt Membrane Covering to Gutter	A2	Soft/Woody Vegetation Growth	A9	Capped Chimney Stack	A16	Spalled/Friable Masonry
Lead Flashing/Weathering	Single Ply Membrane Roof Covering	A3	Unclipped Lead Flashing	A10	Doubling Up of Coping Stones		
Stone Copings	Ridge Tiles	A4	Ridge Tiles Generally Loose/Dislodged	A11	Aluminium Louvres Within Parapet		
Concrete Copings	Liquid Waterproofer Flashing Over Felt	A5	Timber Access Ladders	A12	Duck Boards		

0 0.5 1.0 cm
0 2.0 m 4.0 m 6.0 m 8.0 m 10.0 m 12.0 m 14.0 m 16.0 m 18.0 m 20.0 m
1:200

Example of condition drawings - refer to separate marked up plans for further information

3.6 Special Exhibitions Gallery

3.6.1 The Special Exhibitions Gallery (SEG) is located within the lower ground floor plate towards the west end of the New Warehouse. The gallery was introduced in 2020 and involved extensive restoration and fabric repair works by others across the interior.

3.6.2 For the purpose of this report, the areas in question are focused towards the most western end of the SEG, where the lower ground footprint extends beyond the west façade of the warehouse and is capped by a concrete slab and external hard landscaped surfaces, forming what could be deemed as a 'roof'.

3.6.3 The existing building fabric at lower ground level is exposed, with bare faced masonry to the outer walls and masonry vaulted ceiling onto ferrous beams with modern concrete floor.

3.6.4 Water ingress within this area has been ongoing for some time. The current arrangement is a managed solution and is currently accepted that the bare faced masonry walls are subjected to continuous saturation. A drainage channel has been introduced at ground level to act as a catchment pit, connected to below ground drainage network within the back of house area (1.).

3.6.5 There are localised open mortar joints, soiling across masonry walls and ceiling with localised areas of soft vegetation and organic growth, in particular across back of house areas.

3.6.6 The walls within the back of house area to the northwest side of the gallery generally exudes a gentle trickle of water with occasional periods of heavy showers down the face of the wall. Water can typically be seen working through open mortar joints at the padstone with the embedded ferrous beams.

3.6.7 Decoration in areas is defective, brittle and flaking.

3.6.8 Visibility and access is limited due to the mounting of ducting, tight up to the walls and vaulted ceiling.

3.6.9 An exposed concrete raft is located directly above this area within the west yard.

3.6.10 In addition, there are sporadic water ingress issues across the vaulted ceiling at lower ground level with ongoing issues focused within the location of the Stair Core C main entrance doors at ground level (2.).

3.6.11 Access to this area is gained via a set of automated doors linked to a PIR. There is a small glass canopy externally over the entrance, which disperses water to either side, providing minor cover to those in close proximity.

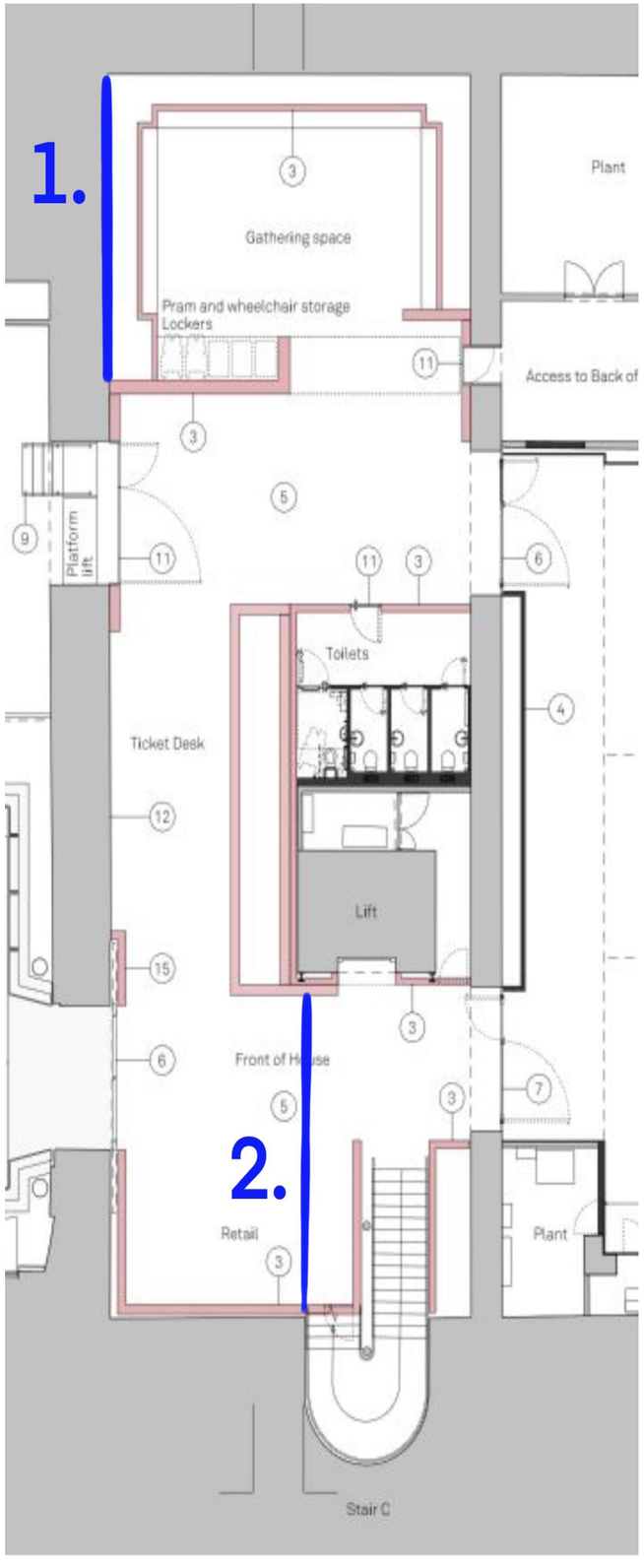
3.6.12 The matwell internally at ground level is visibly wet and heavily soiled.

3.6.13 It is clear that this area suffers from both driving rain and foot traffic, forcing water down into the lower ground level. A managed solution was installed during the SEG fitout, involving the introduction and fixing of an internal gutter and downpipe, to catch any water which may migrate through the ground floor plate, however this has proved to be insufficient with water overspilling and cascading over the sides.

3.6.14 The external yard to the west of the warehouse and which sits directly over the SEG below is hard landscaped with the vast majority of the area made up of stone cobble setts. A rectangular concrete raft protrudes from the surface to the west side with plant and equipment fixed on top.

3.6.15 There are remnants of embedded railway tracks to the centre of the yard with macadam directly outside of the main entrance.

3.6.16 There is a metal post and rail boundary fence to the north and west sides of the yard which denotes the boundary line with neighbouring properties beyond.



1. Water ingress locations, lower ground level plan - Note: general arrangement may not match current scheme

Not to scale

3.7 Summary of defects across the New Warehouse

3.7.1 To summarise, the following defects have been observed across the New Warehouse.

- Aging materials
- Slipped, cracked, defective materials
- Spalled masonry and stonework
- Eroded and friable masonry and stonework
- Cracks and fissures
- Defective paint finishes
- Defective waterproofing finishes
- Defective rainwater / drainage goods
- Timber rot / decay
- Brittle / defective sealants and mastics

4.0

Investigative Surveys

4.0 Investigative Surveys

4.1 Surveys

4.1.1 As part of the initial inspection works, a series of additional surveys were commissioned to help ascertain material build-ups / arrangements as well as condition within concealed and hidden areas.

4.1.2 The additional surveys included the following:

- focused opening up works across roof coverings
- timber and damp survey
- focused opening up works across external hard covered areas to west yard
- dye / flood testing across areas of the west yard

4.1.3 The output of these various surveys included written reports of findings and recommendations, as well as general photographs and sketch details.

4.1.4 The purpose of the investigative works was to provide up-to-date imagery across the roofscape and west yard to be able to report upon the current condition, in addition it provided the opportunity to inspect the various substrates across the roof and SEG areas to understand the various layers and build-ups.

4.1.5 It should be noted that the surveys carried out were limited and focused only within a few select areas, as a means to limit any future defects or cause any further issues or harm, than those already exhibited onsite, therefore there can be no guarantee or certainty that the areas exposed are fully representative of the substrates across the entire footprint. Further survey works will be required in the future, once appropriate safe access has been provided.

4.1.6 Roofscape

4.1.7 Areas of the roof coverings across the traditional slate roofs and valley gutters were temporary lifted to allow for inspection of substrate below.

4.1.7.1 Survey Findings

- Slates which were taken out were found to have been re-holed numerous times.
- The size of the slates removed were circa 350x600mm.
- The nails extracted were circa 35mm in length.
- The gutter width varies, between circa 100-130mm typically due to overlaying of membranes.
- The gutter depth varies due to steps/drips and gradients
- Concrete copings were circa 120x455mm with a camber, with circa 30mm drip edge.
- Offset from pitched roof to underside of copings was circa 160mm.
- Rafters are circa 125x60mm at circa 740-755mm centres.
- Sumps to valley gutter vary in size. They are open, with a steep slope into chute. No leaf guards were present.
- Hoppers measure were circa 475(w)x265(h)x265(d) mm and are set back in the fabric by circa 137mm
- The lead outlet / chute was circa 340(w)x230(h)mm

4.1.7.2 Build-up – pitched roof

- Slates
- Timber tilt fillets
- Timber counter battens | 25x50mm
- Timber battens | 25x50mm
- 1-layer bituminous membrane
- Rigid insulation board | 30mm
- 2-layers bituminous membranes
- Sarking boards | 25mm thick, 220mm wide with 8-10mm penny gaps

4.1.7.3 Build-up – valley gutter

- Stepped gutter, pitched high in the centre, dispersing north and south
- Fibreglass (localised)
- 1- layer bituminous membrane
- Rigid insulation board | 30mm (noted to the sides only)
- 2-layers bituminous membranes | unknown
- Gutter sole boards | unknown thickness
- Gutter beams | 95mm thick, circa 450mm deep
- Inner gutter beam width (valley gutter) circa 305mm
- Timber noggins | 32x80mm, centres unknown
- Battens | 20x45mm

4.1.7.4 Valley gutter width

- 110mm | varies +/- 15mm

4.1.7.5 Parapet gutter width

- 220mm | varies +/- 15mm

4.1.8 The area where the valley gutter and pitched roof substrates were revealed was found to be visibly saturated, with evidence of timber decay, rot, moisture, being held between the various layers. The bituminous membrane was brittle and perished in areas.

4.1.9 The exact arrangement of the valley gutter within this location was inconclusive.



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1. Section of roofing membrane removed to expose the outer face of the sarking board below. The layers include roofing felts and insulation
2. Retrospective waterproofing repair undertaken post survey works
3. Section of valley gutter finishes removed, to expose the tilt fillet and layers below
4. Battens and counter battens with felt underlay below
5. Typical hopper outlet with lead chute, arrangement differs between each outlet

4.2 Timber and Damp Survey

4.2.1 A timber and damp survey was commissioned to be undertaken across the New Warehouse roof structure internally only. This document excludes all other areas of the asset.

4.2.2 The report was carried out by Hutton & Rostron Environmental Investigations Ltd, dated 23-25 January 2023.

4.2.3 Key observations, findings and recommendations have been directly extracted from the timber and damp report for information.

4.2.4 Observations:

4.2.5 Roof structure was a softwood construction, original timbers were Scot's pine group and later timber repairs were initially identified as Norway spruce or Douglas fir. There was evidence of water penetration in multiple areas generally correlating with gutters, wet masonry at the gables and leaks via the rooflights. There was one area that was significantly wet at the east elevation corresponding with a short section gutter. Timbers here were at a heightened risk of decay. The deep moisture content in most locations was below 8 per cent w/w and 'dry' suggesting the decay was historical. However, the survey was carried out during a period of dry weather and the upper floor of the building was excessively heated. The deep moisture contents of timbers may increase following a period of heavy rain the raised internal temperatures encourage evaporation.

4.2.6 Structurally significant decay caused by wet rot was detected in the bearing ends of purlins, valley beams, and at the tie beam in a small number of areas identified at Appendix F. Partial decay was also identified in the valley gutter boards and sarking boards in localised areas. Previous phases of repair were identified using both, scarf joints and steels. These repairs were in response to historical damp and timber decay. However, a selection of repaired timbers were water-stained where embedded in the masonry which suggested sustained wetting or slate shims etc Inspection of the roof structure to all pitches was limited due to ceiling finishes and plant. The void behind the roof access portal in gridline 'I' was inaccessible, and timbers in these areas could be at risk of decay.

4.2.7 Recommendations:

4.2.8 It's recommended that the Estates Department maintain a floor/roof plan indicating the locations of persistent water penetration. These areas can then be revisited prior to reroofing. Allow for structural repairs to decayed roof timbers as directed by the Structural Engineer. Previous timber repairs and steel reinforcement should be assessed by the Structural Engineer. Gutters should be assessed for their efficiency and gutter timbers investigated for their condition following exposure from above during reroofing. New suitably specified softwood timbers should be separated from direct contact with the masonry using a suitable dpm and/or ventilated air gaps.

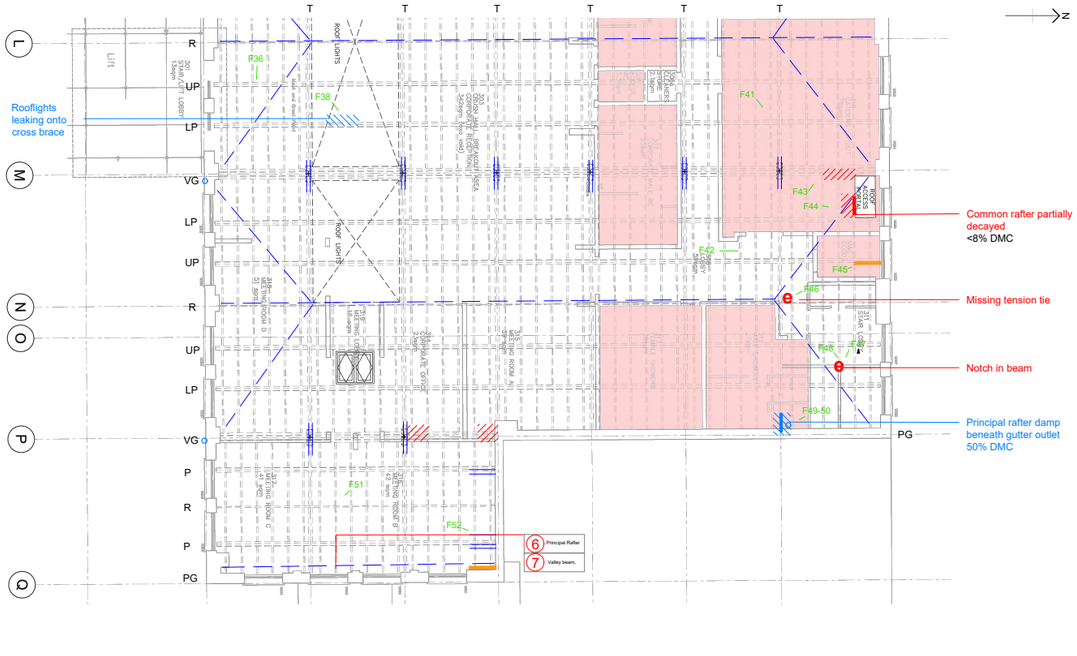
4.2.9 Roof drainage and high-level masonry e.g. gables and copings should be investigated and appropriate repairs implemented to limit further water penetration

4.2.10 Extracts of images from the report are adjacent.

4.2.11 A handful of figures have been extracted from the report for information.

4.2.12 Refer to detailed timber and damp report for complete findings and recommendations.

4.2.13 It should be noted that the timber and damp report has reports against the interior of the roof structure only.



Example of a plan extracted from the timber and damp survey report



Fig 24:

Administration Office G-I; showing where decayed sarking boards had been replaced

Note the original sarking boards had received in situ abrasive cleaning prior to their removal and reinstatement. This is evidenced by the dark-coloured sections that were previously concealed over the common rafters during cleaning



Fig 30:

Conference Room I-K; showing decay to a depth of ~70mm in the tie beam. Decay was just under 1/2 the depth of the 170mm deep tie beam



Fig 37:

Conference Area K-M; showing a general view of rooflight area accessed by scaffold

Note the disintegrated expanding water barrier, buckets and mats used to mitigate previous water penetration



Fig 49:

Offices and Meeting Rooms M-P, roof space at East wall; showing internal rainwater downpipes which serves a short section of valley gutter. The area was subject to ongoing water penetration providing the conditions for damp and decay



Fig 11:

Education Suite A-C, North gable; access was limited but the lower purlin at this wall was suspected to be damp and vulnerable to decay

Photos and figures taken from the timber and damp survey report

4.3 External Capping to SEG Area

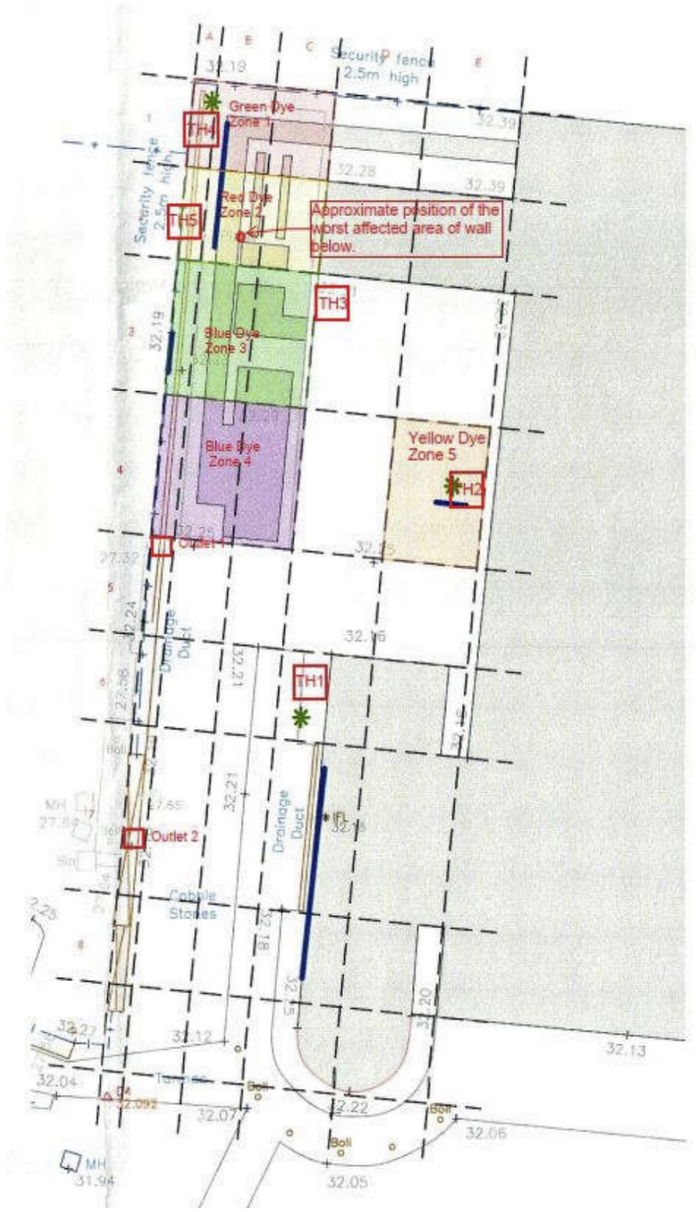
4.3.1 Areas of the external west yard were temporarily lifted to expose the substrate below; this also provided an opportunity to undertake localised flood and dye testing within these locations to ascertain where interior leaks originated from.

4.3.2 The investigation works included the following:

- Cleaning two separate drainage channels and investigation by CCTV and/or dye testing.
- 5 exploratory trial holes to identify the make-up of the ground and inspect any waterproofing membranes.
- Water testing of Stair Core C entrance door.
- Close up inspection of the suspended toilet ceiling grid.

4.3.3 Key (2) illustrates in red fill the SIM western yard area, with neighbouring properties highlighted with yellow and green coloured fill towards the west and north.

4.3.4 The drainage surveyor was unable to use specialist ultrasonic survey equipment due to interference from plant and equipment within this location.



1



2

1. Key plan marked up by drainage surveyors to illustrate excavation locations
2. Key plan showing yard and neighbouring property interface

Not to scale

4.4 Observations by Specialist Drainage Surveyor

4.4.1 The following observations were made and reported by the drainage surveyor, wording is verbatim, extracted directly from their report. The report can be found within appendix B.

4.4.2 (01) Trial hole 1 – 30/03/2022 opening area 750mm x 700mm cobbled surface of various depth ranging from 100mm to 150mm, 50-70mm pea gravel base. Resin base at depth of approximately 200mm below surface.

4.4.3 (02) Trial hole 2 before excavation. Yellow dye tested Flood Zone 5, 30/03/2022 over cobbles. No evidence of infiltration below after 1 hour and after 1 day.

4.4.4 (03) Flood testing of ACO channel, Flood Zone 1 - and surround with green dye 04/04/2022. (End of pad) No evidence of dye after 1 hour and after 1 day, there was evidence of increased water flow in the area of wall below, but no dye was seen.

