2ND RECONAISSANCE DAMP AND TIMBER DECAY SURVEY

GREAT NORTHERN, MANCHESTER

JOB NO. 211.18



GNW DEVELOPMENT LTD

30 MAY-1 JUNE 2022

Prepared by:	Technical review by:	Administration by:
Chris Whitfield	D P Bannister	Joanne Clegg

© Copyright Hutton+Rostron, 2022

CONTENTS

1 Introduction

2 Executive summary

3 Observations *and Recommendations*

4 General recommendations

Appendices

A Common decay organisms

B Specialist search techniques and their limitations

C Remedial building works and environmental control

D Maintenance and monitoring

E Photographs

F Plans

Hutton+Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA,
Tel: 01483 203221 Email: ei@handr.co.uk Web: www.handr.co.uk

© Copyright Hutton+Rostron, 2022

1 INTRODUCTION

1.1 AUTHORITY AND REFERENCE

Hutton+Rostron Environmental Investigations Limited carried out a reconnaissance damp and timber decay survey at the Great Northern (Railway Company's Goods Warehouse) in Manchester on 30 May-1 June 2022 in accordance with instructions received from Adam Linard of 2110 Consult by email dated 22 April on behalf of GNW Developments Ltd. Reference was made to drawings supplied by Simpsonhaugh, reference 10161 for the identification of structures. For the purpose of orientation in this report, the Great Northern was taken as facing north

1.2 AIM

The aim of this investigation was to make a 2nd Reconnaissance Survey to identify potential damp and timber decay problems or relevant building defects that will require specialist investigation

1.3 LIMITATIONS

This survey was confined to the accessible structures. Structures were not examined in detail except as described in this report, and no liability can be accepted for defects that may exist in other parts of the building. We have not inspected woodwork or other parts of the structure which are covered, unexposed or inaccessible and we are therefore unable to report that any such part of the property is free from defect or, in the event that such part of the property is not free from defect, that it will not contaminate and/or affect any other part of the property. The contents of this report do not imply the adoption of the role of Principal Designer by H+R for the purposes of the Construction (Design and Management) (CDM) Regulations 2015

1.4 H+R STAFF ON SITE

Chris Whitfield

1.5 PERSONNEL CONTACTED

Michelle Lusiola - Operations Manager (The Great Northern Warehouse)

© Copyright Hutton+Rostron, 2022

2 EXECUTIVE SUMMARY

2.1 EXTERIORS

1 Roof: The roof finishes were of relatively recent origin. Patch repairs of broken slate had been undertaken since 2017 using a synthetic slate but numerous breakages remained. Although extensive repairs to slate work were required due to damage caused by access and vandalism, the coverings are regarded as serviceable. Repair works are required to the masonry of the central parapet wall to reduce water penetration and also to the perimeter parapet walls to preserve the masonry fabric. The gutter boards to the south of the east parapet and centre of the north parapet were spongy and probably decayed by wet rot

2 Elevations: Façade materials were generally in serviceable condition. However, detailed surveys of the condition of brickwork and other features, particularly at high-level, to the west elevation and to the base of the walls generally was required. An original rock asphalt DPC was present at the base of the walls but this had been 'bridged' by the raising of the street levels to Watson Street. It's probably impracticable to alter the external levels. Therefore, subject to detailed investigation, any resultant increased material moisture contents at the base of the walls to the east of the building should be mitigated by management, including maximising evaporative loss of moisture, especially from any voids or cavities created by interior architecture

2.2 INTERIORS

1 Roof: The roof structure comprised traditional purlin and rafter arrangements supported by timber queen post trusses on brick walls, valley beams and columns. All timbers were of softwood timber species. Several locations of active, recent or historical water penetration were identified (see Drawings at Appendix F) . Timber decay should be specifically investigated in these locations using means appropriate to the construction and its Listed Status. A truss tie beam to the south of the east parapet wall appeared to be structurally decayed and required propping. Abundant steel flitch plate repairs indicated a history of water penetration and timber decay. The central parapet wall was a consistent factor in moisture concentration at the valley gutter locations and some timber decay here is probable, now or in the future, if water penetration is allowed to persist. Historical fire damage of the roof timbers at the south-west corner of the building appeared to be superficial. However, formal evaluation of the residual strength of timbers should be undertaken

2 Damp and decay below roof level: Floors were of steel/iron, brick and concrete construction (no timber). No structurally significant timber decay was detected below roof level. Some isolated plumbing leaks were identified that require inspection by a building services engineer but these were relatively minor. However, several of the premises below the NCP car park levels include partition walls, ceilings and floating floors which include timbers. The survey identified a small number of such features where a lack of interstitial ventilation and a moisture source are likely to lead to future damp and decay problems. Whist these may result in localised disruption to the premises concerned, they are not considered structurally significant or particularly detrimental to the historic fabric.