4.4.5 (04) Water test 2 on next section, red dye over flood zone 2 did show in the basement, however it was a small quantity and appeared following overnight testing.

4.4.6 (05) Third test using blue dye, there was difficulty isolating zones 3 and 4 due to the fence and falls on the ground, therefore these were combined, no evidence of dye in the basement after 1 hour and overnight.

4.4.7 All three tests on the ACO channel held water under test but obviously the surrounding gravel soaked away.

4.4.8 (06) Additional test 3, Trial Hole 3 by the concrete air con slab, slowly drained, and was refilled three times, but no dye showed in the basement.

4.4.9 (07) Trial hole 2, hole in membrane.

4.4.10 (08) ACO in front of sliding glass doors rear exit. Water did not hold and leaked through the pea gravel and soaked through backfill into hole 1 indicating that the ACO channel joints were not watertight. However, no dye came through to the basement.

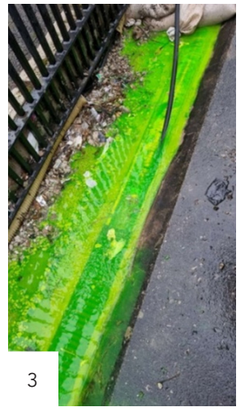
4.4.11 (09) Trial Hole 4 – where a section of ACO was removed, no evidence of dye coming through to the basement. Arrow shows steel plate covering a second abandoned deeper ACO channel. Tests on both channels appeared to show that the water was holding within the channels with no leakage.

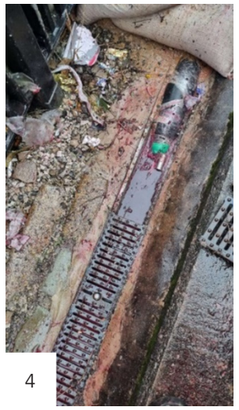
4.4.12 (10) Trial Hole 5, concrete slab below a thin membrane. Please note that the slab has a crack running from left to right. The hole was filled with yellow dye.

4.4.13 (11 & 12) Excavated area at TH5, exposed membrane. TH5 filled with yellow dye.


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2

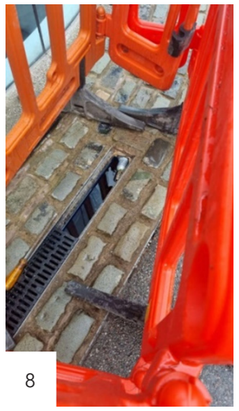

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4.5 Conclusions by Specialist Drainage Surveyor

4.5.1 The following conclusions were made and reported by the drainage surveyor, wording is verbatim, extracted directly from their report. The report can be found within appendix B.

4.5.2 Of the dye testing carried out, two of the tests showed dye coming through to the basement wall, these were in flood zone 2, where a small quantity of red dye came through overnight, and after TH5, when a substantial quantity of yellow dye came through overnight, suspected to be soaking away through the crack in the sub-ground concrete slab.

4.5.3 When we commenced on site the weather had been dry for several days, and the water was seeping down the wall. After some heavy rain during the works, the seepage rate increased after a few days, and continued at a high rate for days after the rain had stopped.

4.5.4 Although we can't be 100% certain, the sub-ground concrete protective slab and membrane may be compromised and ground water from rainfall is accumulating over the slab and tracking to any weakness area, particularly where the slab may be cracked or compromised in some way. It does not help that the area to the side of the long ACO channel, including a strip under the fence line, is gravel and rainwater can pass through easily and effectively by-pass the channel drain.

4.5.5 The short ACO channel in front of the glass doors failed the water test, and we suspect that the channel joints are leaking into the ground, this could be adding to the ground water accumulation issue over the sub-slab.

4.5.6 During the time of our survey works we did not experience any water coming through the ceiling over the basement toilet area, despite flooding zone 5.

4.5.7 Key plan (03) produced by Buttress Architects illustrates the existing western yard within a red fill and indicates the uncontrolled below ground water which is transferred from the adjacent properties.



3

3. Key plan showing uncontrolled surface water from adjacent properties

Not to scale

4.6 Summary of Findings and Illustrations

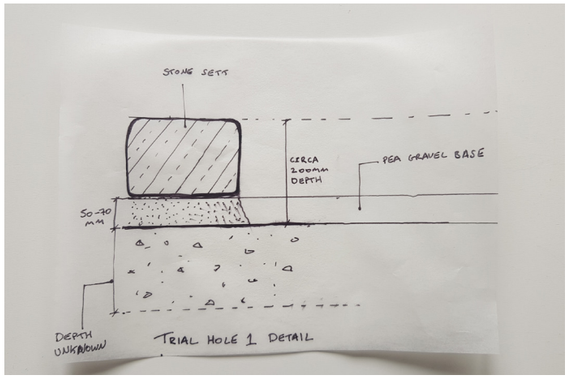
4.6.1 The opening up works, and site surveys clarified the following, with respect to the physical arrangement of elements and components:

1. There are only two prevalent locations where water ingress is of concern at present.
2. A concrete slab exists below the external west yard finishes, though the exact extent, detail and makeup could not be confirmed.
3. A membrane over the concrete slab exists only within localised areas, typically used at interface junctions with glazed curtain wall, wall abutments, channel drains.
4. The concrete raft to the plant deck does not appear to be laid upon a DPM but appears to site directly upon the concrete slab.
5. There appears to be no studded drainage layer or below ground drainage system which takes the ground water which permeates its way through the stone cobbled setts. Ground water is uncontrolled within this location and likely just sits on this flush surface, working its way horizontally, naturally.
6. No movement / day joints were found within the locations excavated.
7. here is an abandoned drainage channel to the west perimeter boundary fence, which has a new drainage channel installed above. We were unable to expose the secondary line due to it being capped with a steel plate.
8. The channel drain arrangement to the west perimeter boundary wall has little to no impact on surface water drainage within this location, due to its location and material palette of surrounding hard surfaces. Extensive silt and debris found within the channel drain system.
9. There appears to be no below ground drainage in place, to take away the majority of ground water from the hard landscaped yard area. The area is served by two drainage channels only.
10. There appears to be no waterproof interface, between the adjacent neighbouring properties.
11. Water was seen seeping down the interior face of the bare faced masonry wall within the lower ground level, even though it had been dry (no rain) for a number of days. Possible causes of constant steady stream of water may include:
    - There is a potential holding cell of water below ground which slowly seeps through the wall
    - Defective below ground surface water drainage systems,
    - A high water table.
    - Ineffective surface water management within adjacent properties.
    - Arrangement of neighbouring properties.
12. There is no internal tanking insitu at lower ground level, with exposed masonry walls and it is highly likely that no tanking system or waterproofing measures exist to the external (below ground, buried) face of the below ground masonry wall.
13. It is unknown if a soakaway / land drain is in place below ground to the external face.
14. The ground bearing slab at lower ground level does not appear to lap up the interior face of the masonry wall with a flashing interface. It is unknown if a drainage layer or sump system exists within this newer slab.
15. The slab and junctions with Staircore C have had many retrospective remediation works carried out in the past, much appears to have been unsuccessful.
16. The internal gutter within Staircore C is not particularly well detailed and appears to be a retrospective managed solution only. A means to temporarily mitigate and stem the flow of water internally.
17. The internal rainwater collection system for Staircore C is not easily and readily accessible, appearing difficult to maintain and likely to struggle during an increase in capacity, rainfall. There appear to be no failsafes or overflow pipes in place.
18. The matwell, barrier mat is not designed to take increased loadings of rainwater. It does not appear to be a drainage catchment trough, interfaced and linked with the gutter below.
19. The entrance doors to Staircore C are automated via a sensor. They are large horizontal sliding doors, both wide and tall. There is currently no protection to the internal matwell during periods of driving rain or heavy footfall. With surfaces saturated.
20. The entrance doors to Staircore C have a shallow glazed canopy fixed above the doors externally. There are no gutters and rainwater disperses towards either side via a very shallow gutter at the vertical abutment.
21. The drainage channel installed to the front of the main entrance doors externally does little to stem the flow of water, migrating internally, with falls away from the channel, not towards.
22. The drainage channel to the main entrance was not sealed with water seen dispersing from the pipe horizontally, even when temporarily blocked.
23. The concrete raft which houses the large plant / equipment appears to be flat with no drainage channels or falls to encourage standing water to run-off.
24. There is a significant amount of plant, cabling, ducting, trunking etc which limits access to maintain any surface water drainage.
25. Cabling penetrates through the slab vertically. Water stopping measures are unknown. The extent of distribution is unknown.
26. There appears to be little to no ventilation within the service corridor, BoH room at lower ground level where the western wall is heavily saturated. Such conditions may encourage fungal outbreaks.
27. Much of the land to the neighbouring property to the west is taken up by a concrete raft with plant sat on top. The exposed ground around the raft is typically gravel, unmade ground, littered with detritus, soft and woody vegetation. The ground level roughly aligns with the SIM site.
28. The land to the north appears to be a much more recent installation of macadam. The ground level is approximately 150-250mm above the SIM site. The surface is poorly finished at the perimeter abutment with the SIM site, with no kerb edge or abutment detail.

4.7 Trial Hole 1

4.7.1 Trial hole 1 was located at the main entrance referred to by the Museum as Staircore C. Upon lifting of the stone setts, the top of a concrete slab was exposed. There were no waterproofing measures in place on top of the slab. It was unknown if the slab had been overcoated with a liquid waterproofer or if in fact the slab is a waterproof type concrete. There was a remnant of a bitumen flashing at the abutment with the external cladding wall. It was not possible to further expose the exact makeup and interconnection at this point due to the nature of the cladding arrangement and this being on a principal access route, open to the general public.

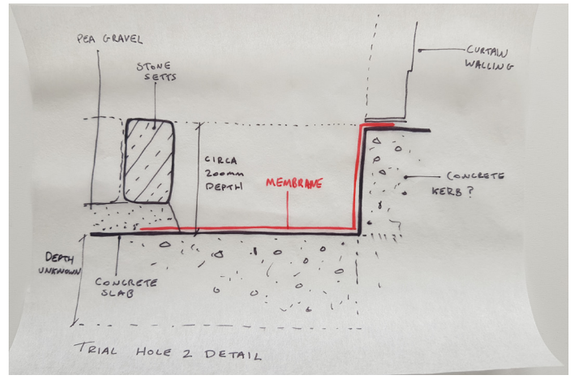
4.7.2 During the flood test of the hole, water did find its way into the drainage channel, even though the drainage channel appeared to be a sealed system, suggesting an uncapped, open end.



4.8 Trial Hole 2

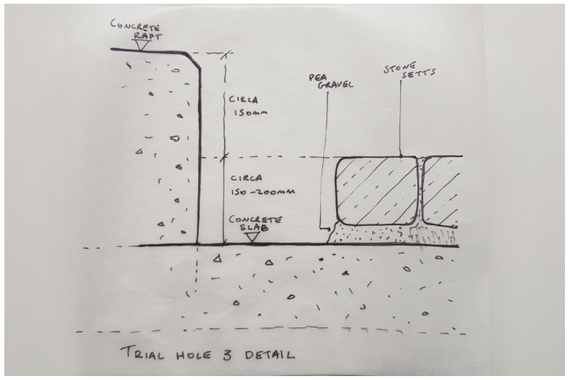
4.8.1 Trial hole 2 was located within the main cobbled yard at the abutment with the curtain walling to the west elevation of the New Warehouse. This was positioned over a location where water ingress had been ongoing internally.

4.8.2 Like Trial Hole 1, a solid slab was found circa 150-200mm deep below external FFL. However, a bituminous membrane was found to be in place which was laid horizontally on top of the slab and ran vertically to the perimeter kerb / upstand with the glazed curtain walling. The membrane was found to be extremely brittle, with a heavily fissured surface. The exact extent of the membrane was unknown and is believed to only be used locally, at the abutment with the curtain wall.



4.9 Trial Hole 3

4.9.1 Trial hole 3 was located adjacent to the large concrete raft which protrudes circa 150mm above external FFL. The raft houses the museum main plant supply. We wanted to understand the relationship between the raft and slab / capping over the SEG and if any waterproofing measures were in place. Following excavation, it was found that no physical waterproofing measures were in place, with the raft appearing to be directly poured on top of the main slab / capping over the gallery below.



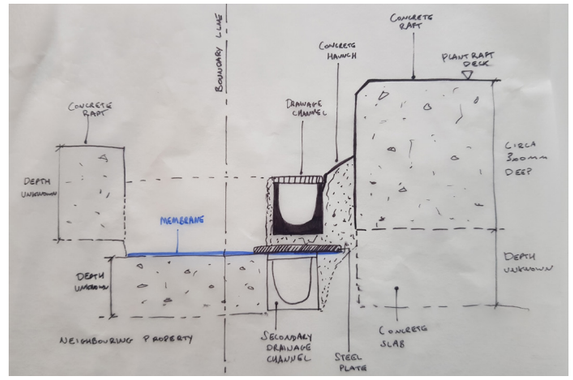
4.10 Trial Hole 4

4.10.1 Trial hole 4 was positioned to the west of the external yard, in a confined area between neighbouring properties and the Museum plant. This was roughly within the area of the main water ingress issue exhibited internally. Upon removal of stone setts and the drainage channel. A steel plate was found to be secured in position directly below the drainage channel with a bituminous membrane lapped and wrapped to the underside. It was confirmed by the drainage surveyor that there was in fact a second abandoned drainage channel directly below the one at surface level. Presumably a remnant of the old system, left insitu.

4.10.2 It is assumed that the steel plate is in position to provide a solid base for the newer drainage channel above. Though it cannot be discounted that this may extend to form part of a structural element below.

4.10.3 It is believed that this channel drain does not directly sit above the water ingress issue within the basement.

4.10.4 Dye flood tests carried out across both of the channel drains appeared to show that they both held water, with no evidence of coloured dye found within the basement area.

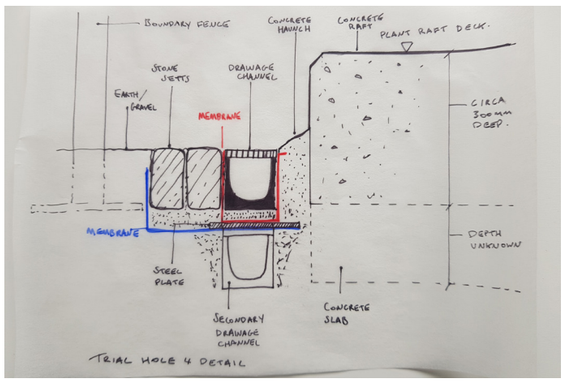


4.11 Trial Hole 5

4.11.1 Trial hole 5 was positioned just south of Trial Hole 4, directly adjacent the neighbouring property line and their own plant slab edge opposite. The makeup was similar to that seen within Hole 4 with the doubling up of drainage channels. In addition, there was a concrete slab with a bituminous membrane over, which became exposed once the stone setts and earth infill was temporarily removed.

4.11.2 The membrane was found to be brittle and perished under contact. A fissure / crack was found running left to right through the concrete slab.

4.11.3 The hole was filled with a coloured dye and left to disperse overnight. Remnants of the coloured dye were found internally the next morning within the basement area, across the face of the masonry wall and within the low-level concrete drainage trough. This may be the sole cause of the water ingress issues, though more likely to extend beyond this location.



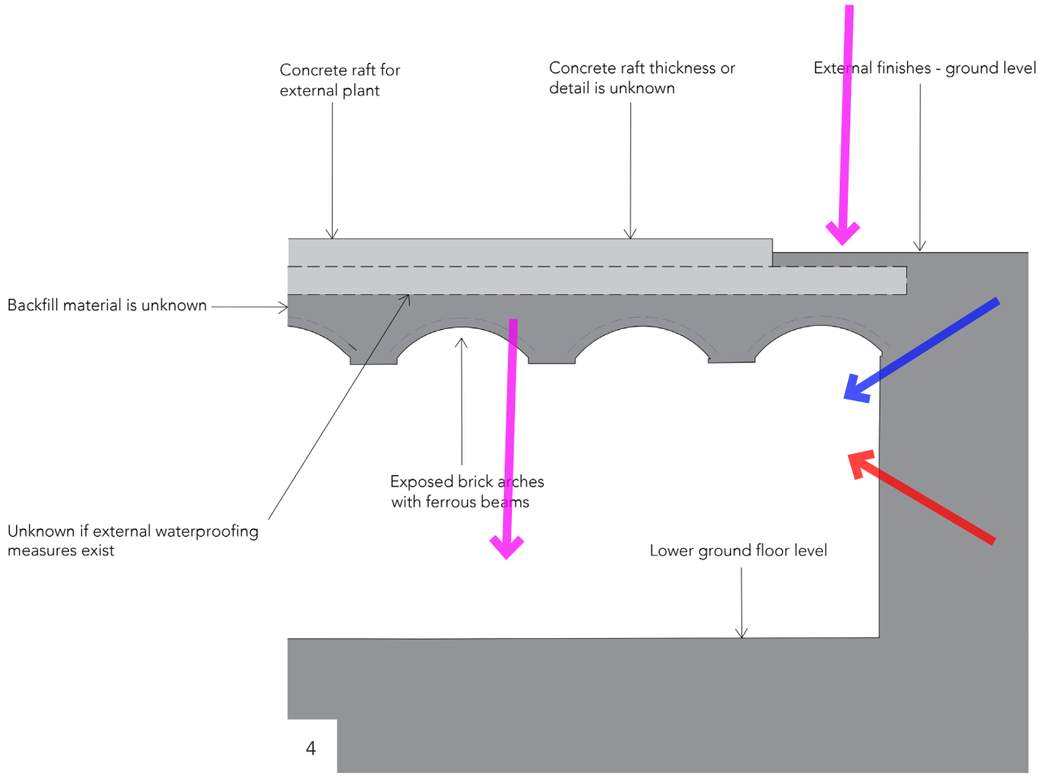
4.12 Potential Causes of Water Ingress Issues

4.12.1 The exact cause of the water ingress issues found within the lower basement is still inconclusive, in particular with respect to the western leak.

4.12.2 Potential causes of water ingress issues, but not limited to:

1. Ground water is bypassing the current concrete slab capping over the SEG and working its way through the path of least resistance.
2. The concrete slab capping is cracked / fissures within numerous locations.
3. The mastic seals between the suspected day / movement joints within the concrete slab have perished.
4. There is a high-water table with significant pressures transferred onto the lower ground level walls and vaulting.
5. There is defective below ground surface water drainage.
6. There is poor quality original detailing.
7. There are poor quality retrospective repairs.
8. There may be potential uplift of below ground ferrous structures.
9. The land to the neighbouring properties is uncontrolled with surface water able to permeate down through the surface coverings and migrate around any below ground waterproofing measures.
10. The original waterproofing membranes have perished, are brittle.

4.12.3 Water within the SEG space is currently migrating into the interior from the external yard and through the retaining wall, with isolated issues through the ground bearing slab, as illustrated in the adjacent section with the red and blue arrows. For the purposes of this report, only the exterior yard was inspected in detail.



4. Section of the SEG area showing potential causes of water ingress.

Not to scale

5.0

Current design and arrangement

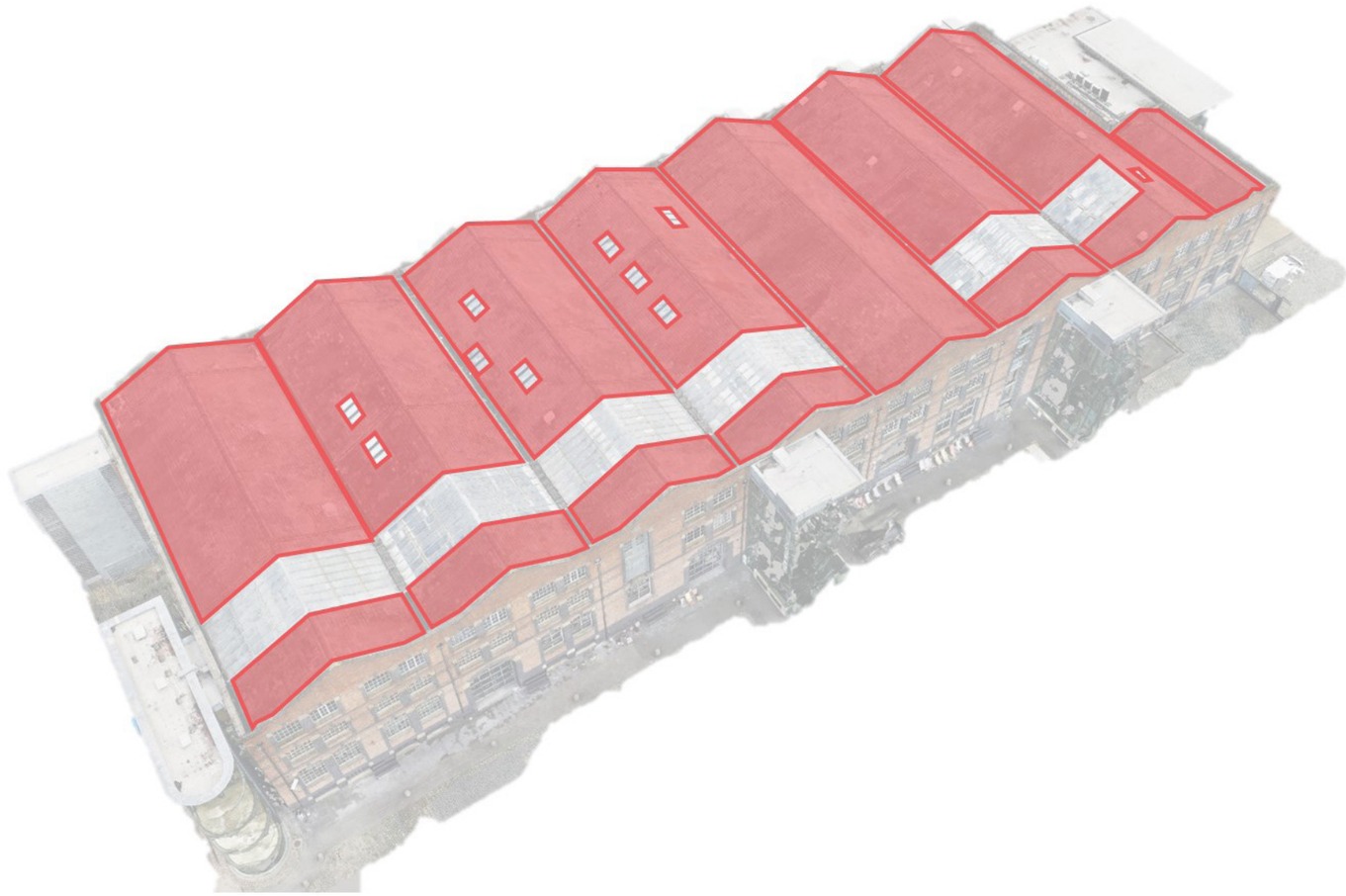
5.0 Current design and arrangement

5.1 Pitched Roofs

5.1.1 The main slated roof plan form extends over an area of circa 3114m² with roof slopes at approximately 27° pitch. A single up and over bay covers a plan area of circa 405m².