© Copyright Hutton+Rostron, 2022

Many of these finishes are also probably destined to be removed as part of any future redevelopment of the building

© Copyright Hutton+Rostron, 2022

3 OBSERVATIONS *AND RECOMMENDATIONS*

3.1 EXTERIORS

3.1.1 Roof

See Figures 1-14 in the Schedule of Photographs at Appendix E

1 Slates: Several localised areas of damaged slate reported in June 2017 had been replaced with artificial slate, as opposed to natural slate. However, there remained multiple areas of damaged slate especially in close proximity to the perimeter parapet gutter and central valley gutters. There were also breakages in the artificial slate. The damage had been caused by people walking the gutters to undertake maintenance works, as the provision for safe and convenient access was inadequate. There were also isolated areas of damaged slates to the east, which are believed to have been caused by glass bottles thrown from the balconies of the neighbouring Great Northern Tower apartments. However, in the short-term the presence of a roofing membrane beneath the slate battens should stop any water penetration due to broken slates

Allowance should be made for the provision of a roof access system for people undertaking maintenance and other tasks on the roof of the building to improve access without causing damage to the roof slates, e.g., stepped walkways with handrails over the perimeter parapet gutters and over the central parapet wall

Allowance should be made for replacement of all broken natural and artificial slates with a suitably specified natural slate

2 Gutters: Although generally free from biological debris there were some areas of build-up and broken slates allowing rainwater to pool within the EPDM lined valley and parapet gutters. In some localised areas the plywood gutter boarding and upstand was ‘spongy’ underfoot, notably at the southern end of the east parapet for approximately 3m and centre of the north parapet for 2m. The gutter boards were partially decayed in these areas and potentially at risk of failure/collapse if too highly loaded by persons accessing the roof or by snow

Access onto the two areas of decayed gutter should be prohibited until temporary repairs are undertaken or propping has been undertaken from beneath

3 Parapets: The coping stone butt joints were heavily washed-out throughout the perimeter parapet walls and central parapet wall. There was no DPC beneath the copings to the central parapet wall. There was craze cracking throughout the render to the inside face of the parapets which is shrinkage related. However, in some areas the render was defective and had separated from the brickwork revealing washed-out mortar joints behind. Some lead flashings had also separated from the base of the parapet. These defects were allowing water penetration and presenting a hazard to the softwood roof structure beneath. There were multiple buddleia and ferns growing from the central and perimeter parapets, evidence of high moisture levels within the masonry

H+R to carry out detailed investigation of parapet walls and provide recommendations on appropriate repairs

© Copyright Hutton+Rostron, 2022

4 Roof drainage: The roof was drained via raised outlet spigot drains at the end of each valley gutter that discharge into internal cast-iron downpipes which swan-neck into cast-iron hoppers and external downpipes on the east and west elevations. There was no noted evidence of chronic water penetration to the facades associated with the rainwater goods. At ground level, the downpipes drain below pavement level and are accessed via sealed access covers. Although the roof drainage appears to have been relatively well maintained, some outlets were partially blocked with debris and broken slates

Allow for routine inspection and maintenance of rainwater drainage goods. H+R to carry out detailed investigation of rainwater drainage systems and provide recommendation on appropriate repairs, when necessary

3.1.2 North elevation

See Figures 15-17 at Appendix E

1 Brickwork: There were no significant changes since the survey of 2017 other than removal of the advertisement hoardings to the west. In some areas at high-level there were localised areas of spalled brickwork above the lettered "GREAT NORTHERN RAILWAY COMPANY'S GOODS WAREHOUSE" white glazed brickwork. Remaining 'latticed' mortar is evident of a cement-based mortar that is harder than the bricks themselves, resulting in premature deterioration of the bricks

H+R to carry out detailed investigation of facades and mortar analysis and provide recommendations on appropriate repairs

2 Damp-proof course: There is a rock asphalt DPC (damp-proof course) approximately 18mm thick. The DPC steps from 13 no. courses below the plinth brick in the north-west corner to 12 no. courses at the entrance into Lane 7, and to 11 no. courses below the plinth brick at the entrance into Almost Famous. As the ground level rises to the east, the DPC is ultimately bridged by the street levels in the north-east corner and along Watson Street by approximately 9-10 no. courses. In the north-west corner, there is evidence of an earlier/original render from the asphalt DPC to ground level

External ground levels should be reduced to at least 150mm below DPC height where practical. Alternatively, allow internal waterproofing/damp mitigation e.g., a cavity drainage system capable of providing dry internal surfaces but that will not damage to historic fabric

3 Ground and surface drainage: In the north-west corner the brickwork above and below the damp-proof course had been washed out and there was biological growth at the base of the wall indicating high moisture levels, providing the conditions for damp and decay. Similarly, in the north-east corner the brickwork was washed out and there is biological growth beneath the plinth. It is unclear whether the canopy drainage above is maintained and this could potentially be overtopping in these locations during periods of heavy rainfall

Allow for routine inspection and maintenance of the canopy gutter and rainwater drainage systems

3.1.3 East elevation

See Figures 18-19 at Appendix E

1 Brickwork: There was no significant changes since the survey of 2017. However, there were some localised areas of spalled brickwork at high level

© Copyright Hutton+Rostron, 2022

H+R to carry out detailed investigation of facades and mortar analysis and provide recommendations on appropriate repairs

2 Damp-proof course: The DPC steps from 12 no. courses below the plinth brick in the north-east corner to 15 no. courses below the plinth brick in in the south-east corner. The raised footpath level has bridged the DPC

External ground levels should be reduced to at least 150mm below DPC height where practical. Alternatively, allow internal waterproofing/damp mitigation e.g., a cavity drainage system capable of providing dry internal surfaces but that will not damage to historic fabric

3 Ground and surface drainage: The lower courses of brickwork were washed-out with biological growth the full length of the elevation indicating high moisture levels, providing conditions for damp and decay. It is unclear whether the canopy drainage over the entrance into Manchester 235 Casino is maintained and this could potentially be overtopping during periods of heavy rainfall

Allow for routine inspection and maintenance of the canopy gutter and rainwater drainage systems

3.1.4 South elevation

See Figures 20-23 at Appendix E

1 Stonemasonry: There was mechanical damage and cracking through the stone string course above and either side of the opening to the south-east corner. Although this damage appears to be historical there is a potential risk that cracked stone may detach and fall onto the footpath beneath

Allow for tactile assessment of the damaged stonemasonry, removing any loose material vulnerable to detachment. H+R to carry out detailed investigation of facades and mortar analysis and provide recommendations on appropriate repairs

2 Damp-proof course: At the centre of the elevation the DPC is visible 13 no. courses below the plinth brick, but is then bridged as the ground level ramps up eastwards towards Watson Street

External ground levels should be reduced to at least 150mm below DPC height where practical. Alternatively, allow internal waterproofing/damp mitigation e.g., a cavity drainage system capable of providing dry internal surfaces but that will not damage to historic fabric

3 Ground and surface drainage: In the south-east corner the brickwork beneath the plinth brick had generally been washed-out allowing water penetration on the structures beneath. In the south-west corner, defective surface drainage from the Mews level bridge has washed-out approximately $3m^2$ of brickwork and caused erosion of stonemasonry. There is extensive plant and biological growth indicating high moisture levels, providing the conditions for damp and decay

Allow for detailed inspection of the above façade defects and for a schedule of repairs to be provided

4 Podium deck: Several potential building defects associated with the water-proofing of the podium deck where it abuts the south-west corner of the Warehouse were noted in 2017. These included discontinuity or poor detailing of the podium deck waterproofing membranes, discontinuity or defective drainage from the podium deck. Preformed bituminous sheet membranes had been used. It is impractical to expect the joints in these sheets to be free from leakage. Since 2017 a lead flashing had been installed over the lower course of brickwork to the south-west masonry above the podium deck. This presumably extends over the

© Copyright Hutton+Rostron, 2022

face of the deck waterproofing membrane. The effectiveness of this intervention is as yet unknown but unlikely to provide a permanent solution to waterproofing. Stable pavers of the Mews bridge podium reported as loose in 2017 had also been removed where abutting the south elevation and the void infilled with concrete

H+R to carry out investigation of podium deck waterproofing and drainage measures

3.1.5 West elevation

See Figures 24-28 at Appendix E

1 Glazed roof: Water penetrating was occurring via the valley gutter to the glazed canopy towards the north-west corner of the building. There were no obvious timber structures beneath but there was a risk to the electrics, and pooling water on the corridor was a slip hazard

Allow for routine inspection and maintenance of the glazed roof gutter and rainwater drainage systems

2 Concrete lintels: Pairs of segmental headed windows and the brickwork between them have been removed and concrete lintels introduced to allow for vehicular access. A render has been applied over the concrete lintels to give the appearance of stone, but in some areas the render had failed and appears to have been deliberately removed from one lintel, presumably to limit damage to passing cars beneath. No mechanical key had been made to this smooth concrete lintel and this may be the case elsewhere

H+R to carry out investigation of render to these lintels

3 Timber sills: The cast-iron loading doorways have lead-lined timber sills and in some areas the timber sills were partially exposed and vulnerable to wet rot. Disturbance of the leadwork presumably due to thermal movement was also noted and this increased the likelihood of lead splitting. This provided an additional route for water penetration and entrapment

H+R to carry out investigation of all timber sills to establish areas of water penetration, extent of decay and provide recommendations

3.2 INTERIORS

3.2.1 Roof/Fourth Floor – NCP Car Park

See Figures 29-38 at Appendix E

1 Water penetration: There was ongoing water penetration occurring in numerous areas, primarily associated with defects in the central parapet wall and parapet and valley gutters. This was providing the condition for damp and timber decay affecting roof timbers especially where embedded or in direct contact with the masonry. Areas of water penetration are identified on the Plans at Appendix F. Since our survey of 2017 the upper floor of the NCP car park had been closed to vehicles, possibly due to water penetration

2 Timber decay: There was structurally significant decay identified in the bearing end of a truss tie beam to the south-east corner. The parapet gutter boards were also structurally decayed. The parapet gutter boards were also decayed to the centre of the north elevation

Allow for the temporary propping of the structurally decayed truss tie beam

© Copyright Hutton+Rostron, 2022

H+R to undertake a detailed timber condition survey from beneath the roof structure by decay detection drilling and deep moisture content probing, along with the gutter timbers

3.2.2 Third floor-Second Floor – NCP Car Park

1 Access: Car parks were not accessed during survey. Floors of 'fireproof' construction comprising riveted steel girders and columns with brick jack arches that support concrete floors. No timber structures at these levels

3.2.3 First Floor – Manchester 235 Casino and James Martin Restaurant

See Figures 39-42 at Appendix E

1 Damp and decay: No major damp penetration issues or subsequent structurally significant timber decay issues were detected along the external walls, where accessible. However, electronic capacitance meter readings taken of the floor to the Female WC to the south-east corner identified moisture beneath the vinyl floor. Although this may be evidence of a plumbing leak, the moisture could possibly be related to entrapped moisture from wet mopping. In addition, the seal around a sink tap to the northern Female WC was defective and this provided a route for leakage during use. Elsewhere, in the plant room there were several areas where minor localised leakages had occurred intermittently in the past which is to be expected

Leakages from plumbing systems should be addressed as a matter of urgency or as required to prevent water penetration and damage to valuable finishes, services or the original building fabric. Suitable building services engineers should undertake this work. No specialist investigations were thought necessary