5.1.2 The pitched roofs discharge into valley gutters which extend north to south over an approximate 32.5m length, with slopes discharging into a box gutter at the east and west parapets. The valley gutters appear to be stepped with a high point in the centre, discharging towards the north and south outlets.

5.1.3 The base graphic of the New Warehouse adjacent and presented across the following pages was taken from the 2019 Ortho-rectified Inspection Model.



Key

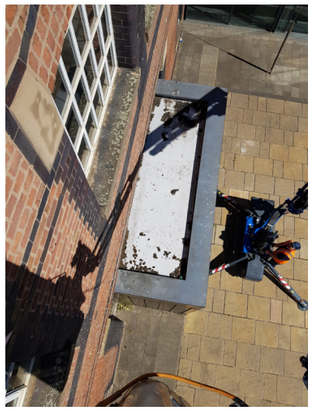
Roof coverings - slate

5.2 Flat Roofs

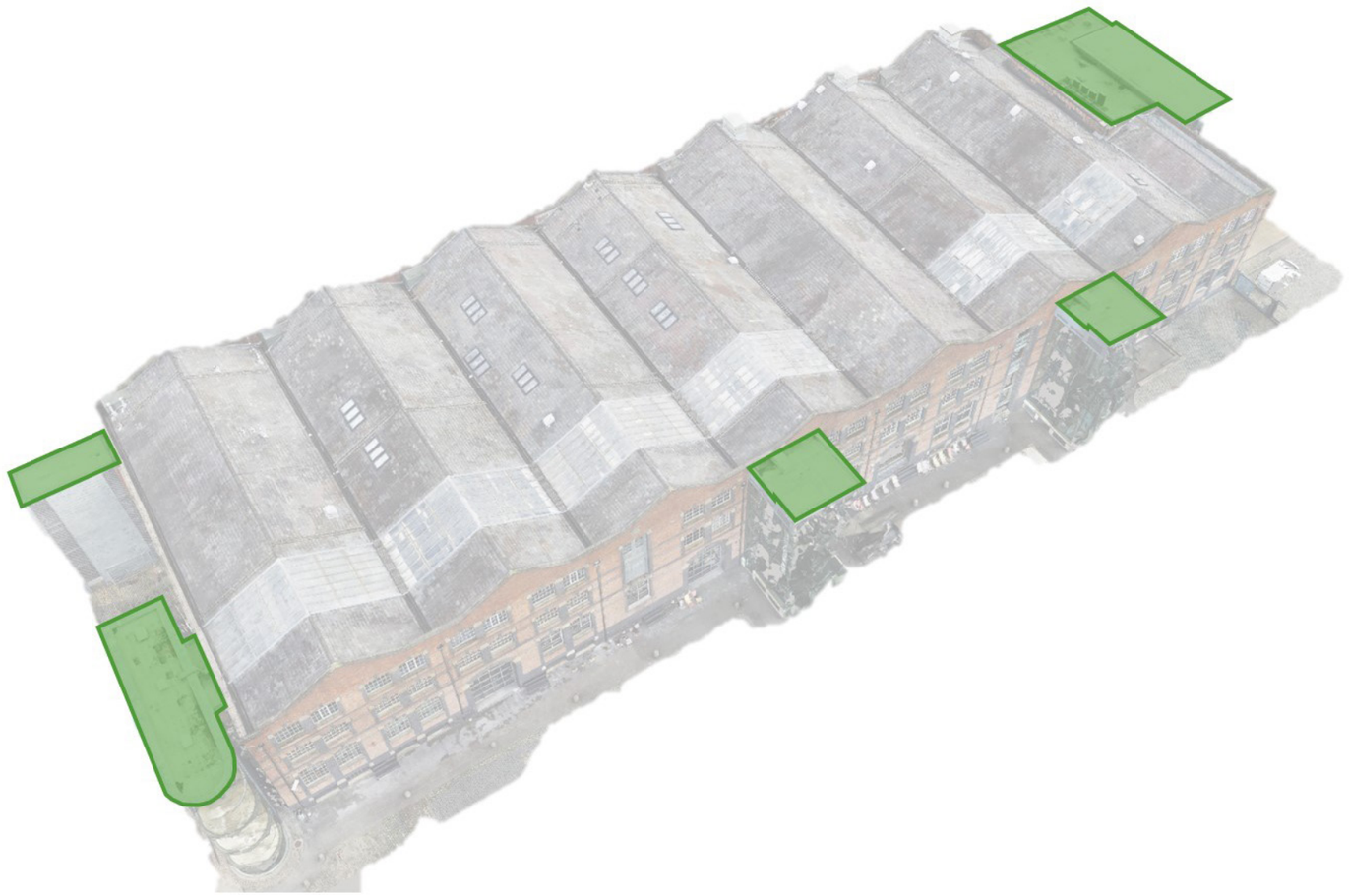
5.2.1 The modern extensions to the perimeter of the masonry asset have flat roofs. The coverings appears to be a single ply type membrane. The southern cores disperse back onto the main pitched roofs. The fire escape core to the northwestern corner discharges into a single outlet internally. The stair core to the west elevation disperses into two outlets, with the downpipes concealed and hidden behind cladding. The outlets to the large eastern extension discharge to outlets internally.

5.2.2 There is a small flat roof over the western main entrance porch, which is not visible on the adjacent graphic. This discharges direct to ground.









Key

Flat roofs - single ply membrane

5.3 Valley & Parapet Gutters

5.3.1 There are typically two outlets per length of gutter, one located at the north and one at the south.

5.3.2 The gutters are not tapered but appear to be stepped with a high point in the centre of the gutter run, sloped to the north and south outlets. The supporting structure, visible internally, also suggests a stepped gutter. Full inspection and survey of the gutters has not been feasible due to the presence of ponding water, silt, and debris which has masked the arrangement, as well as no safe access being available at the time of the inspection.

5.3.3 The valley and parapet gutters discharge into deep sumps, which disperse directly through a lead chute. The hoppers sit within a pre-formed opening within the masonry wall, the chute projects over a recessed hopper head. The design and arrangement of the hopper apertures differ, with some having a simple shallow stone lintel and others more decorative, formed in masonry.

5.3.4 The downpipes to the underside of the hopper are recessed within the face of the masonry and run vertically with no bends above ground, the downpipes connect into the below ground drainage network. The condition of the below ground pipework and infrastructure is unknown at this time.

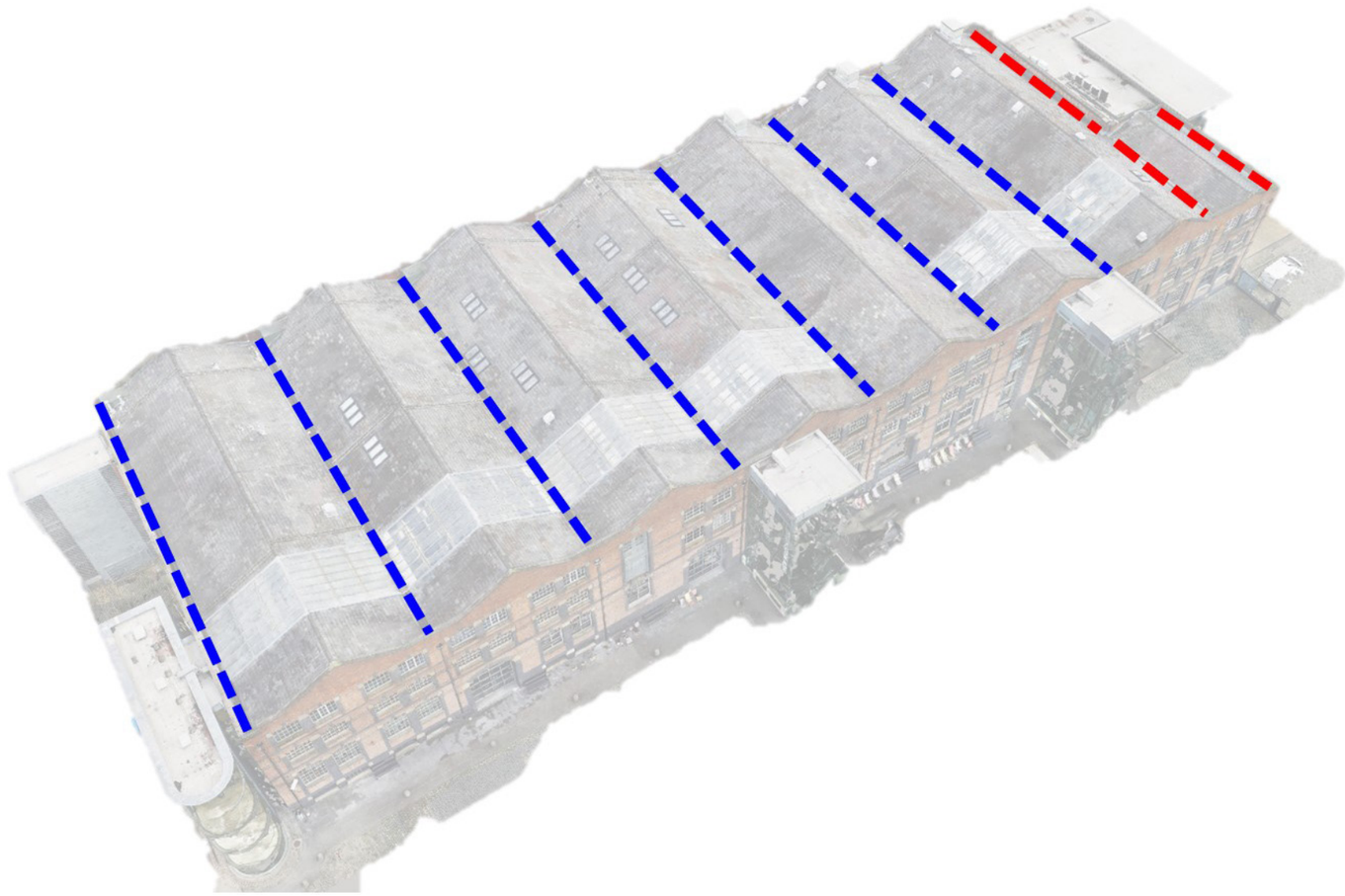
5.3.5 There is a single outlet to three shorter gutter lengths, towards the east end of the warehouse, presumably as a result of the shortened projecting eastern 'L' outrigger. The longer gutter, next to the short length is split into two separate gutters.

5.3.6 The most northeastern gutter appears to run internally for a small segment, where it passes through a short dormer. The exact details and arrangements within this area are unknown as it is currently unsafe to access this location.









Key

Roof coverings - gutters (2 outlets)

Roof coverings - gutters (single outlets)

5.4 Copings

5.4.1 The masonry parapets and raked gables are capped with copings. There are two types, the walls are predominantly capped with concrete copings, with a small length of potentially original stone copings towards the northeast corner of the building.









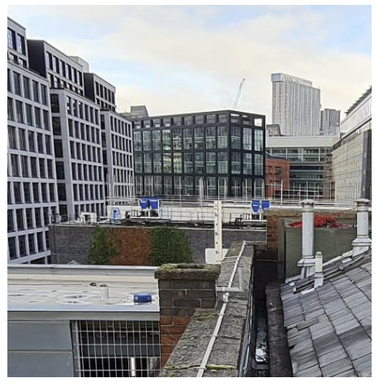


Key

- Concrete copings
- Stone Copings
- Chimney stacks

5.5 Chimneystacks

5.5.1 There are remnants of three chimneystacks, two are located to the east end of the building and one to the west elevation. The stacks appear to have been lowered and are typically capped.







5.6 Access Portals

5.6.1 Originally, each valley gutter was directly accessible from the interior, however the remnants of 5 portals now only exist, with only two now providing access via the provision of a non-fixed ladder internally.

5.6.2 The portals are not insulated and have been covered with a bituminous membrane. The doors or access panels have been fixed shut and have to be manually unscrewed to gain access.





5.7 Safe Access

5.7.1 Physical access onto the roofs is obtained through the existing roof portals, available at second floor level. The portals are narrow and are difficult to climb out from.

5.7.2 There are no latchways or fall restraint systems currently installed across the main slated roofs.

5.7.3 There are the remains of now redundant timber access ladders, which can be found strewn across the pitched roofs externally, in various stages of disrepair. These ladders once provided access up and over roofs and down into valley gutters.

5.7.4 The current roofing maintenance contractors have left unfixed metal ladders within several locations, to aid access across the roofs.

5.7.5 Roofing contractors currently provide their own abseiling equipment to manually secure themselves to the structure and traverse across the roofscape.

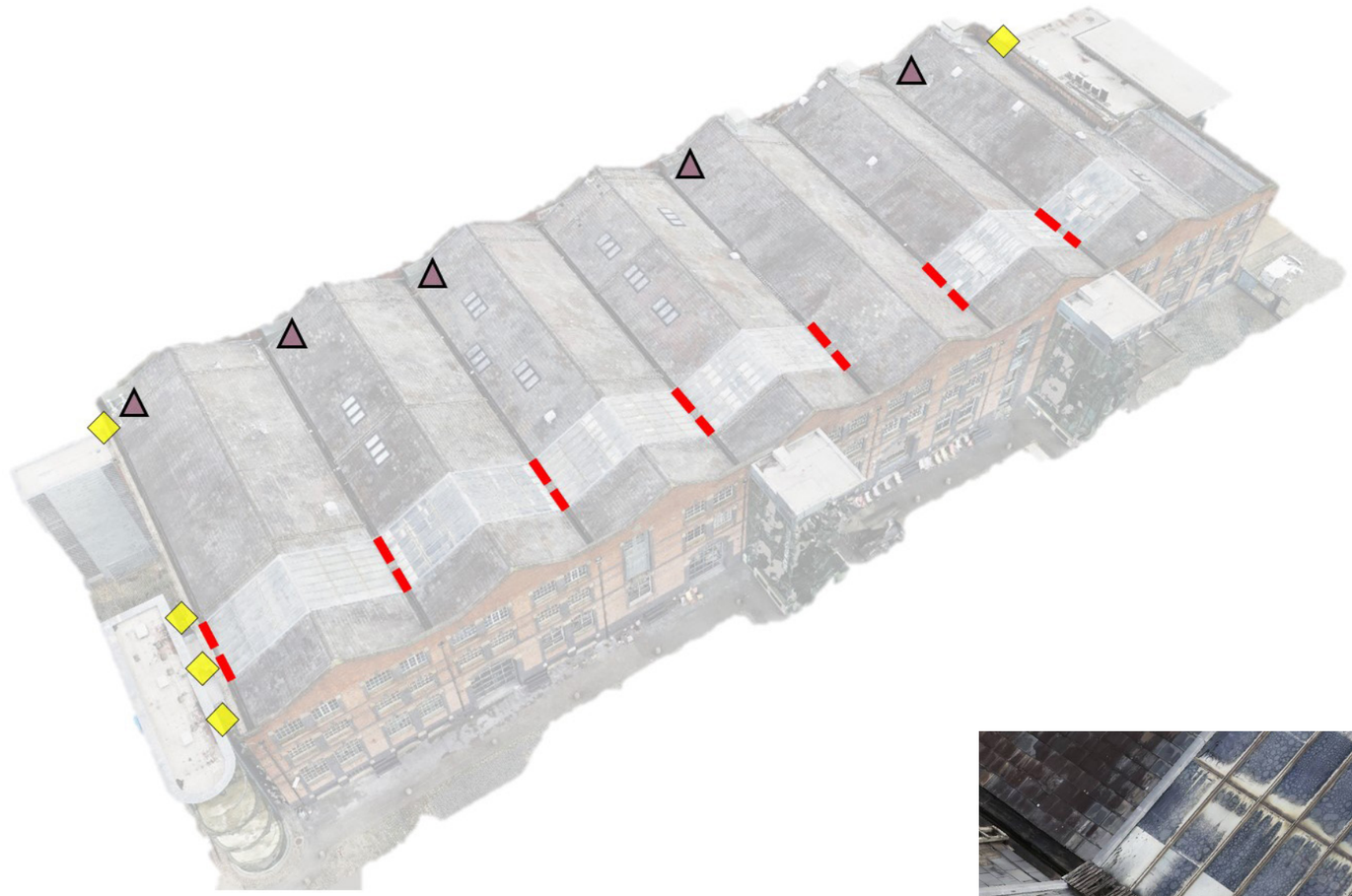
5.7.6 The valley gutters provide a free width between slates of circa 530mm, allowing maintenance access up and down the valley gutters, without impeding and walking upon the slates. However, the gutter is slotted, which leaves circa 220mm per side to walk / shuffle across the gutter.

5.7.7 The parapet heights are circa 1000mm in height to the east and west elevations, with a gutter zone of circa 220mm to walk up and down the gutter. There are no fall restraint measures installed within the parapet locations.

5.7.8 The remnants of timber duckboards remain insitu within the valley gutters at the base of each skylight

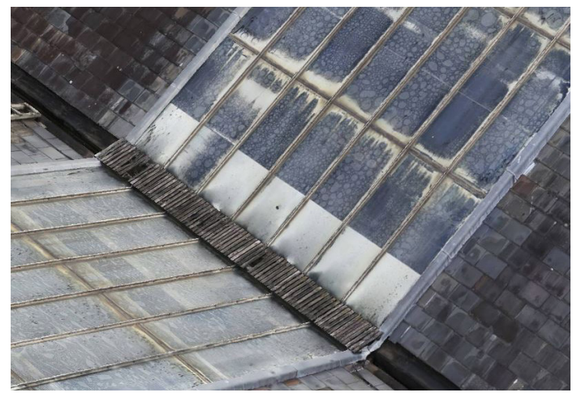






Key

- Access portals
- Duckboards
- Vertical Access ladders



5.8 Roof lights & Glazed Roofs

5.8.1 Patent glazing / skylights are currently located in a strip to the south of the warehouse. It is difficult to gain safe access beyond and between the glazed areas due to the current condition of timber walkway duck boards and ladders. There are no handrails or balustrading insitu or any other forms of fall arrest systems in place. All interfaces with the slate covered roof are clad and flashed in lead.

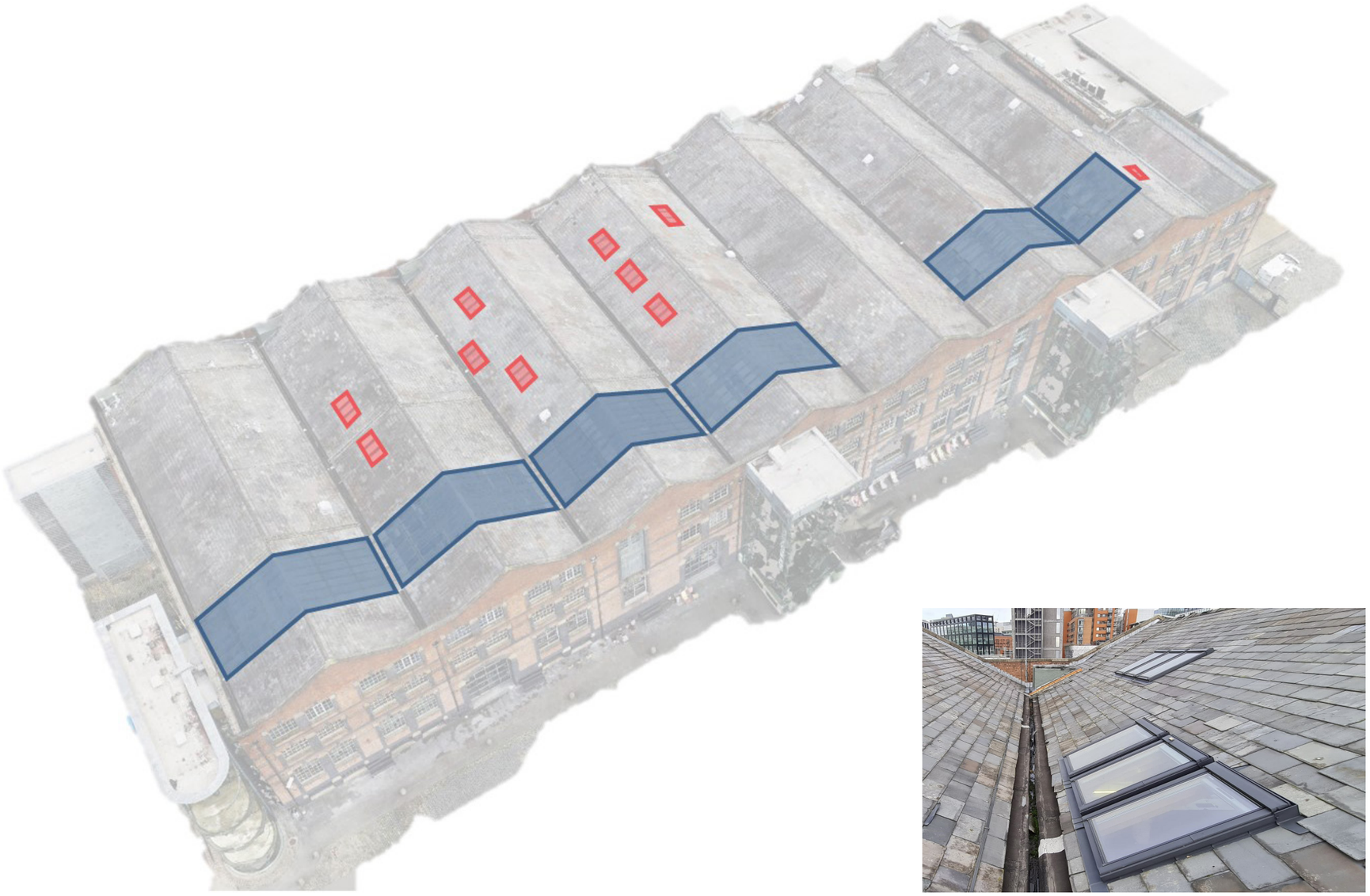
5.8.2 Modern Velux rooflights were installed in 2010 during the major renovation project.

5.8.3 Internally, there are the remains of a blind, solar shading system installed. It is believed that this is no longer operational along with the actuators that may have once provided naturally ventilation, linked with a BMS. Equally, internal applied UV films can be seen peeling, discoloured with air pockets visible.









Key

Rooflights (velux)

Patent glazing / sky lights

5.9 Mechanical & Electrical

5.9.1 A lightening conductor strip is affixed to the top of the copings and runs around the entire perimeter of the masonry building, extending across ridges and down slopes.

5.9.2 There are numerous M&E penetrations littered across the roofscape, including ducts, flues, louvres, aerials, cabling etc. The M&E consultant will provide comments separately. It is unknown if items are live or redundant.







5.10 Elevations

5.10.1 The masonry exterior elevations have not been extensively altered from their original form, with the rhythm and arrangement of the existing windows and doors retained. A large proportion of the windows are metal framed and follow the same design as existing.

5.10.2 All extensions and interventions and distinctly modern, so as to contrast and be clearly defined with large expanses of glass, steel and modern cladding.

5.10.3 Many of the original features have been retained, such as remnants of former cart entrance / loading door hosts still insitu to the north elevation.











5.11 Downpipes

5.11.1 There are 9 recessed downpipes to the south elevation and 8 recessed downpipes to the north elevation.

5.11.2 There appear to be no original sections of downpipes retained, having been replaced predominantly by uPVC with a handful of cast aluminium.

5.11.3 The downpipes are circa 110mm diameter, fixed within a masonry recess which varies in width from 115-130mm by approximately 130mm deep.

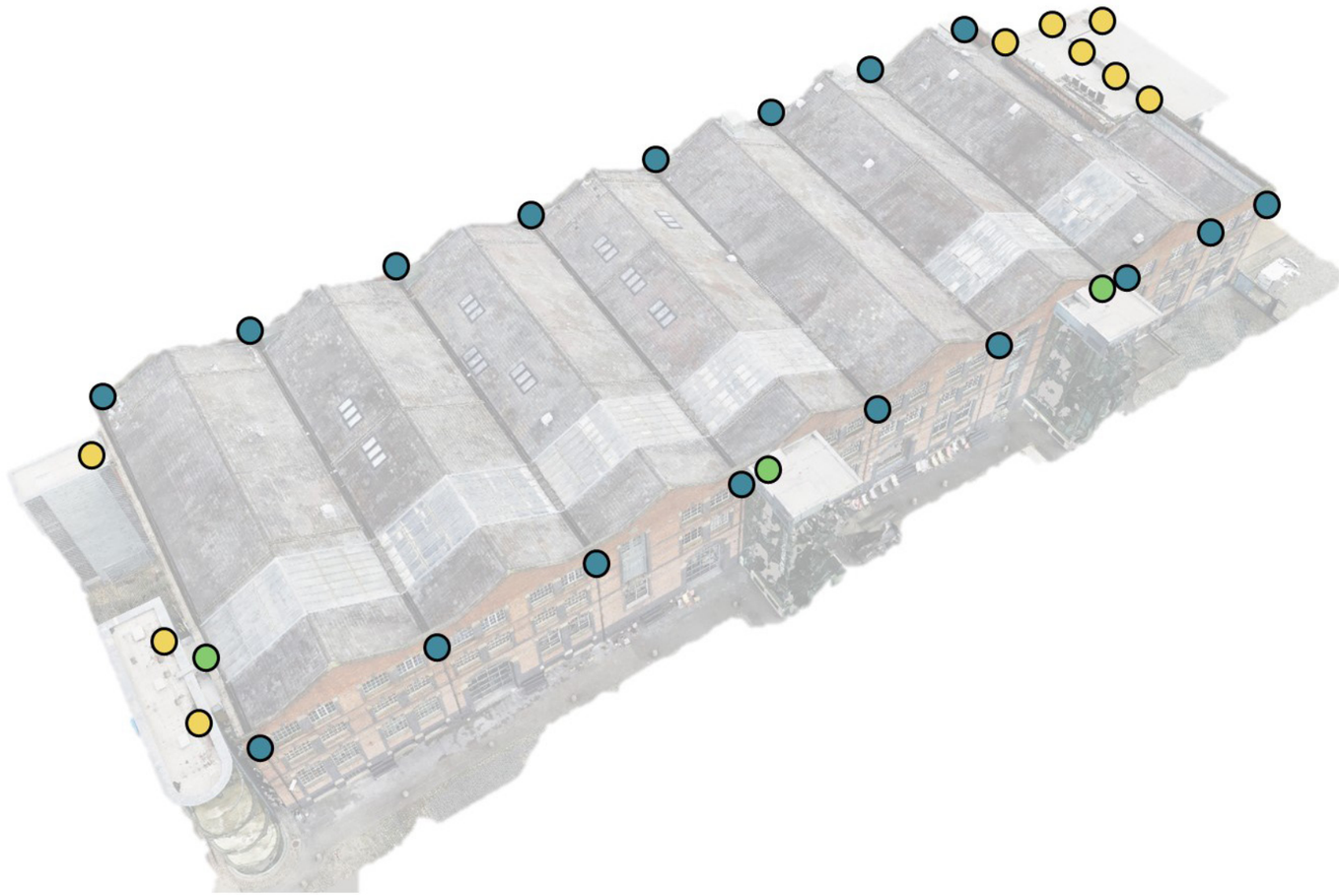
5.11.4 Standard rodding points have not typically been specified across the downpipes, with most connected directly into the below ground drainage system with a continuous run.

5.11.5 Rodding access has been formed retrospectively and quite crudely within a number of locations.









Key

- Original building
- Extension - Outlet Pipes
- Extension - Internal Outlets

5.12 Windows

5.12.1 The windows are set within original masonry openings with exposed facing masonry internally. The reveals are bullnosed to the head and jambs both internally and externally. The frames are set back from the external face by 1 brick length. The windows have been reported as having some original and some replacement.

5.12.2 The structural glazing within former shutter door openings is set back from the external face by approximately 2 ½ brick lengths.

5.12.3 An obscure film has been applied internally across several windowpanes, thought to provide a mix of UV protection, as well as privacy.

5.12.4 The adjacent elevation extract denotes the typical arrangement of the elevational bays, with the first and second floor windows being the same size and arrangement (Red). The ground floor windows are the same width but taller (Blue) and the basement lightwell windows again are the same width by narrower in height (Green).

5.12.5 The elevation also highlights the recessed rainwater downpipes either side of the 2-pairs of windows, capped with a recessed hopper.







5.13 Original Design Constraints across roofscape

5.13.1 There is limited scope to adapt or rearrange the current surface rainwater drainage system from the main building, due to the configuration of the original design intent.

5.13.2 The existing roof structure and layout dictates the location and size of the gutters. The deep timber gutter beams span over the ferrous columns and sit upon the truss chords, creating a zone for the gutter to reside. The deep beams provide enough tolerance (cover depth) for the stepped gutter gradients to transition discreetly within. This current zone is approximately 305mm wide (internal dimension), though the depth varies, due to the stepped arrangement.

5.13.3 It would not be feasible to increase the depth of the gutter beam internally, due to the presence of the existing truss chord and column shoe / seat. Equally, modern partitions have been constructed up to the underside of the gutter beam soffit and floor levels raised locally below, which limits head heights and would require major internal works to remediate.

5.13.4 Due to the configuration of the roof structure, the gutters are narrow, particularly the valley gutters, with the width further reduced by the introduction of additional membranes and poor repairs over time.

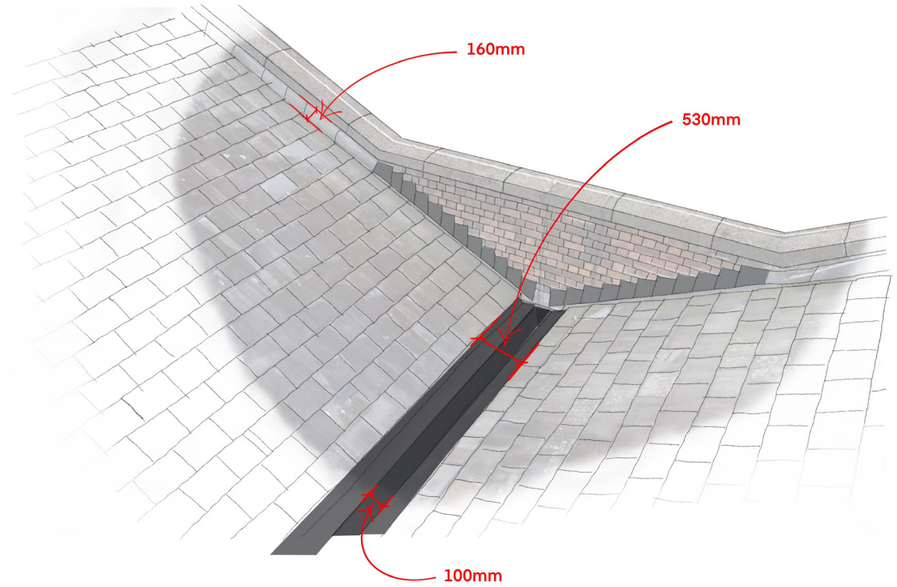
5.13.5 Most of the downpipes are currently positioned and aligned centrally with the gutters concealed beyond, though some are not centred, presumably due to obstructions with structural elements beyond.

5.13.6 The visible downpipes are fixed within a narrow crudely formed vertical recess, with a larger aperture / recess at the head, allowing the hopper to be affixed tight back to the external face, with the lead chute dressed over. The size of the downpipe recess measures approximately 115(w) x130(d)mm and as such limits the proposed increase of the downpipe diameter, if the downpipe was to follow the same principles.

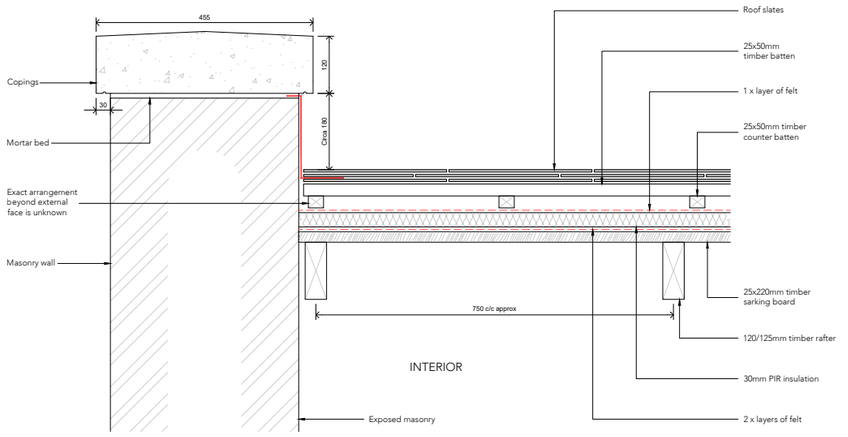
5.13.7 The current surface water arrangement does not include any form of warning system or fail-safe measures, in the event that an outlet or gutter is obstructed by debris or accidentally blocked. This includes the omission of rodding points for routine maintenance. However, 'access points' have been retrospectively and, in some instances, brutally created at the base of a number of the downpipes, presumably due to the pipes becoming blocked and a need to rod the system to remove obstructions.

5.13.8 The elevations to the north and south are raked to match the pitched roofs beyond, with deeper parapets in between, providing an area to conceal and mask the access portals from the external façades. The raked parapets and copings are offset upwards from the slate coverings by approximately 160mm to the underside of the copings. The impact of this, is that any proposed roof build-ups must take into consideration this constraint, as exceeding this dimension would likely result in the roof lines projecting beyond the façades, whilst also introducing complex geometries at flashing and coping interfaces. This can be mitigated by the introduction of a secret gutter at the abutment, where approximately 50-75mm may be gained.

5.13.9 The locations for permanent roof access are likely limited to the north elevation, as the south elevation at second floor is open, currently used as a main circulation space.

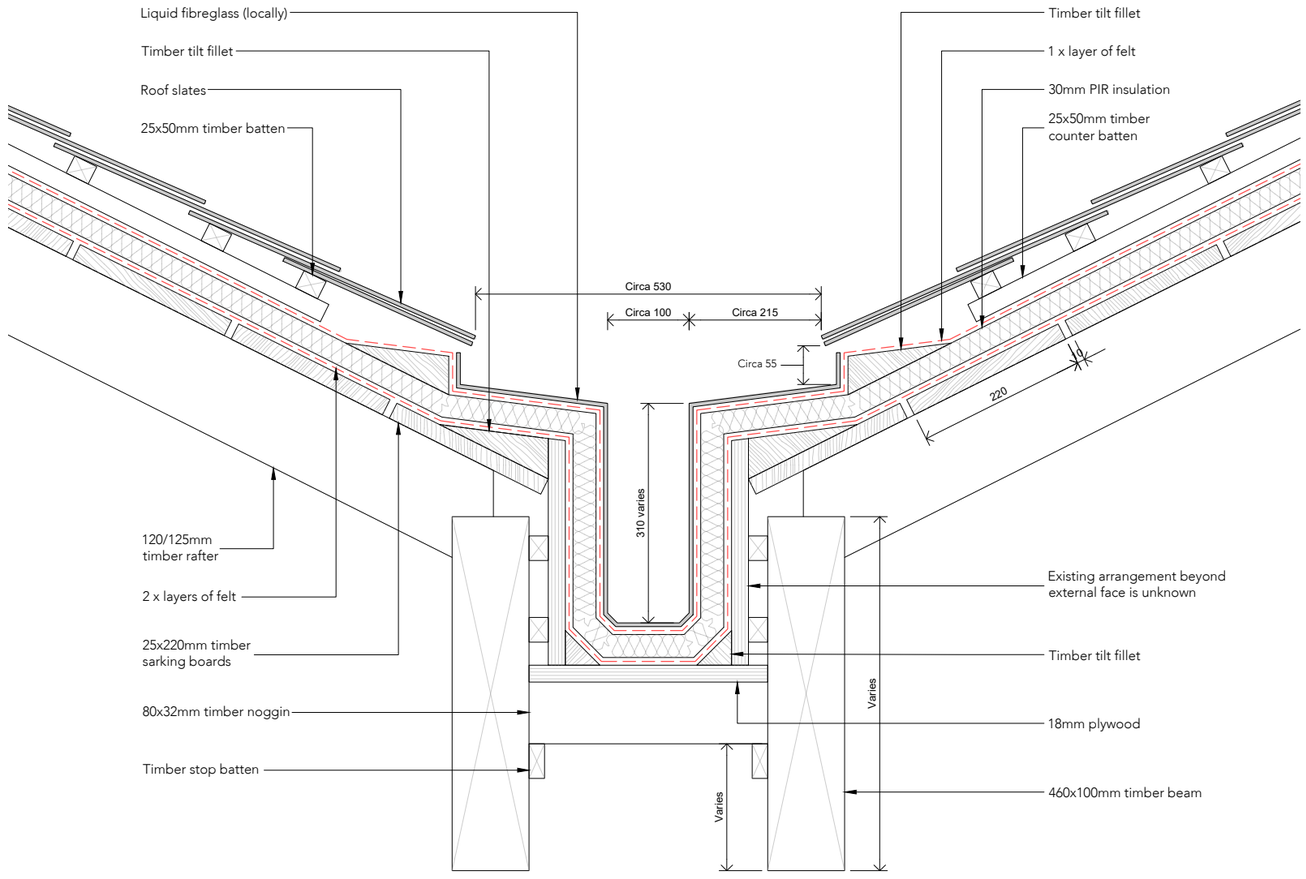


This graphic illustrates current roof level constraints



07. Roof Parapet / Raked Gable Detail 1 as Existing

Typical as existing roof detail at interface between pitched slate roof and raked copings



04. Roof Valley Gutter Detail as Existing - Slate to Slate

Note: the exact interface and arrangement illustrated below coverings are unknown, the detail above is indicative only.

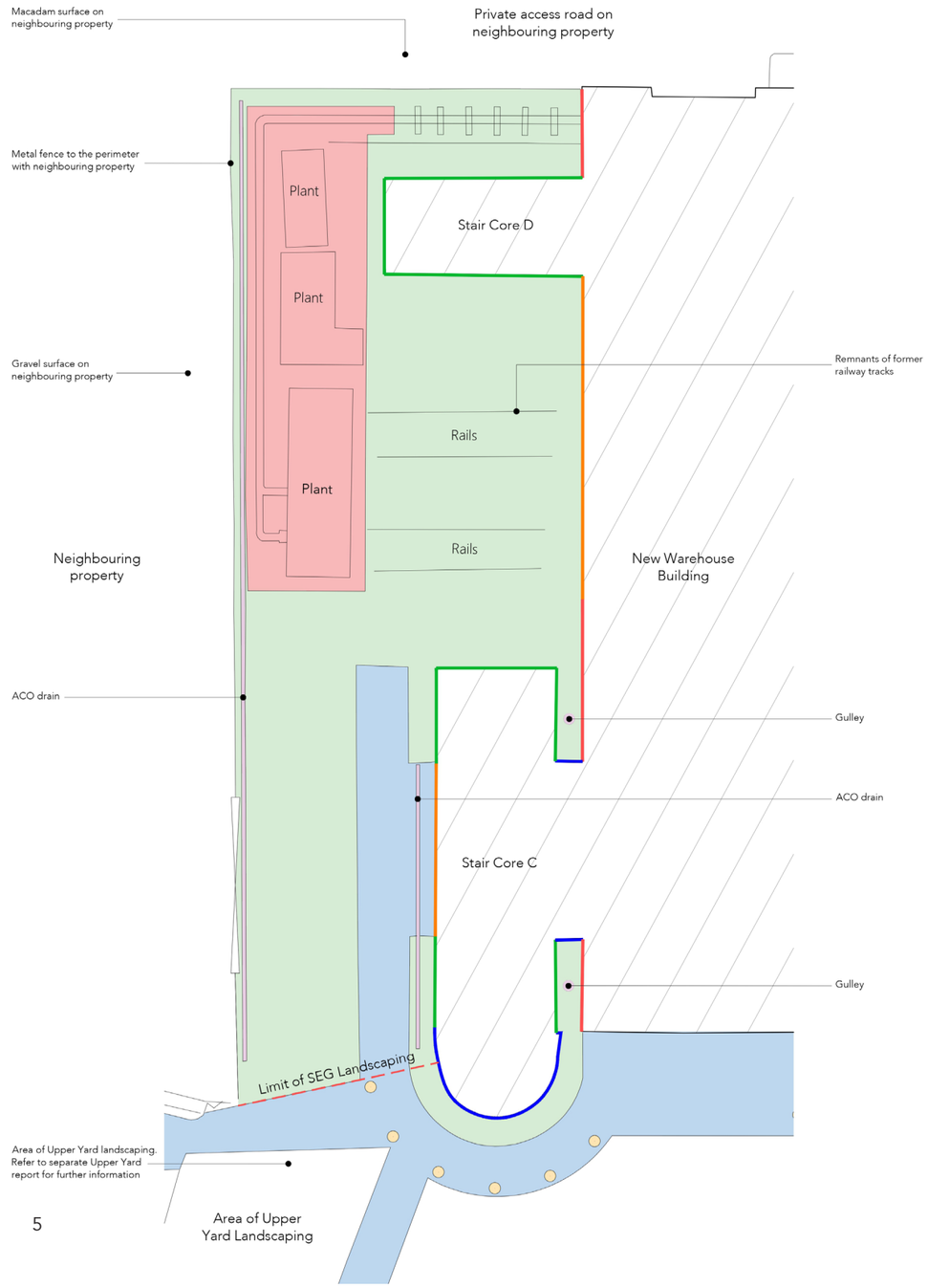
5.14 West Yard External Finishes

5.14.1 The external areas in question extend over the West yard located adjacent to the New Warehouse building and Staircores C and D.