2 Ventilation to floor: Numerous areas of mezzanine floors and raised floor podiums such as WC areas etc. appear to be of suspended timber construction. The voids between the structural floor and the raised podiums generally did not appear to be serviced by ventilation. As there were no major moisture sources at the time of the survey, this was not thought to be a significant issue. However, should water escape from building services and accumulate within the voids, problems with fungal infection and potentially timber decay may develop

Vigilance should be taken with regard to preventing escapes of water, or where these do occur, to act promptly and completely eliminate the moisture cause and ensure drying of all the materials subsequently affected. This is particularly important in the case of unventilated voids. Specialist advice may be required in this event

3.2.4 Ground Floor – Manchester 235 Casino

See Figures 43-50 at Appendix E

1 Damp and decay: No major damp penetration issues or subsequent structurally significant timber decay issues were detected along the external walls, where accessible. However, there was a current plumbing leak from a sink to a disused Female WC towards the north-west corner. Water had penetrated beneath the floor tiles and caused damage and decay in the timber floor coverings of the adjacent room. Moisture has also been absorbed into the drylined wall materials. The permeability of the finishes will effectively contain the damp, retarding any drying that will be required following rectification of the leak. It is envisaged that large areas of floor and wall finishes will be damaged as a result. An old plumbing leak from a WC cistern to the disused Kitchen had also caused damp

© Copyright Hutton+Rostron, 2022

and deterioration to finishes. This was previously reported in 2017 but no opening-up/further investigation appears to have been undertaken

Early action is required to stem further escape of water, to remove the impermeable finishes and to allow rapid drying of the absorbent substrate materials beneath. H+R can provide further guidance and specific advice if required

3.2.5 Ground Floor – Almost Famous

1 Damp and decay: No major damp penetration issues or subsequent structurally significant timber decay issues were detected along the north and east walls. However, in the north-east corner the external ground level is higher than the internal ground level. The shop front finishes appear to be of recently built brickwork similar in appearance to the original brickwork. There was no evidence of damp noted and it is assumed that a cavity construction has been used at this point. No plumbing leaks were reported to H+R by Almost Famous staff

No specialist investigations recommended at this time

2 Ventilation to steps: On the east wall, there's a series of steps up to the east emergency exit onto Watson Street. The construction is not clear and is thought to be either a concrete or timber structure with a void beneath it. As the void is unventilated and if it is a timber structure there is a risk of timber decay here

The staircase construction at the east entrance should be investigated and whether it is a timber structure or a concrete structure the void beneath should be ventilated. This may be achieved via the partition wall in the adjacent WC at ground floor level

3.2.6 Ground Floor – Lane 7

1 Damp and decay: No major damp penetration issues or subsequent structurally significant timber decay issues were detected along the north wall. No plumbing leaks were reported to H+R by Lane 7 staff

No specialist investigations recommended at this time

3.2.7 Ground Floor – CIBO

See Figures 51-53 at Appendix E

1 Damp and decay: No major damp penetration issues or subsequent structurally significant timber decay issues were detected along the north wall. However, staff reported a plumbing leak from the Male WC at Mezzanine level that they were currently managing with a bucket. Leakage appears to relate to the water tank that supplies the urinals

Leakages from plumbing systems should be addressed as a matter of urgency by a suitable building services engineer

© Copyright Hutton+Rostron, 2022

4 GENERAL RECOMMENDATIONS

All new and refurbishment detailing should be assessed for its effect on environmental and structural health. General principles are set out below. Special care is required when introducing new materials, moisture sources or heating and ventilation systems, for example air conditioning

4.1 ROOF AND SURFACE DRAINAGE

4.1.1 Maintenance

All guttering, hopperheads and outlets should be regularly checked and cleared to keep them free of debris, especially during the autumn months

4.1.2 Roof drainage calculations

Roof drainage calculations should be made to check the adequacy of gutters, drains and downpipes so that their capacities may be increased if necessary during refurbishment. H+R can carry out these calculations if required

4.1.3 Monitoring

The installation of an automatic monitoring and alarm system should be considered to give warning of blockage or overflow in the roof drainage system

4.1.4 Access

Safe and convenient access ladders, safety points and wallboards should be installed to all roof areas to allow proper inspection and maintenance

4.1.5 Pigeons

Feral pigeons should be controlled. H+R can give advice on this if necessary

4.2 VENTILATION

4.2.1 Structural voids

All structural voids within the building should be provided with adequate through ventilation so as to prevent moisture build-up. This must be done with regard to the applicable fire regulations

© Copyright Hutton+Rostron, 2022

4.2.2 Chimneys

All chimneys not in use should be capped so as to minimise water ingress but so as to allow maximum ventilation of the flues. Flues should be cleared and cleaned to remove blockages. Fireplaces and chimney breasts should be opened or vented to allow through-ventilation of the flues. This prevents moisture build-up in the flues and helps interior ventilation by the stack effect

4.2.3 Bathrooms and kitchens

All bathrooms and kitchens should be fitted with adequate extractor fan systems. These should run for at least fifteen minutes after occupancy to prevent condensation. The installation of floor drains should be considered in these rooms in case of overflow

4.2.4 Roof spaces

All roof spaces, including flat roof areas and gutter soles, should be provided with adequate through-ventilation. This may occur via the gaps between slates in unsarked pitched roofs. However, flat roofs and pitched roofs with sarking or insulation will require the installation of vents through the roof surfaces or at the eaves and ridges. Insulation material in roof spaces should be kept clear of external walls, gutter soles or timbers in contact with damp or potentially damp masonry