5.14.2 Externally, the zones can be broken down as follows:

- Stone setts
- Macadam paving
- Concrete raft for plant
- Drainage channels

5.14.3 Below the hard landscaping finishes, it is expected that a concrete slab extends across the entire area. The full extent of the concrete slab is unknown, though it is expected to fill the area currently infilled and hidden, concealed by the external finishes located over the full extent of the West yard. There is potential that the slab and existing waterproofing measures also exist under the paved area located to the South in the Upper Yard area, though this has not been confirmed.



KEY

Stone Setts	Metal Cladding
Concrete Raft for Plant	Entrance to Building
Macadam	Masonry Walls
Drainage Channel	Glazed Walls

5. Key plan showing external finishes and interfaces.

Not to scale

5.15 West Yard Slab Level

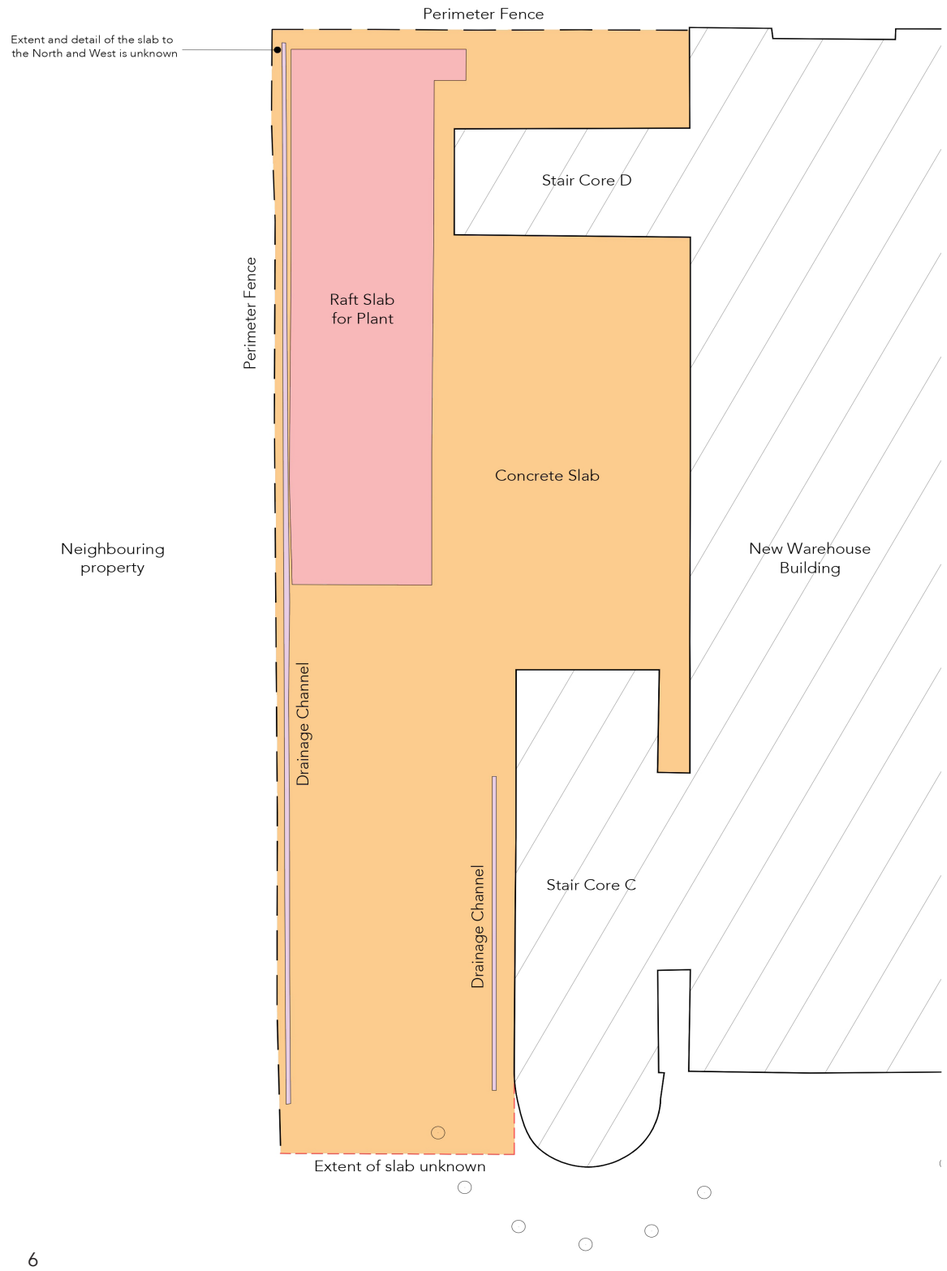
5.15.1 The general arrangement plan illustrates the interpreted layout of the below ground concrete slab and ground surface water drainage system which extends across the full length of the West yard.

5.15.2 The external finishes have been omitted for presentational purposes.

5.15.3 The drainage channels are highlighted with a purple fill with the primary drainage channel abutting the perimeter of the neighbouring property to the West and the secondary drainage channel located across the entrance to Staircore C.

5.15.4 The main slab highlighted in orange is believed to be located and extend under the external hard finishes, abutting the West elevation and boundary lines to the North and West. The full extent, detail and interfacing with below ground drainage infrastructure is unknown. An obsolete below ground drainage channel is positioned directly underneath the existing primary surface water drainage channel located adjacent to the Western perimeter. It is currently not known if there are any additional below ground drainage channels.

5.15.5 The concrete raft highlighted in red protrudes above external finishes. It is unknown if this was introduced at the same time as the primary slab or fitted retrospectively.



KEY

- Concrete Slab
- Concrete Raft for Plant
- Drainage Channel

6

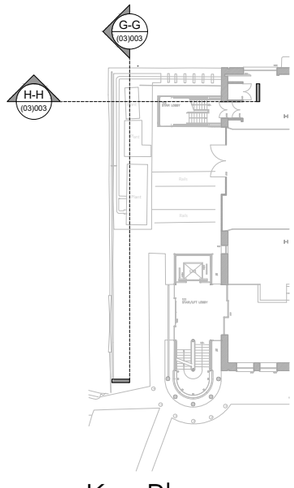
6. Key plan showing current concrete slab and drainage layout.

Not to scale

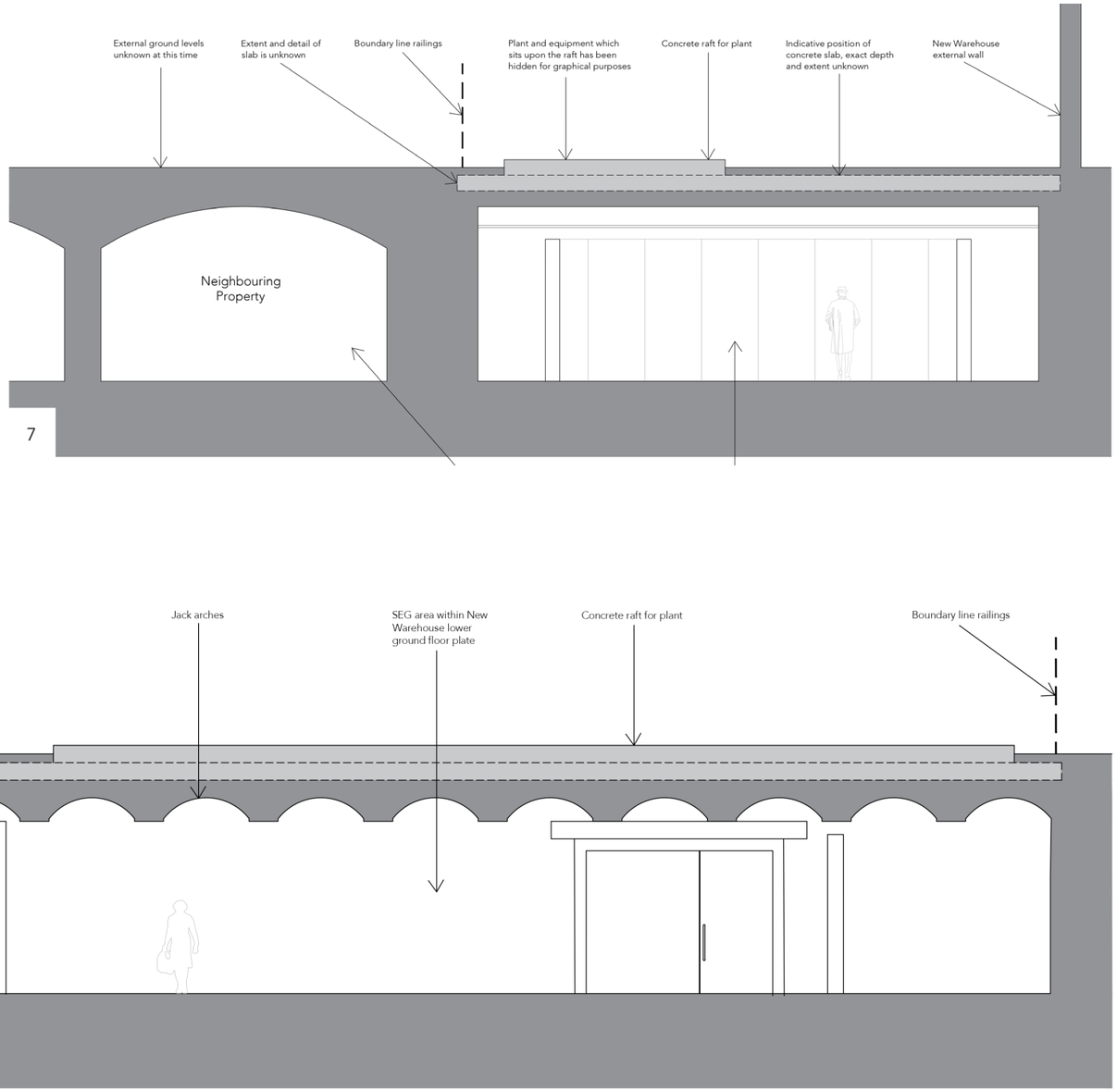
5.16 West Yard & SEG Cross Sections

5.16.1 To aid with understanding the relationship between the West yard, the New Warehouse and the adjacent neighbouring property, a working section has been developed for illustrative purposes. It is by no means meant to fully interpret the below ground make-up but to identify changes in level and the intricacies of the potential waterproofing interfaces.

5.16.2 The standard GA section has been developed from a combination of legacy data and information provided by an external surveyor, however the below ground drainage, waterproofing and levels are purely indicative representative of isolated follow-up dimensional surveys only, following package of opening up and investigative works.



Key Plan
NTS



7
8

7. Typical long section showing the SEG area.
8. Typical short section showing the SEG area.

Not to scale - Note: for more detailed drawings - refer to the full drawing package.

6.0

Proposals

6.0 Proposals

The proposals are broken down into a series of headings, including the following, which are then further broken down by element:

- Re-roofing
- Fabric Repairs across Elevations
- SEG

6.1 Re-roofing

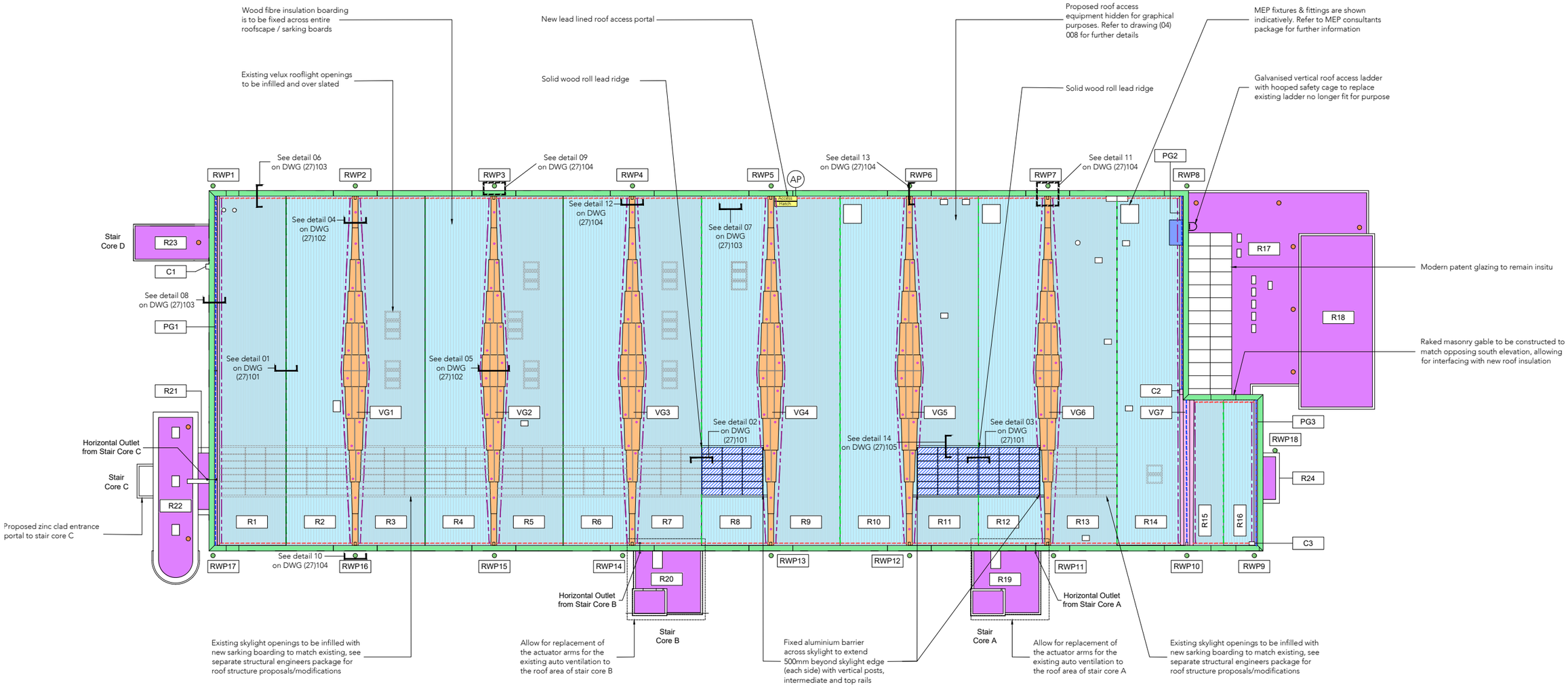
6.1.1 The existing slate pitched roofs currently disperse into narrow slotted gutters which discharge into outlets to the north and south façades. The existing roof offers limited thermal efficiencies with only approximately 30mm depth of insulation boarding laid upon existing timber sarking boards.

6.1.2 The roof is well beyond its serviceable life and therefore full replacement of the roof coverings across within the masonry envelope is proposed.

6.1.3 The proposed scheme will retain the general configuration and arrangement of the existing roof, though will be improved, and enhanced in areas to provide thermal and access efficiencies.

6.1.4 This will involve the careful full removal of all existing slates, ridge tiles, battens, counter battens, membrane, insulation to expose the external face of the existing timber sarking boards below. In addition, all existing modern rooflights and skylights will be removed, including all associated elements and components.

6.1.5 The existing sarking boards and roof structure will be retained, replaced, and repaired where found to be defective, requiring remedial works. The interior should remain unaffected, retaining its current character and aesthetic.



Detailed Roof Plan as Proposed

Scale 1:200

KEY

- New blue/grey Welsh slate. 500x300mm, County (7mm) grade thickness
- Code 6 lead cappings with welded joints laid on a geotextile membrane with continuous stainless steel clips
- 2 courses of slate removed with code 6 lead sheets with welded joints laid to slope to provide widened access route
- Code 8 stepped taped lead lined gutter @ 1:80 fall
- Code 6 lead lined access portal with solid wood roll to roof and welded cheeks
- Existing felt lined dormer to be removed and original slope of roof and box gutter to be reinstated
- Flat roof to remain as existing
- New heritage patent glazing system with double glazed infill
- New capped angle ridge tiles to match existing with ventilated ridge detail (Nicholson airvent)
- Code 6 lead lined box gutter with T-pren joints & lead cloaks
- Code 4 lead lined secret gutter
- Ventilated eaves detail (Nicholson airvent)
- AP — Access Point - Hardwood vertically boarded access door and frame with bolt and latch
- Code 7 lead chute/spitter with spigot into hopper
- Existing vertical outlet
- Code 7 lead mushroom vents
- Existing horizontal outlet
- R1 — Roof 1 etc.
- PG1 — Parapet Gutter 1 etc.
- VG1 — Valley Gutter 1 etc.
- RWP1 — Rainwater Pipe 1 etc.
- C1 — Chimney Stack 1 etc.

0 0.5 1.0 cm
0 2.0m 4.0m 6.0m 8.0m 10.0m 12.0m 14.0m 16.0m 18.0m 20.0m
1:200

N

6.2 Existing Roof Build-up

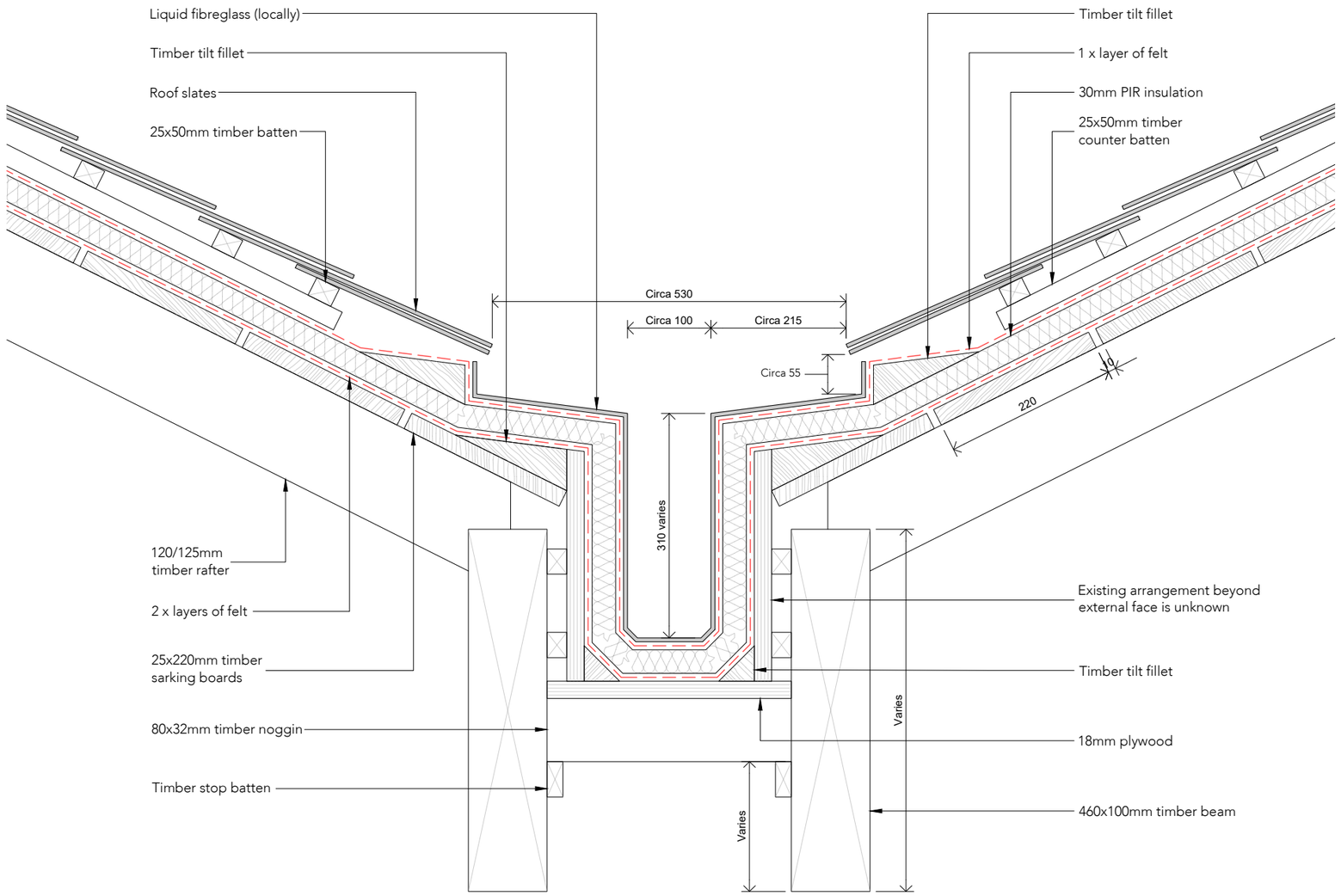
- Pitched roofs
- Material: Slate and mix of lead, bitumen, fibre glass to gutters
- U-value: approximately 0.56W/m²K.
- Estimated weight: as per structural engineers analysis
- Condition of finishes: very poor
- Substrate: timber rafters and sarking boarding
- Air tightness: not achieved
-

6.2.1 Alongside the requirement to undertake wholesale re-roofing, there is an opportunity to incorporate increased thermal provisions. It is proposed to install a wood fibre installation board on top of the existing sarking boarding to increase the thermal mass of the roof.

6.2.2 This will require the existing ridge heights to be raised to accommodate the increased insulation depth. The current arrangement of the façades dictates that the locations of gutter outlets, downpipes and roof slopes will largely remain within their current positions.

6.2.3 The façades include masonry parapets and raked gables that sit higher than the existing roof coverings, allowing for the ridge height to be raised, whilst not protruding beyond the existing copings.

6.2.4 The raising of the roof coverings will however require the installation of a lead capping across all copings and the installation of a secret gutter at the interface of new slate roof and copings, to enable the correct laps and weathering's to be maintained.



Roof Valley Gutter Detail as existing - Slate to Slate - Not to Scale

6.3 Proposed Roof Build-up

- Pitched roofs
- Material: Slate and lead lined gutters
- U-value: approximately 0.20W/m²K.
- Estimated weight: as per structural engineers analysis
- Substrate: timber rafters and sarking boarding
- Air tightness: not achieved

6.3.1 The design and interfacing of key junctions across the eaves, ridges, copings and valleys have been carefully considered in order to be sympathetic to the original building and arrangement.

6.3.2 The adjacent diagrams highlight how a greater depth of roof insulation is proposed to be introduced, whilst retaining the existing internal and external aesthetic.

6.3.3 The existing arrangement currently offers very limited thermal efficiencies with only an approximate 30mm depth of insulation batt observed, laid directly atop of the timber sarking boards.

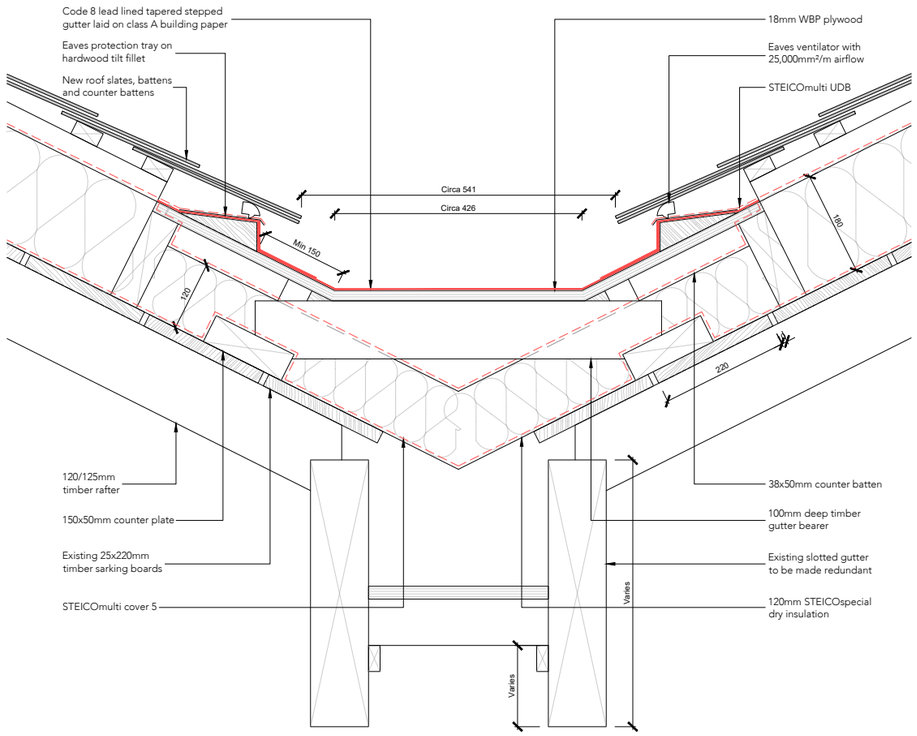
6.3.4 The Science Museum Group has produced decarbonization plans for each of their sites. The strategies focus on reducing carbon emissions and upgrading assets underpinned by a fabric first approach, ensuring that buildings are enhanced, where feasible to improve energy efficiencies.

6.3.5 In this instance, there is an opportunity to increase the thermal mass of the roof make-up, which will offer increased u-values, as well as significantly improving air tightness.

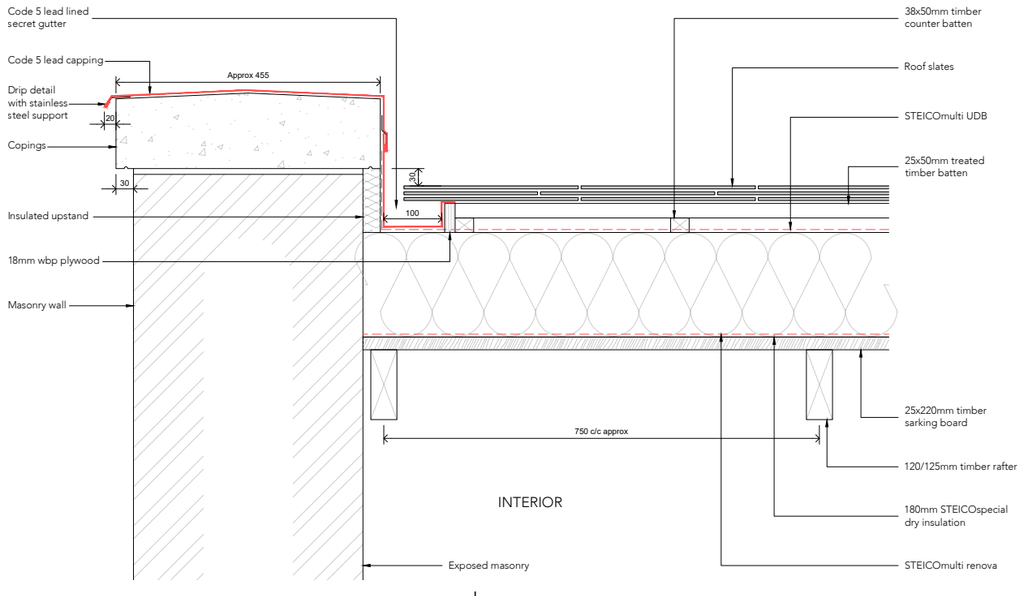
6.3.6 This will result in the overall roof depth being increased to incorporate the insulation, a sustainable wood fibre insulation. The exterior appearance will see no change from a materialist perspective but will of course result in the ridge heights being raised. A similar wood fibre product has been installed at the Power Hall building, to the south of the New Warehouse.

6.3.7 This has been carefully considered with secret gutters introduced at the interface with the perimeter raked gables. The pitched roofs will not extend above the exterior masonry elevations.

6.3.8 Introducing insulation across the interior was never a consideration, due to the exposed and beautifully crafted timber structure and sarking boarding. There will be no change across the interior, other than where rooflights / skylights have been overslated and minor modification between gutter bearers at outlet / sump locations.



Roof Valley Gutter Detail as proposed - Slate to Slate - Not to Scale



Roof Parapet Detail as Proposed- - Not to Scale

6.4 Materials & Appearance

6.4.1 The visual impact of the proposal is minimal, and any difference can be considered a positive as the current condition of the roof is very poor.

6.4.2 New blue / grey slates have been identified to match existing in colour

6.4.3 The existing slates are coursed. The size of the new slates will be in a smaller more readily available format.

6.4.4 The new stepped and tapered valley gutters and box gutters will be lined with lead, with lead mushroom vents into each lead bay.

6.4.5 The sole remaining access portal will be constructed from timber and clad in lead sheets with a timber external grade door.

6.4.6 All elements and components to be redecorated will undergo a colour sampling and selection process.



Roof slate sample



Existing roof slates and arrangement

6.5 Rooflights/Skylights

6.5.1 The existing modern velux type rooflights were installed during the 2010 refurbishment.

6.5.2 The slot of skylights to the south are understood to have been installed between 1987-88.

6.5.3 Analysis of existing archival material, in this case, historic photographs, suggests that skylights were installed, orientated to match the direction of the ridge, to west roof pitches only. It is unknown if they were included across every west roof pitch.

6.5.4 However, there appear to be no remnants of this arrangement visible internally across the second floor plate sarking boarding or roof structure, no scarring or markings across sarking boarding or roof structure. Apertures have been infilled in the past with new timber rafters and sarking boarding.

6.5.5 It is proposed to remove the vast majority of current rooflights across the roofscape, with skylights to be reinstated over the internal atriums only.

6.5.6 New skylights / patent glazing is to be installed with new double-glazed units and lead flashings and ridge.

6.5.7 Where existing rooflights and skylights are not proposed to be reinstated, these will be overslated, involving the installation of new timber rafters and sarking boarding to match the original arrangement internally. Sarking boarding and timber to be sized to match existing arrangement.

6.5.8 The omission and reduction of rooflights and skylights will offer much greater flexibility and use of space internally, as well as increased thermal and acoustic benefits.



NW Second Floor 1987



NW Second Floor Learning Loft



NW Second Floor crash deck



Typical photographs of underside of sarking boarding



NW Second Floor small meeting room

6.6 Roof Access & Maintenance

6.6.1 The maintenance and cleaning strategies for the existing building must take into account the buildings Grade II listed status.

6.6.2 There will be stepped lead lined gutters across the valley gutters, lead lined box gutters within the parapets with the pitched roofs covered in slate.

6.6.3 At present, the roof is not readily or safely accessible and can only be accessed by commissioning external roof access contractors.

6.6.4 Access can be gained internally via two access portal locations but are deemed to be unsafe / precarious. Access here requires the provision of loose / unfixed ladders, with the requirement to then climb up and over obstacles, such as plant and equipment.

6.6.5 The proposed renovation and roof replacement works provide the opportunity to incorporate permanent safe access points and equipment, providing the client estate management team with the most optimum arrangement. This will allow for any potential unforeseen issues to be dealt with in a timely and reactive manner, as well as providing suitably safe access to undertake cyclical maintenance tasks, such as removing any debris from gutter outelts, cleaning of skylights, as well as providing up close access to the building fabric for completion of all other general maintenance duties.

6.6.6 The proposal is to reinstate the original primary access point to the northeast corner of the warehouse, accessed from the northeast stair core internally. . A fixed metal vertical ladder is already insitu, accessed directly from the stair mid landing. This provides access to a small external access hatch, which provides access to the flat roof over the modern café extension to the east. The proposed works will see the installation of new edge protection on this roof and the replacement of the dilapidated metal vertical hooped access ladder, on a like-for-like basis.

6.6.7 Once at roof level, a new aluminium access platform will be provided, to provide a suitable access deck for transfer to the parapet box gutter.

6.6.8 The surface treatment within the parapet box gutters will be improved by removing two courses of slate and extended lead sheets up the slope of the roof. This will provide a more suitable and robust surface for foot traffic, limiting impact damage upon the roofing slates.

6.6.9 A fall restraint cable will be fixed back to the roof structure, providing a secure fixed horizontal transfer point for the roofing contractor(s).

6.6.10 The old timber up and over ladders will be removed and replaced with a new aluminium fixed up and over stepped access gantry, with handrails and kick plates to either side, this will meet and fully comply with the Work at Height Regulations, providing full collective protection. The gantries will be located within a central location, vastly restricting and limiting visibility from ground level or other vantage points.

6.6.11 Aluminium balustrading will be provided across valley gutters where skylights are reinstated.

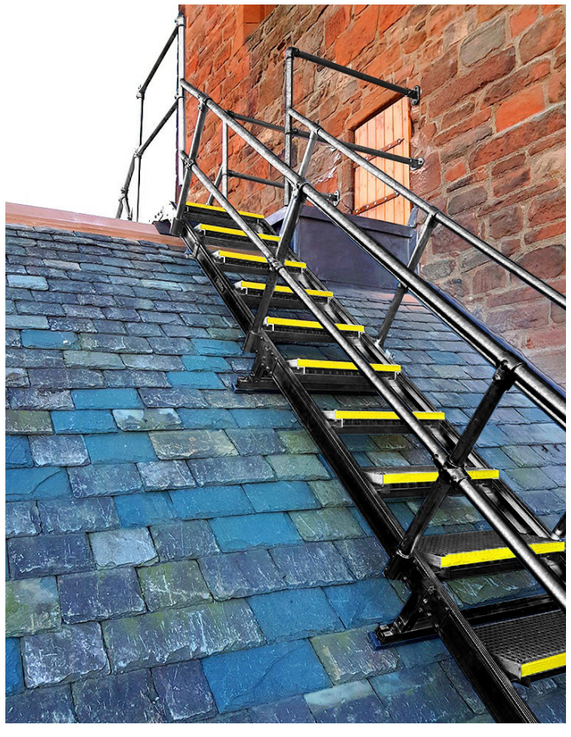
6.6.12 A lanyard / mansafe type system will be installed along all parapet box gutters and within valley gutters to provide access to sumps and catchment pits where the existing perimeter parapet and raked gables to not provide adequate protection from a fall from height.

6.6.13 All access portals are to be removed, apart from one access portal which is to be reinstated to the middle of the roof footprint to the north. This will be used as a secondary roof access point, to be used as access / egress in the event of an emergency.

6.6.14 The access portal will be clad in lead externally with a timber external grade lockable door. A new fixed metal hooped vertical ladder will be installed internally to provide access to and from the second floor plate.



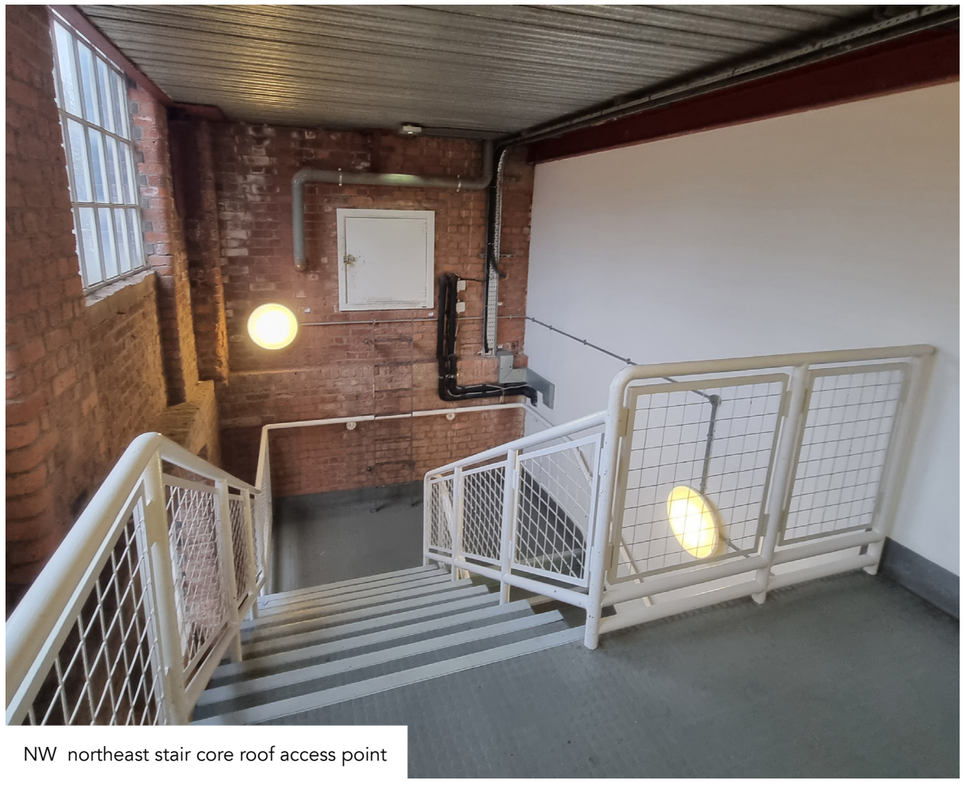
Example fall arrest cable system, with anchor points fixed through lead sheets into the structure, encapsulated and weathered with lead. The photo also illustrates the proposed use of discrete lead roof vents, which will be installed to provide cross ventilation across the parapet gutters.



Example of a metal up and over access ladder over a slate roof



Example of a metal up and over access ladder over a slate roof



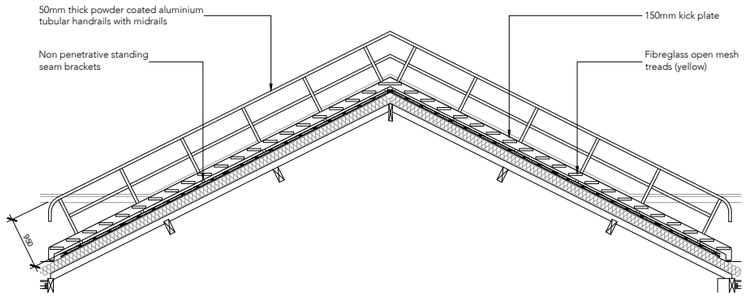
NW northeast stair core roof access point



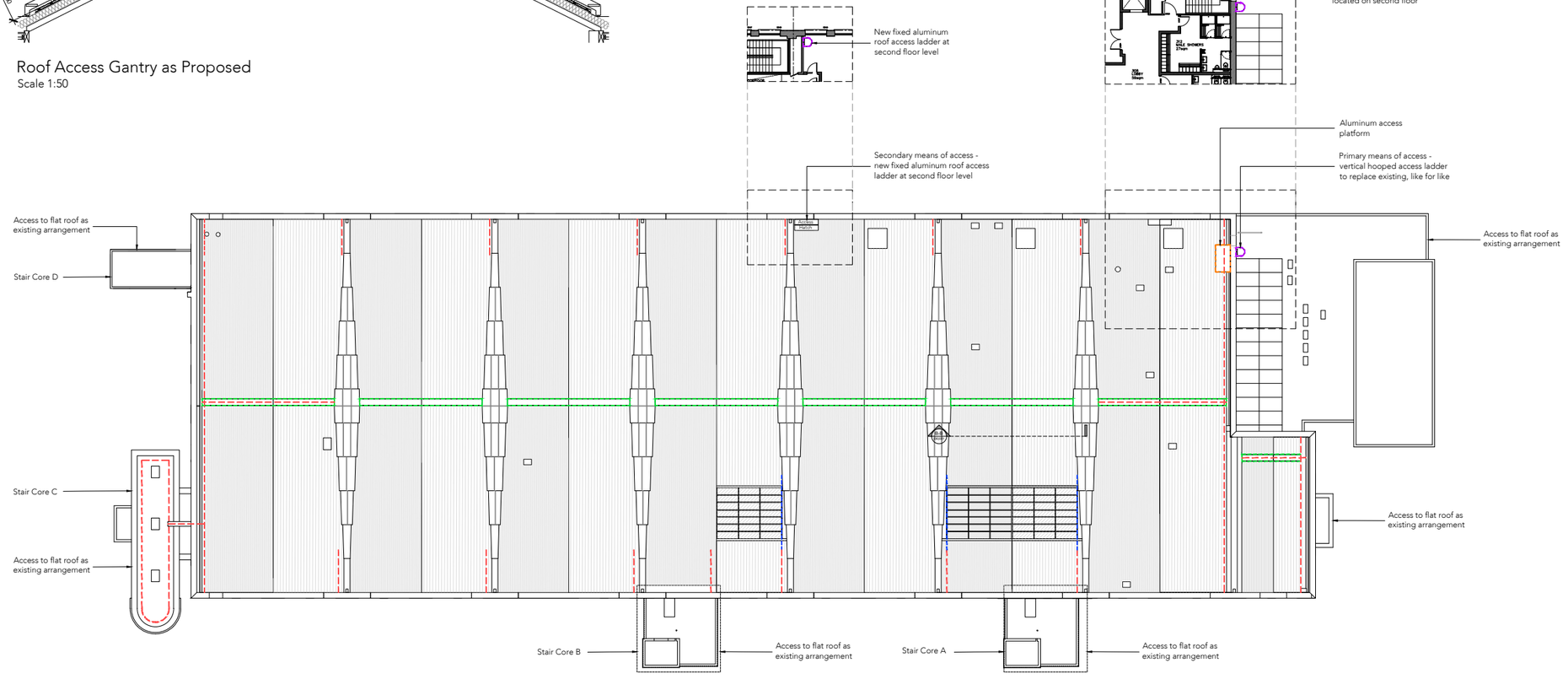
NW roof access point



Example of a roof access portal, clad in lead with a hardwood door



Roof Access Gantry as Proposed
Scale 1:50



Roof Access Plan as Proposed
Scale 1:200

Connection to Building Superstructure

As per structural engineer design to ensure safe transmittal of walking/platform/ladder loads to main building structure.