4.2.5 Windows

Windows should be refurbished so as to allow easy and convenient opening and closing by occupants in order to encourage proper ventilation of the building. This is important both for environmental and structural health. Windows should be fitted with security locks so as to allow secure locking in a partially opened position

4.3 STRUCTURAL DETAILING

4.3.1 New timbers

New timbers should be isolated from any damp or potentially damp masonry with a damp proof material or ventilated air gap

4.3.2 Timber repairs

Structurally decayed timbers should be removed or cut back to sound timber unless required for aesthetic reasons. Timbers should then be partnered or spliced. If steel plates or hangers are used, they should be detailed so as to allow sufficient ventilated air gaps and drainage to prevent moisture build-up due to condensation. No timber preservation or remedial treatments should be required

4.3.3 Paint finishes

Moisture vapour permeable or 'microporous' paint finishes should be preferred for internal and external surfaces and woodwork. This is especially important on window timbers. To take advantage of the properties of such paints, the complete removal of old alkyd paint systems is recommended. Health and Safety: Special precautions should be taken during surface preparation of pre 1960's paint surfaces as they may contain harmful lead

© Copyright Hutton+Rostron, 2022

Appendix A

COMMON DECAY ORGANISMS

1 DRY ROT

Dry rot (*Serpula lacrymans*) belongs to the same group of fungi as most of the common mushrooms and toadstools. Reproduction is by means of spores which are produced in enormous numbers by the fleshy pancake-shaped fruiting body. These fruiting bodies generally only appear when the fungus is stressed or dying off. A well established infestation may produce fruiting bodies more than one metre across and be accompanied by thick layers of rust-coloured spore dust. Each minute spore has an outer coat which affords it some protection against heat and desiccation, and germination has been achieved after a twenty-year latent period. Dry rot spores are ubiquitous and there is no domestic or natural environment entirely free of them. They can be found throughout the environment from high up in the jet stream to the middle of the countryside

Spores will germinate and grow in timber with a moisture content of between 20 and 30 per cent. The fine fungal thread (hypha) digests the cellulose and hemi cellulose fractions of the wood, but is unable to attack the structural linings. These remain as a brittle matrix which cracks into cubes under differential stresses. Cuboidal cracking is also a characteristic of many wet rots and does not automatically indicate the presence of dry rot

Fungal hyphae may clump together into a variety of structures known as mycelia which take various forms depending on the surrounding conditions. They may fill a humid cavity as a cotton wool-like mass, or grow across the surface of the timber, as a grey-white skin. Active dry rot has a fresh white or greyish appearance and smells strongly of mushrooms. Distinctive patches of lilac or canary yellow pigmentation are usually present

Some hyphae group together to form conducting strands. These have a fairly impervious outer layer rich in chitin, the major constituent of insect cuticle. The strands, which may reach a centimetre in thickness, are flexible when moist, becoming progressively more brittle as they dry out. Their main function is the conduction of nutrients, through or across inert non-nutrient materials (brickwork etc) to other timbers. Their relatively impervious outer layer, together with an unusual alkaline tolerance, allows them to survive in the mortar layers within masonry and walls. An infested area may be full of dry rot strands. The dry rot fungus may tolerate relatively lower moisture contents and, through this, and other quirks in its biology, is potentially capable of considerable destruction. Realisation of this potential, however, requires a narrow range of environmental conditions and, in practice, several factors restrict growth

Dry rot hyphae may attack timber with a moisture content of about 18 per cent; however, spores would not germinate under these conditions. This moisture content is still 5 to 10 per cent wetter than timber should be in a healthy domestic building, and indicates water penetration or, perhaps, faulty plumbing. There is no evidence that dry rot can 'wet up' timber to any appreciable extent under conditions expected in a healthy building, although this is often claimed. The fine attacking hyphae, unlike the coarse conducting strands, are susceptible to desiccation and dry wood may disperse moisture faster than it can be transported. This means they cannot move through dry masonry and wood or across ventilated cavities

The total breakdown of wood by fungus produces considerable quantities of water. It has been suggested that dry rot can sustain itself on this 'metabolic' water alone. However, in practice, external drying factors disperse the moisture so that favourable conditions can be maintained only in exceptional circumstances such as behind impermeable finishes or in sealed cavities

© Copyright Hutton+Rostron, 2022

In order to thrive, dry rot requires a moisture content in timber in excess of 20 per cent, and a relative humidity above 95 per cent. Below these levels the fungus will cease to cause current decay problems. Temperature is also a strong regulating factor, and growth ceases at about 25^{o}C, a temperature frequently exceeded in roof spaces, for example. Large radiators can be particularly lethal to dry rot and measurements of 30^{o}C with 20 per cent relative humidity are not unusual in their immediate vicinity

Dry rot is attacked by many other decay organisms which cause particular damage when the fungus is under stress will eventually destroy it. However, under dry conditions, dead dry rot does not disappear. Strands may eventually darken and the fungal mats may lose their fresh appearance, becoming tinged with brown, and leathery or papery in texture. The decayed wood becomes powdery as it dries, shrinks and distorts, which can be the first sign of decay having occurred behind paint finishes