DESIGN INTENT

This drawing is indicative of design intent for tender purposes only. Completion of detailed design is to be undertaken by sub-contractor as required by CDP and detailed in Employers Requirements

KEY

- Clip in fall restraint guide system
- Fixed Aluminium barrier across skylight to extend 500mm beyond skylight edge (each side) with vertical posts, intermediate and top rails
- Aluminium walkway steps at 600mm wide to suit roof slope, complete with handrails, intermediate rail & kick plates to both sides with contrasting treads
- Aluminium access platform
- Galvanised vertical access ladder with hoops

0 0.5 1.0 cm
0 0.5 m 1.0 m 1.5 m 2.0 m 2.5 m 3.0 m 3.5 m 4.0 m 4.5 m 5.0 m
1:50

0 0.5 1.0 cm
0 2.0 m 4.0m 6.0 m 8.0 m 10.0 m 12.0 m 14.0 m 16.0 m 18.0 m 20.0 m
1:200

6.7 Fabric Repairs

6.7.1 Due to the extensive access scaffolding provisions required externally to facilitate the roof replacement project, there is an opportunity to carry out fabric repairs across the entire masonry envelope.

6.7.2 These works will generally include the following:

- Repointing
- Conservation clean of soiled surfaces
- Removal or organic growth, soft vegetation
- Stone and masonry indents / replacements
- Other masonry and stone repairs
- Redecoration of metalwork, features
- Redecoration of windows and doors
- Redecoration of timberwork, joinery items
- Improved flashings and weathering's
- Replacement of flashings, weathering's with lead
- Existing raking and horizontal copings to be capped with lead sheets
- Ensure no areas of ponding and water is free flowing

6.7.3 Fabric repairs across the inner face of the masonry raked gables and parapets, as well as across the interior spaces of the SEG are also included within the conservation works.

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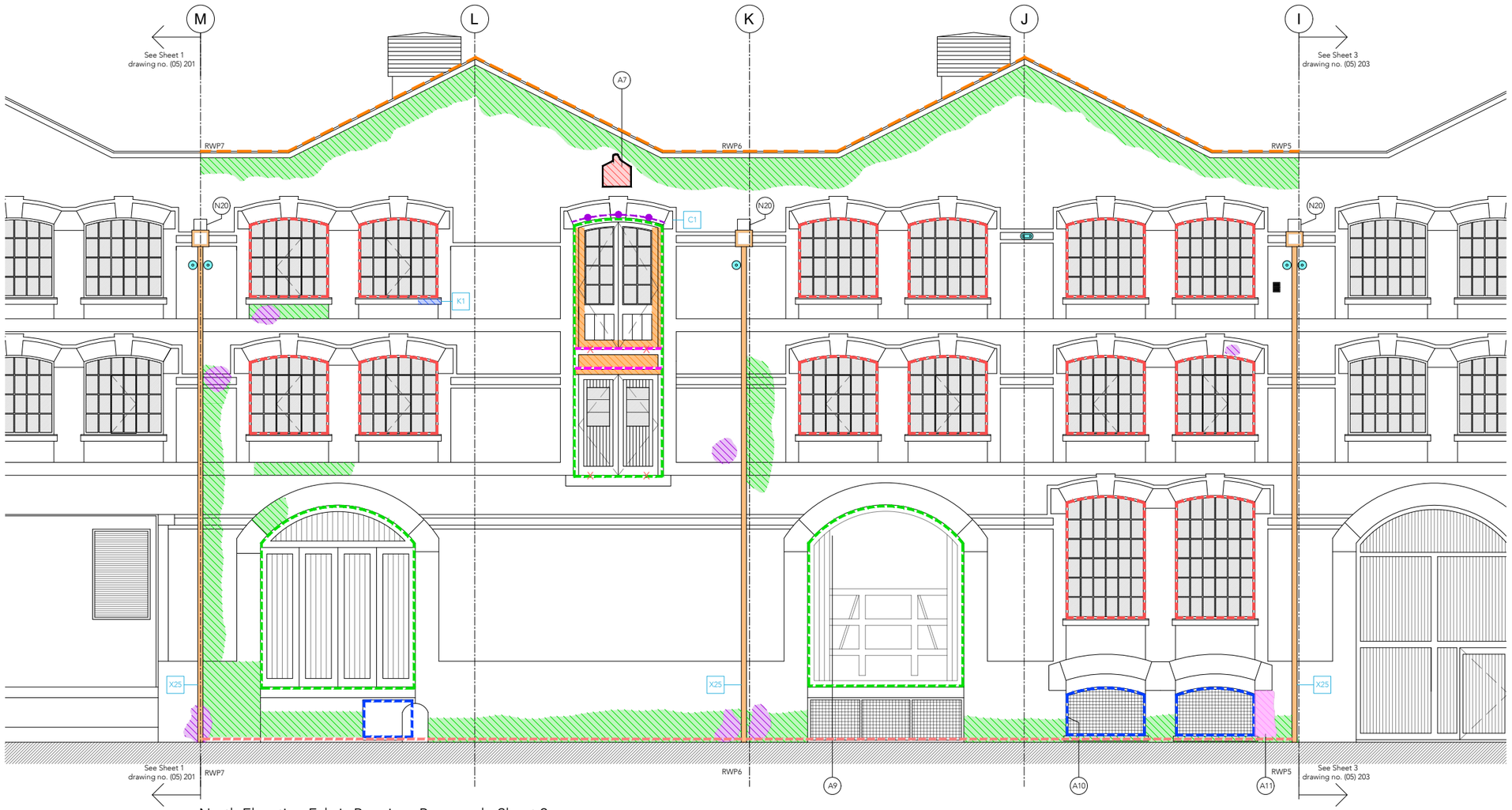








Key Plan
NTS



North Elevation Fabric Repair as Proposed - Sheet 2
Scale 1:50

0 0.5 1.0 cm
0 0.5m 1.0m 1.5m 2.0m 2.5m 3.0m 3.5m 4.0m 4.5m 5.0m
1:50

KEY

- Rake out and repoint
- Stone repair
- Redress stonework
- Cut out & replace defective masonry
- Mortar repair
- Cut out & replace timber like-for-like
- Prepare and redecorate metal features
- All existing rainwater goods, hoppers etc to be removed & replaced with cast aluminium. Hopper to be bespoke & match existing
- Prepare & redecorate exposed ferrous flange/lintel full length
- Prepare & redecorate timber louvres + metal grillage
- Prepare & redecorate timber features, door, windows etc
- Prepare & redecorate metal framed windows
- Lead sheet capping across coping stone
- Supply & fix code 5 lead cover flashing
- Remove & replace defective low level render like-for-like
- X Remove ferrous/steel embedded fixing elements and repoint with a suitable mortar
- N1 Install helical bars to stepped crack
- N2 Remove graffiti
- N3 Mortar fill hole
- N4 Mortar fill 2 holes
- N5 Replace defective timber louvre blade for full length
- N6 Remove & dip 2nr metal brackets
- N7 Infill opening with masonry
- N8 Carefully remove vertical access ladder & replace
- N9 Prepare & redecorate pin and bracket
- N10 Replace bricks to reveal
- N11 Rebuild reveal
- N12 Prepare & redecorate timber beam and ferrous fascia plates/surround
- N13 Cut out & redecorate 6nr bricks to arch
- N14 Replace cill/beam full length
- N15 Prepare & redecorate ferrous brackets
- N16 Prepare & redecorate 2nr ferrous pins and plate
- N17 Build up raked gable with copings to match South elevation
- N18 Extend existing masonry parapet to match and align with South elevation
- N19 Inspect all lead flashings with cafe skylights and facades
- N20 Code 7 lead overflow chute/spitter

6.8 Rainwater Goods

6.8.1 The poor quality upvc recessed rainwater pipes to the north and south façades will be replaced with aluminium heritage type downpipes and bracketing. The locations and quantities will match existing. The new downpipes will incorporate rodding points at the base to aid access for routine maintenance.

6.8.2 The existing recessed hoppers are suspected to contain asbestos containing materials and as such are proposed to be replaced with aluminium, sizes, and profiles to match existing.

6.8.3 Each roof outlet will incorporate and include a new lead chute, connected to the valley and parapet gutters to aid as a visual warning, in the event that an outlet becomes blocked.

6.8.4 The re-roofing works will impact upon the internal environment and as such environmental monitoring is recommended to be commissioned and implemented, if this is not already available or live.

6.8.5 The removal of the roof and exposure to the elements will see variable changes across internal temperatures and humidity levels, which will not only impact general comfort but can have a severe impact upon the building fabric and any collections / exhibits, where rapid differential changes may adversely affect the composition of an element or component.

6.8.6 SEG West Yard

6.8.7 It is proposed to lift all external surfaces across the west external yard to facilitate access to undertake waterproofing works across the concrete slab / capping.

6.8.8 Existing surface treatments, such as stone cobble setts and railway tracks are to be carefully lifted, stored onsite, ready for reinstatement.

6.8.9 Modern macadam and surfaces are to be broken out and removed.

6.8.10 The existing concrete raft, plant and equipment is to be retained insitu, as the museum is to remain fully operational for the duration of the construction works.

6.8.11 A new waterproofing system is to be installed across the exposed concrete pad, following proprietary works and any necessary concrete repairs, with concealed flashings and upstands across interfaces and abutments.

6.9 Proposed Cross Section

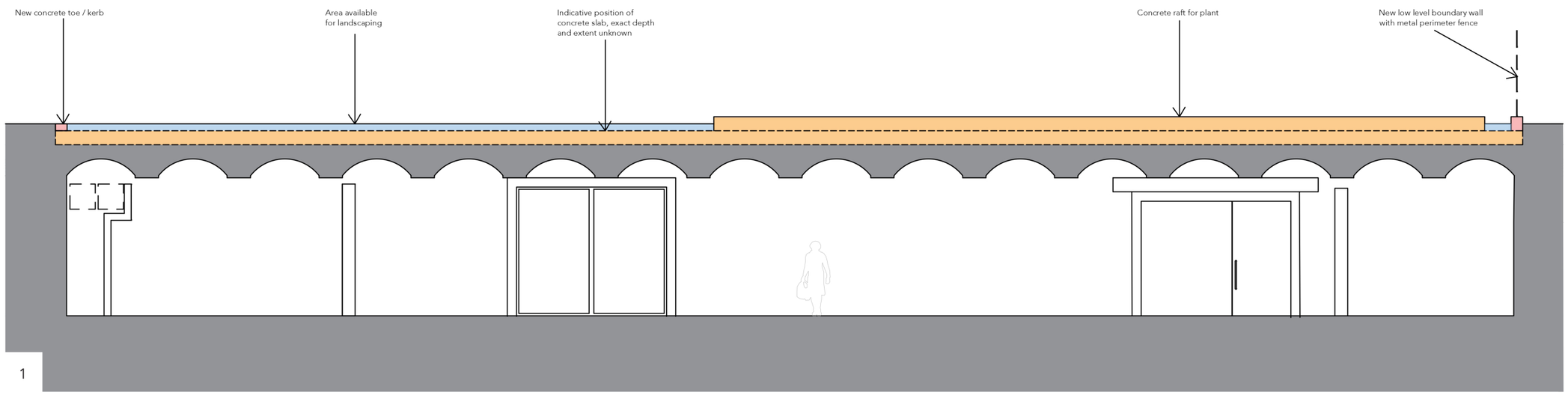
6.9.1 The adjacent proposed section highlights the separate individual elements that will make up the final SEG waterproofing solution.

6.9.2 The existing concrete slab (orange fill) will remain in its current form and will be appropriately prepared for the installation of a waterproofing system.

6.9.3 As part of this scheme, the concrete raft which houses the plant will remain insitu. If the plant and equipment is retained insitu during the waterproofing works, it will be difficult and highly unlikely that a guaranteed waterproofing system will be provided.

6.9.4 New kerb upstand / low level boundary wall with perimeter fence (red fill) is proposed around the perimeter of the West yard to accommodate the waterproofing system.

6.9.5 The area shaded in blue is the zone that remains for the Landscape Architect to put forward suitable proposals.



1. Section showing proposed elements.

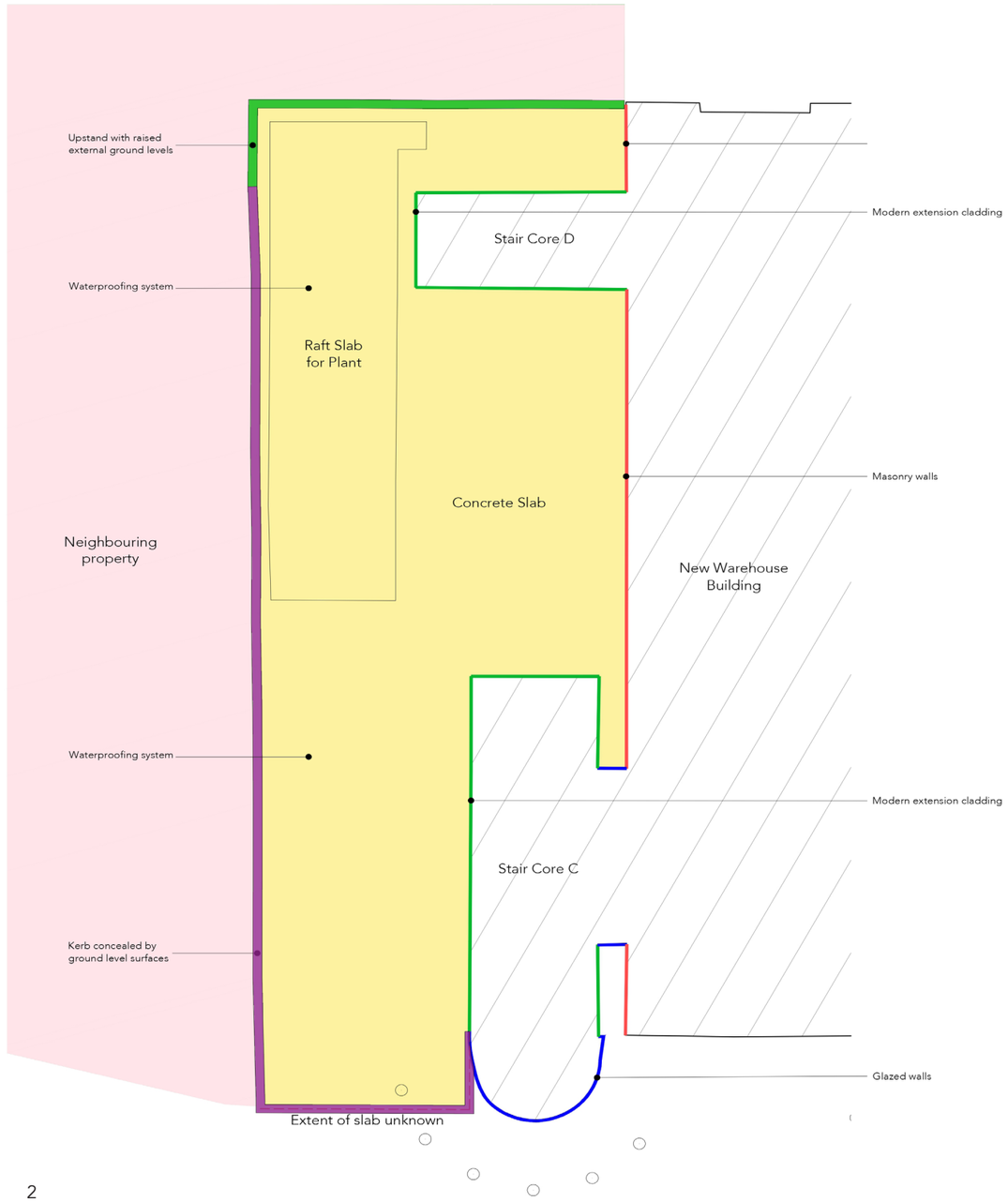
Not to scale - Note: for more detailed drawings - refer to the full drawing package.

6.10 Proposed Slab Level General Arrangement Plan

6.10.1 The proposed general arrangement plan illustrates the extent of the proposed waterproofing system highlighted with yellow fill, which is to extend across the entire concrete slab, drainage channels and external zones.

6.10.2 The waterproofing solution will be appropriately lapped and flashed at the abutment with the existing masonry walls to the west elevation of the New Warehouse including projecting modern extensions.

6.10.3 The vertical substrates at the abutments are predominantly masonry, highlighted with red lines. In addition there will be a requirement to provide a wind and watertight seal / flashing with the modern extension (green lines) and glazed screen (blue lines). A complete watertight solution will be difficult to facilitate to the north and west abutments with the neighbouring properties (pink fill).



2

2. Plan showing proposed waterproofing system.

Not to scale

6.11 SEG Waterproofing System

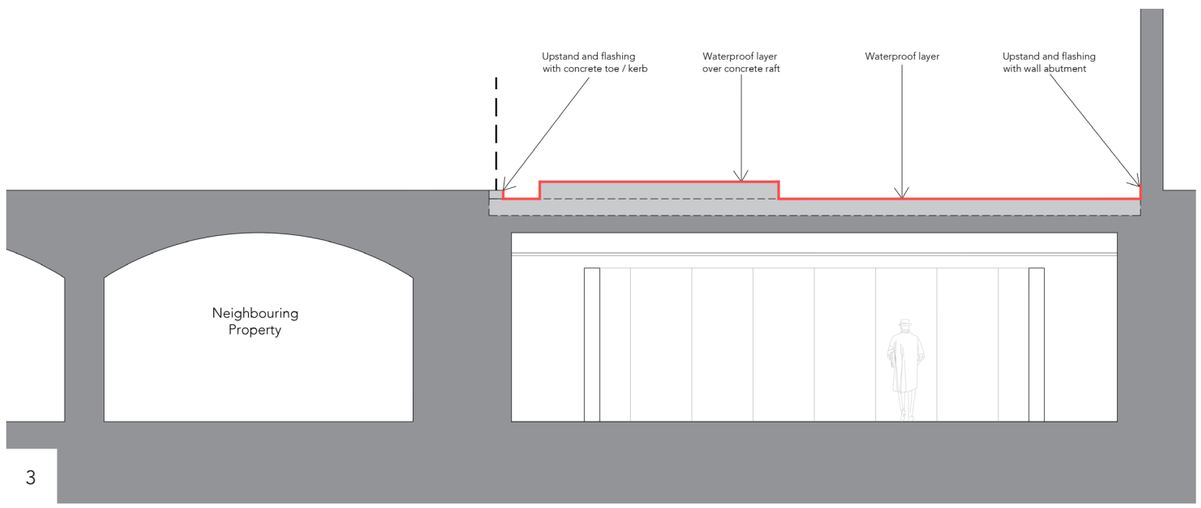
6.11.1 Due to the concrete slab being concealed and hidden, masked by external hard surfaces, the exact arrangement and true extent of potential defects and remediation works across the slab will remain unknown, until said surfaces have been carefully lifted, exposing the concrete surfaces below.

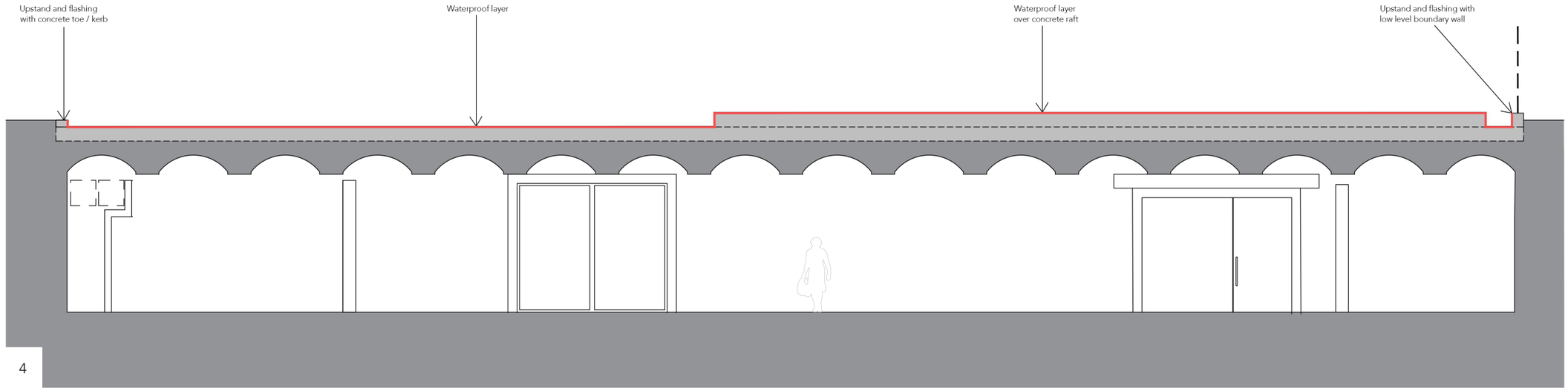
6.11.2 Localised investigations have been undertaken within focused areas, as reported in an earlier section. The areas of the slab exposed appear to be in reasonable condition, however this only provides a small snapshot across a very small percentage of the total surface area of the slab.

6.11.3 It is likely that the waterproofing solution will likely be a hybrid approach using both a spray and membrane solution. It is important to note that the final solution will be dependent on what is uncovered and therefore the final solution and interfacing arrangement may differ from those presented.

6.12 Cross Sections

6.12.1 The adjacent sections illustrate the extent of the proposed waterproofing system. Hard surfaces and finishes have been hidden for graphical purposes.



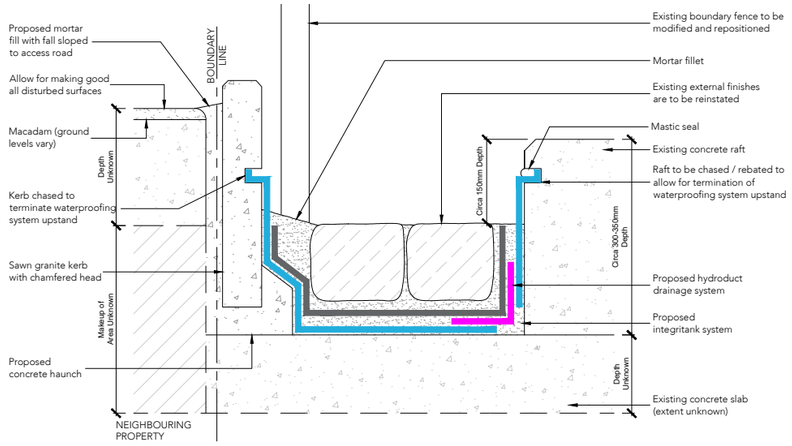


3. Typical short section showing proposed waterproofing system.
4. Typical long section showing proposed waterproofing system.

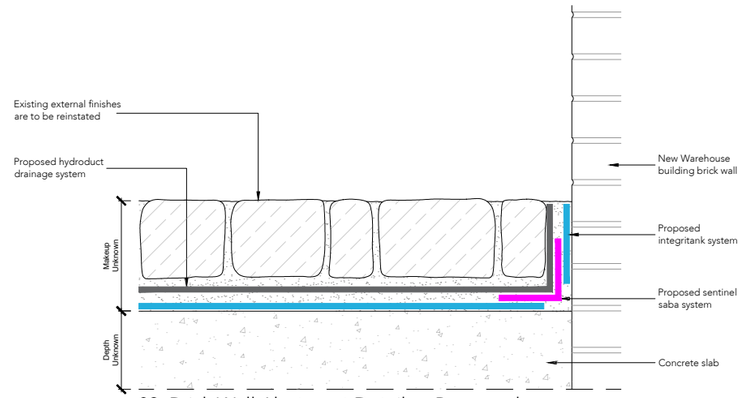
Not to scale - Note: for more detailed drawings - refer to the full drawing package.

6.12.2 Following installation of the waterproofing system, the existing landscape treatment is to be reinstated to match pre waterproofing arrangement.

6.12.3 The pictures adjacent are examples of these solutions being applied.

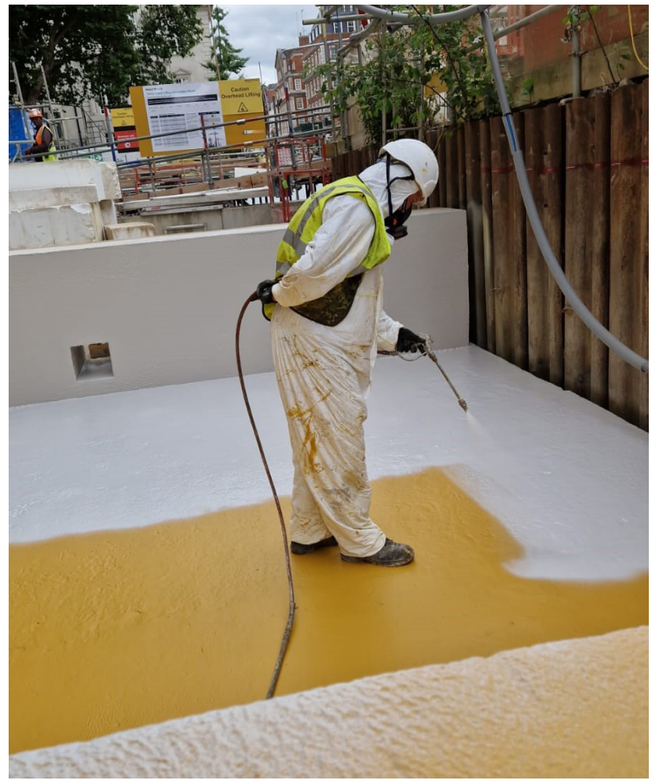


07. North Boundary Detail as Proposed



09. Brick Wall Abutment Detail as Proposed





6.13 Entrance Portal

6.13.1 The existing shallow sloped glass canopy and supporting structure fixed over the Stair Core C main entrance doors at ground level is to be removed and replaced with a larger solid enclosure includes sides.

6.13.2 The current arrangement provides limited to no protection to the interior circulation lobby from the transfer of water. Water is brought into the lobby underfoot as well as being susceptible to driving rain.

6.13.3 This location is unique in that there is an internal area, below ground level, that sits outside the protection of the masonry superstructure and footprint. This has been identified as a weakness in the original design of the extension, as surface water separation has not been incorporated.

6.13.4 Water works its way into the interior, either underfoot or driven, settles into the barrier matting and subsequently can migrate through the ground floor plate, down into the lower ground floor area.

6.13.5 The lower ground floor area currently houses the Special Exhibition Gallery (SEG) visitor entrance as well as being on a primary circulation route.

6.13.6 The proposal allows for the removal of the glass canopy and supporting framework and looks to retain the existing automated sliding double doorset and curtain glazing arrangement.

6.13.7 A bespoke tailored solid steel entrance portal will be fabricated offsite, then brought to site, fixed, and installed to the concrete slab below the cobble setts. The portal will not be directly connected to the existing transoms and mullions but be set off by approximately 10-15mm. The only physical interface will be the canopy, interfacing with the rear gutter at the abutment with the existing curtain glazing solid panel, above the doorset. Rainwater will be ejected either side of the entrance portal to ground.

6.13.8 Solid steel plates / ribs will be welded to the external surface of the portal, to break up the flush surface, as well as providing strength to the self-supporting structure.

6.13.9 The entrance portal will incorporate lighting, signage, as well as an external matwell, fixed within the internal portal footprint, to aid and limit the transfer of dirt and water throughout the interior. Existing external surface treatments are to be reinstated, including stone cobble setts.

6.13.10 The enclosure will be constructed from a blackened steel with surface patination as shown below.

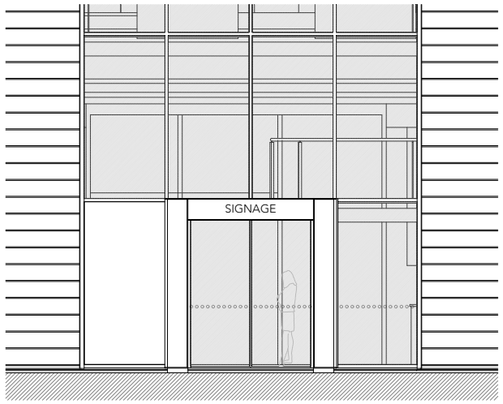




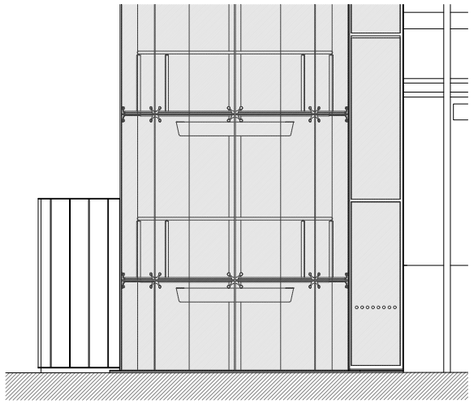




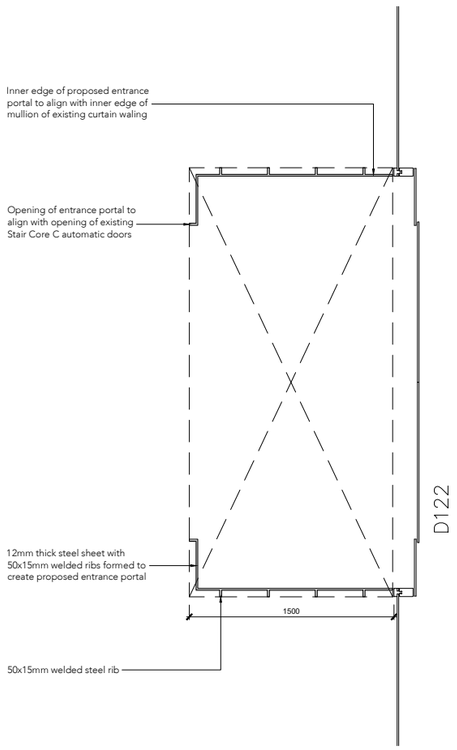
Existing arrangement



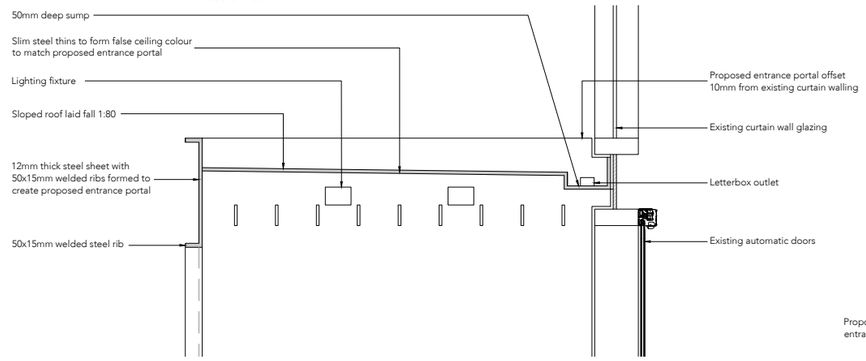
Stair Core C Entrance Front Elevation as Proposed
Scale 1:50



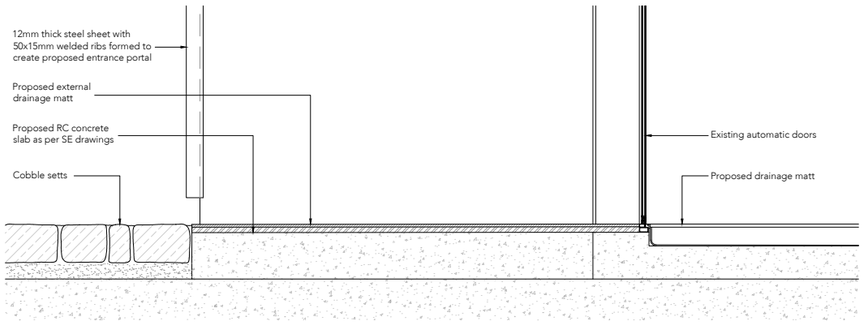
Stair Core C Entrance Side Elevation as Proposed
Scale 1:50



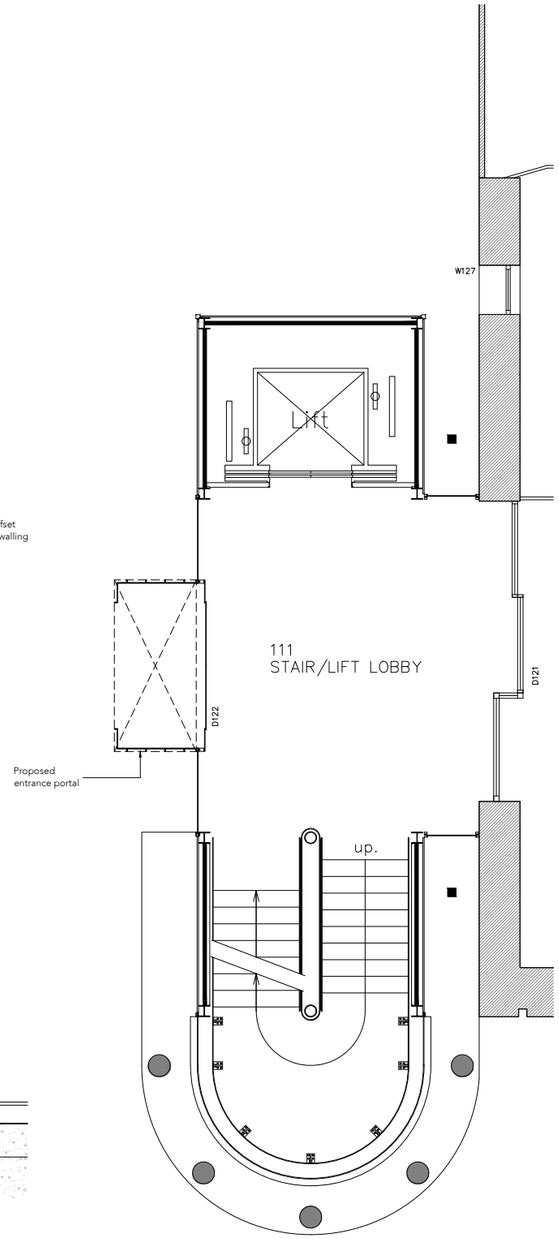
Stair Core C Entrance Plan as Proposed
Scale 1:20



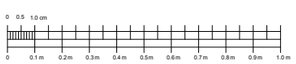
Stair Core C Entrance Roof Detail as Proposed
Scale 1:10

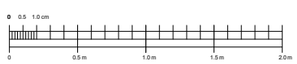


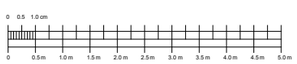
Stair Core C Entrance Floor Detail as Proposed
Scale 1:10



Stair Core C Plan as Proposed
Scale 1:50









6.14 Limitations and further considerations

6.14.1 Percentages and quantities identified are based upon information received or access provided to date and as such cannot be deemed as being wholly accurate.

6.14.2 Insulation thicknesses are subject to further analysis, to inform potential interstitial condensation risks.

6.14.3 The true condition of the substrate below the roofing slates and gutter finishes is unknown. There is evidence of historic staining and soiling internally, likely as the result of major water ingress issues in the past. Water ingress is ongoing within localised areas across the roofscape, with loose rainwater collection buckets / bins placed reactively, when a new or active leak appears.

6.14.4 At this stage, only a single area of roof has been opened up for invasive inspection at roof level, so as to not introduce any more weaknesses or temporary waterproofing issues. The inspection was focused within an area of the valley gutter, the survey identified that moisture is trapped between existing layers with evidence of wood rot. This may be isolated, however, the full extent of rot, leading to potential timber repairs and/or replacement is unknown at this time and is highlighted as a potential risk item.

6.14.5 The wholesale repointing across the exterior façades has not been included. The pointing across the elevations appears to be in reasonable condition generally, with localised failings across weathering's and/or at high level.

6.14.6 Recommendations thus far are that repointing is undertaken locally only.

6.14.7 The proposed mortar mix will require careful consideration and sampling, likely involving the completion of mortar analysis across the existing fabric. It will be advantageous to repoint any defective areas with a suitable lime-based mortar.

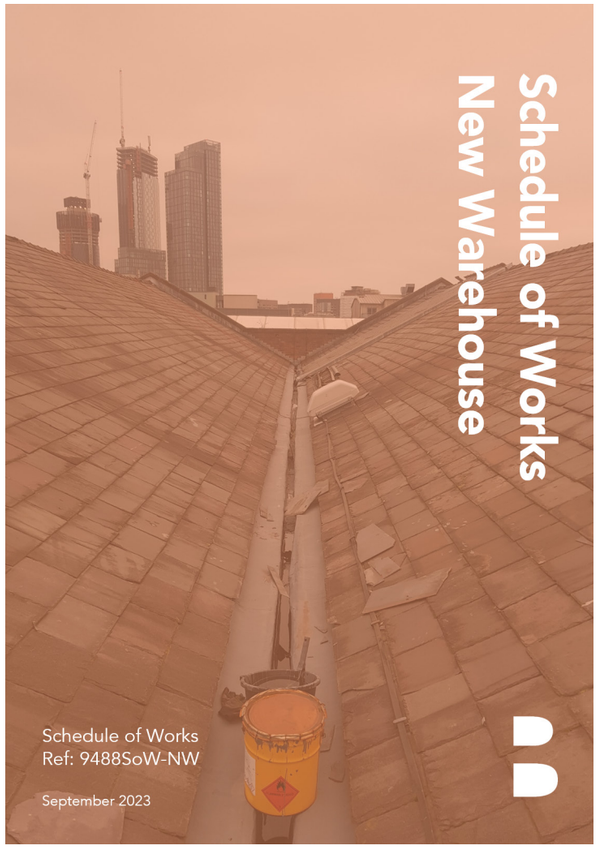
6.15 Schedule of Works

6.15.1 General

6.15.2 A separate schedule of works document is included in the application documents and outlines all the envisaged work items across the New Warehouse roof, elevations, and west yard.

6.15.3 The schedule also refers to the accompanying Architectural Restoration specification.

6.15.4 All specifications, schedules, reports, and drawings must be read in conjunction with this Design and Access Statement.





7.0

Logistics

7.0 Logistics

7.1 Access & Scaffolding

7.1.1 The New Warehouse and museum site complex will remain fully operational and open to the public as the works progress.

7.1.2 The public will continue to have access to lower ground, ground and first floor areas. Access will be maintained across back-of-house areas for museum employees and tenants.

7.1.3 All entrance and exit points are to be maintained as well as all fire escape routes around the external perimeter of the building.

7.1.4 The proposed works across the roofscape are extensive and invasive and will leave the interior of the building fabric exposed and vulnerable to the elements.

7.1.5 A full perimeter access scaffold will be required including the provision of a full temporary roof over the entire masonry footprint to provide access to undertake the works, as well as offering protection against the weather.

7.1.6 As the proposed works across the roofscape will be noisy, highly disruptive with a fluctuating internal environment, the second floor is to be decanted and left empty for use by the contractors during the contract. This level will be restricted to employees.

7.1.7 The interior environment will likely be noticeably colder, as a result of the proposed works.

7.1.8 The New Warehouse is located to the northeastern corner of the Science Museum estate, with the south and west elevations facing out onto the Upper and West Yards. The east elevation faces onto a public pedestrian zone and is used as the primary public entrance with the adjacent café.

7.1.9 The New Warehouse is constrained to the north elevation, built tight to the boundary line with a neighbouring private access road and land. Access to erect a scaffold along this road will be agreed and negotiated with the adjacent landowners. The erection process is likely to be disruptive and out of sequence along this elevation.

7.1.10 This elevation in particular will require careful consideration when fixing and erecting a scaffold, capable of providing access to complete the works, as well as being able to take all imposed loadings.

7.2 Protection

7.2.1 Due to the invasive nature of the external works, exposing the interior to wind and water ingress there will be a requirement to adequately and thoroughly protect the interior of the building during this period.

7.2.2 The works proposed are currently confined to the roof, impacting directly upon the second-floor plate and indirectly across remaining floor levels.

7.2.3 The roof substrate has the benefit of having sarking boarding installed as existing. This will limit the transfer of dust and debris throughout the interior spaces, as well as providing a safe access deck for contractors to work above and below.

7.2.4 There will be a requirement to install temporary crash decks and/or netting across the interior, below any apertures across the roofscape.

7.2.5 Dust and debris will undoubtedly migrate and work its way into the interior and as such, any loose fixtures and fittings (tables, chairs, storage, electricals etc) will need to be suitably stored and protected via the use of appropriate dust sheets etc.

7.2.6 Fixed items, floor finishes etc will also require suitable protection.

7.2.7 The second-floor plate currently has a number of voids (atriums), which are open and linked to the floors below. These voids will require being temporarily and suitably tented / sealed to limit the transfer of dust and debris throughout the museum, as well as limiting heat loss through the roof.

8.0

Summary

8.0 Summary

8.1 Summary of proposals

8.1.1 The proposal, would represent a significant improvement across the status and condition of the New Warehouse building, serving to provide a wind and watertight external envelope which would protect the warehouse structure, its interior and exhibits and collections nestled within, as well as incorporating essential upgrades and fabric repairs, securing its future for years to come.

8.1.2 The scheme would sensitively respond to the Grade II listed asset with minimal visual impact to the museum estate, whilst also providing numerous benefits to the building, including:

- A wind and watertight external envelope, restricting further degradation.
- Enhanced heritage.
- Protect and secure heritage asset for years to come.
- Building fabric repaired including structural enhancements.
- Significant thermal performance enhancements, to make a more sustainable asset.
- Appropriate ventilation requirements provided where necessary.
- Upgrades to provide safe ready access to the roof, to ensure frequent maintenance tasks can be undertaken.
- Aesthetic enhancement across the external appearance of the New Warehouse building.
- Increased performance of surface water management system.
- Widening roof gutters to increase capacity and flow rates, which in turn will improve access for routine maintenance.
- Visual warning system, identifying potential blockages provided over outlet locations.
- Introduction of access / rodding points across rainwater goods to improve maintenance tasks.
- Replacement of inferior / poor quality weathering's, flashings, and coverings with more suitable and robust products.
- Leadwork installed to appropriate standards.
- Improved detailing and interfacing.
- Access to carry out timber and/or other repairs across areas not previously accessible or visible.

Buttress

Architects | Masterplanners | Heritage Consultants