2 WET ROT

Wet rot is caused by a number of basidiomycete fungi of which the most important are *Coniphora puteana* (cellar fungus), *Poria fungi*; *Fibroporia vaillantii*, *Poria placenta*, *Amyloporia xantha*, *Geophyllum trabeum*, *Phellinus contiguus*, *Donkiporia expansa*, *Pleurotus ostreatus*, *Asterostroma* and *Paxillus panuoides*. They attack both softwoods and hardwoods causing a darkening of the timber (brown rot) or bleaching (white rot). Wet rot fungi usually occur in persistently damp conditions, needing an optimum moisture content of 50 to 60 per cent. Unlike dry rot, the conducting strands of wet rot fungi do not extend far from their nutrient wood, hence they cannot travel through masonry and brickwork. The fruiting bodies occur rarely in buildings. Wet rot has been known to hollow out giant beams. Wet rot *Coniphora puteana* is responsible for up to 90 per cent of wood decay within buildings but raises less concern than dry rot, possibly because it is more easily controlled by standard building techniques. Some wet rots are also called soft rots as they destroy both cellulose and lignin, leaving the colour of the wood largely unaltered, but producing a soft felty or spongy texture. Soft rot is caused by *Chaetomium globosum* and a number of other fungi also found growing on wet wood in buildings

3 WOOD-BORING INSECTS

The common furniture beetle (*Anobium punctatum*) has a life cycle consisting of four stages - egg, larva (which causes all the damage), pupa and adult. The eggs are laid in end grain or in existing flight holes and hatch in 4 to 5 weeks and the new larvae bore directly into the wood. The larvae feed and grow within the wood creating a network of tunnels closely packed with frass (small ellipsoidal pellets). The larvae are whitish, curved, approximately 6mm in length and have well defined dark-brown jaws. When fully grown the larva excavates a small chamber and pupates producing a beetle after 6-8 weeks which bores through a thin layer of wood producing the characteristic emergence holes 1-2mm in diameter. Emergence usually occurs between May and August. The life cycle depends on the condition of the wood, the temperature and humidity. The life cycle usually takes a minimum of 3 years within buildings. Attack is usually confined to the sapwood of softwoods and hardwoods but may occur in the heartwood in timbers such as beech, birch, spruce or in timbers modified by fungal decay. As sapwood only makes up a small cross section of the majority of structural timbers in older buildings, attack is often of little or no structural importance. In most instances of suspected attack, the infestation has died out long ago due to unfavourable environmental conditions. Careful checking is therefore required to establish that living woodworm are present

In cases of active infestation the environmental conditions are often marginal allowing the life cycle to continue but at a very slow rate. Small changes in the environmental conditions can tip the balance against insects. Woodworm attack is often very localised to small areas of high humidity or especially 'palatable' timber and further spread is highly unlikely

© Copyright Hutton+Rostron, 2022

In the British Isles, death watch beetle (*Xestobium rufovillosum*) infestations occur most commonly in oak, probably because this wood used to be extensively employed in construction, but infestation can also occur in elm, walnut, chestnut, elder and beech. The life cycle is similar to that of the common furniture beetle but can take many years to complete from one year under experimental conditions, to ten years or more in a building (Ref 11). The hatched larvae wander over the surface of the timber before burrowing into it. When it is fully grown it pupates and changes into the adult beetle which does not emerge until the spring of the following year producing a 3mm diameter hole

In old buildings severe damage can be caused under favourable environmental conditions. Softwoods are occasionally infested where they are in close proximity to damp infected hardwood. Infestation is confined to fungal decayed or damp affected timbers. Many existing cases probably arose from the reuse of infected timbers from demolished buildings and from the use of unseasoned timbers used in their construction. Attack is not confined to the sapwood and often the heartwood is entirely consumed causing severe structural damage. Damage is most severe where ventilation is poor and where timbers are in contact with damp masonry

Death watch beetles are not active fliers. A localised attack of death watch will not automatically spread to the whole house and infest every timber in the building. Lowering of moisture contents of the timber in conjunction with careful observation to determine the level and extent of activity should provide control of the insects. Some severe cases may merit the use of local insecticide treatments as a first aid measure. However, the chemical must be targeted properly or large quantities of toxic pesticides will be used to little effect

Woodworm and death watch beetle infestation will not flourish if the moisture content of timber is below about 14 to 15 per cent. The risk of infestation of insect attack is slight, in timbers with a moisture content at or below 14 per cent and the insect larvae will desiccate below about 12 per cent moisture content. The infestation will eventually die out if the timber moisture content is maintained below this. Healthy roof timbers should have a core moisture content of between 14 to 15 percent, while suspended floor timbers should be between about 11 and 14 per cent. Installation of a central heating system may reduce these moisture contents to about 9 per cent particularly in exposed timbers

It is absolutely necessary to recognise whether an insect infestation is 'active' or 'dead'. The presence of fresh frass (bore dust) in conjunction with damp timbers may be acceptable evidence of active infestation

© Copyright Hutton+Rostron, 2022

Appendix B

SPECIALIST SEARCH TECHNIQUES AND THEIR LIMITATIONS

1 PRELIMINARY INSPECTION AND INVESTIGATION

The basis of any investigation is an understanding of building structures and defects and how these may interact to produce the ecological niches in which various decay organisms can thrive. With experience, an initial visual inspection can give a good idea of the areas that will need further study. A check-list for this preliminary investigation includes building defects, significant timber structures and concealed cavities

The condition of concealed timbers may be deduced from the general condition and moisture content of the adjacent structure. Only demolition or exposure work can enable the condition of timber to be determined with certainty and this destroys what it is intended to preserve. A non-destructive approach is therefore required and to help reduce uncertainty, specialist instrumentation and test equipment can be useful. However, it is important to remember that all tests and instruments are only aids to the surveyor, and must be interpreted with experience and care. A slavish reliance on any technique and failure to take into account its limitations is a recipe for disaster. No technique can be 100 per cent accurate or reliable

The techniques that may be used for preliminary investigation include resistance-based timber moisture meters, capacitance masonry moisture detectors, borescopes and Rothounds

2 DETAILED INVESTIGATION

The findings from the initial investigations are followed up by more detailed study. The aim is to determine as far as possible the distribution and extent of all significant decay and organisms in the building, the distribution of micro environments predisposed to timber decay and the building defects that cause them. The extent of significant timber decay should also be determined as far as possible. Active decay organisms may not yet have caused significant timber decay. Conversely, there may be significant decay even when the decay organisms that caused it have been dead for many years. This may seem obvious but many expensive 'treatments' are carried out on insect or fungus damaged timber that has not been infected for tens or even hundreds of years. Key factors that may be noted are species and viability of decay organisms, moisture content of materials, ambient relative humidity, and ventilation. Timber species and previous chemical treatments may also be significant

It is important that the results of the investigation are co-ordinated with the building structure bearing in mind the characteristics of particular periods and methods of building. They should also be carefully recorded and quantified where possible. This allows analysis of the results by other experts, reduces the 'grey' area in which disputes of opinion can arise and forms a basis on which future investigations can build. Photography can be especially valuable and may be used when necessary

© Copyright Hutton+Rostron, 2022

3 ROTHOUNDS

Rothounds are specialist search dogs trained to help find dry rot (*Serpula lacrymans*) in buildings. Rothounds may indicate areas of active dry rot even before they are visible to the naked eye. This will occur if the dry rot is just developing, is inside the substance of the timber, between the timber and another surface or within porous masonry. Such indications may be confirmed by comparing them with measurements of the moisture content of the structure or by the use of a drilled sample. Rothounds will not indicate the remains of dead dry rot infestations

In areas indicated by Rothounds the significant timber structures should be checked for structural decay or high moisture levels. Even if these are not found steps should be taken to reduce moisture levels and increase ventilation. This may be all that is required to stop a developing problem and all that is then required is to check the area in 6 months. For this purpose Hutton + Rostron again favour the Rothounds

3.1 Capabilities

a May detect living dry rot (*Serpula lacrymans*) by the scent of the metabolites produced by the fungus

b May detect the scent of dry rot even when hidden behind panelling, under floors, behind plaster or in other concealed cavities

c May detect the scent of dry rot at a distance of several metres depending on scenting conditions

d May detect early dry rot growth before it is detectable by the unaided human eye

e May discriminate between living or dead dry rot and between dry rot and other fungi instantly

f Actively search for dry rot in buildings at high speed, covering 20 to 50 rooms in an hour g May indicate extent and spread of dry rot infestation

g Will search small inaccessible areas and roof spaces i Will work in furnished and inhabited buildings

h Totally non-destructive

i Will work 2-4 hours per day

3.2 Limitations

a Trained only to indicate living dry rot, not wet rot or dead dry rot. Will not indicate fruiting bodies on old dead outbreaks of dry rot

b Indicate the scent of dry rot and the point of maximum scent. This may need interpretation as scent can occasionally be moved by air currents from the point of origin

c Scent will not travel through impermeable surfaces such as neoprene. However, it may be detected at the edge of an impermeable barrier, e.g. around the edge of a room with a rubber-backed carpet covering an infected floor

d Indicate dry rot infection, not decay. Therefore heavily decayed but inactive outbreaks may give a weaker indication than a recent highly active outbreak that has not yet caused significant decay

© Copyright Hutton+Rostron, 2022

e May not work if there is a corrosive or choking dust or vapour. However, Rothounds should not be put off by smells and may detect even small amounts of dry rot in the presence of other strong scents

3.3 Uses

a Survey of properties prior to purchase, renovation, change of occupancy etc, to quickly check for hidden problems

b Preliminary survey of properties with suspected decay problems to determine existence and extent of dry rot infestation

c Survey of properties with known dry rot problems to determine activity and extent of infestation

d Survey of properties undergoing remedial works to check for additional hidden areas of infestation

e Survey of properties after remedial works to check for efficiency of treatment

f Routine survey of properties with past problems thought to be at risk in order to detect recurrence of infestation at an early stage before significant decay can occur

g Periodic survey of properties with known problems awaiting renovation, to detect 'hot spots' of dry rot activity

These can then be dealt with by 'reactive maintenance' allowing outbreaks to be controlled by minor exposure works and environmental controls. This avoids expensive building or remedial works. Further decay is prevented and infection controlled with significant savings on eventual renovation

4 FIBRE-OPTIC BORESCOPE EXAMINATION

A technique we have found routinely useful over the last 15 years is the use of fibre optics. We use long reach, fixed side view, rigid borescopes and high-power light sources.
Although this is comparatively expensive it is essential for getting a clear view across a cavity such as a floor space. It also minimises the time spent and the number of holes drilled. Fibre optic inspection can reveal extensive decay and the consequences of water penetration. However, most wood-destroying fungi will not live on the face of timber which is exposed to air movement because this produces a drying effect. It is always a possibility that a fungus, especially dry rot, is travelling behind a wall plate, for example, and is not detectable from the cavity. Fibre optic inspection may not, therefore, find a minor attack which is developing, but it should indicate where these might be initiated so that faults can be identified and remedied. The siting of inspection holes depends on the points at risk within the room and will usually be located adjacent to balcony floors, flat roofs, cracks in rendering and other points where faults may have resulted in water penetration. Inspection may also be limited in areas of tiled and glued flooring materials and ornate or special wall coverings. Inspection holes are numbered and capped off for future use

5 THE MEASUREMENT AND SIGNIFICANCE OF MOISTURE CONTENT

The moisture contents in timber, mortar and plaster are measured by a variety of methods.
Timber moisture content might be ascertained by the use of a standard resistance-type moisture probe which measures the moisture content at the surface of the wood.

© Copyright Hutton+Rostron, 2022

However, this moisture content will be subject to considerable fluctuation, depending on current relative humidity and temperature. A rafter in a roof in summer may, for example, have a moisture content at the surface of 16 per cent which might rise to over 20 per cent in winter. This difference would not necessarily reflect increased water content resulting from a fault in the roof, but might simply be a redeposition of water resulting from a considerable drop in temperature

The condition in the core or subsurface of a timber will remain relatively stable which is why the centre of thick timbers may be preferentially decayed. It is this 'deep' moisture content which must be measured if results are to be meaningful. For this reason, a hammer probe with insulated electrodes or deep moisture probe is used to measure the moisture content within the timber. Healthy roof timbers should maintain a stable core moisture content of between about 12 per cent and 16 per cent, whilst suspended floor timbers (excluding ground floors) should be between about 11 per cent and 14 per cent. Central heating will usually reduce this figure to around 9 per cent

Similarly, surface moisture content readings in plaster and mortar are of limited value except for purposes of comparison. A surface capacitance meter may be used on plastered walls. For further investigation absolute measurements of moisture content may be made on site by means of a carbide-type gas pressure meter

Alternatively, samples are taken back to the laboratory in sealed vials, and the moisture contents are measured by the oven and balance method. For this, mortar samples are obtained by drilling holes in the wall and dust from the first inch of each hole is discarded. Dry mortar and plaster should have moisture contents below about 2 per cent. At levels much above this the moisture content of incorporated timbers will exceed 20 per cent and may easily reach levels at which fungal decay is likely

6 OTHER TECHNIQUES

Other techniques that may be used include microscopy, laboratory culture, hot wire anemometry and electronic RH measurement. We have also developed special instruments for measuring 'available' water in materials and for ultrasonic detection of timber-boring insects. More exotic techniques may sometimes be useful such as pheromone insect traps, infra-red thermography, shortwave radar, automatic weather stations and total building monitoring using specialist data loggers

© Copyright Hutton+Rostron, 2022

Appendix C

REMEDIAL BUILDING WORKS AND ENVIRONMENTAL CONTROL

The most critical factors for the environmental control of decay organisms are available moisture and temperature. The former is dependent on such factors as moisture content, relative humidity, micro-ventilation, and salt content. In simplistic terms it is necessary to correct building defects leading to high moisture contents in timber and to increase ventilation around timber at risk

In practice there are two problems; first it is necessary to identify the significant building defects and then the best techniques must be chosen to control the environment at each point. This may be achieved by analysing the building in terms of moisture sources, moisture reservoirs and moisture sinks

It is not possible to prevent moisture entering a building entirely and often attempts to block the movement of moisture through a building structure using impermeable materials are ineffective. They may also be counter-productive as they can prevent moisture being dissipated, resulting in high moisture levels and decay in adjacent materials. The more effective and robust approach is that used in traditional buildings. Here, porous materials are preferred, and every moisture source is balanced by a moisture sink. Thus ground water may penetrate masonry but is evaporated off before it reaches timber structures. Similarly, water vapour is introduced by occupation, but is ventilated out via windows, chimneys and other passive and active forms of ventilation. Failure to balance a moisture source with an appropriate sink may result in moisture moving into vulnerable materials and eventually causing decay and other problems

Moisture reservoirs occur when a moisture 'source' has not been balanced by a 'sink' and water has accumulated in a porous material. Typical examples of this are to be found when thick masonry walls have been soaked by persistent leaks or when chimney breasts have been filled with rain water from uncapped chimneys. Such reservoirs may take years to dry out, even when the source has been dealt with. As a result, they can act as a source of moisture for recurrent timber decay over a long period. A special case of this phenomenon occurs when large quantities of water have been used in fighting a fire

In practice then, each area of decay is associated with a building defect, resulting in an increased moisture source, a blocked or inappropriate moisture sink or a moisture reservoir. The appropriate building measures should then be specified to correct that defect

A common example might be the bridging of a damp proof course by raised ground levels. This will act as a moisture source and may result in decay of timbers in an adjacent floor space. Reducing the ground level will cut off this source and will also provide a sink of moisture by allowing evaporation from the exposed wall. The sub-floor moisture level might also be controlled by increasing the other available moisture sinks. Cleaning pre-existing airbricks or inserting additional sub-floor ventilation would be a common measure. In general, it is important to increase evaporative surfaces and avoid obstructing them during refurbishment

Another common example would be a blocked and overflowing parapet gutter acting as a moisture source. This could wet up gutter soles, joist ends and wall plates as well as any other structure in an expanding cone extending from the leak down through the building. Preventing this moisture source may require a number of measures such as increasing the capacity of down pipes, re-lining the gutters and fitting thermostatically controlled trace heating tape to increase free flow of snow melt water

© Copyright Hutton+Rostron, 2022

Any failure in a roof finish, gutter or coping will generally result in significant water penetration into the masonry wall beneath, which will then act as a moisture reservoir. Any timber in contact with this reservoir will be at risk of decay as it will tend to 'wick' moisture from the masonry. Steps must therefore be taken to isolate in-contact timber from the masonry using such measures as DPC membranes or joist hangers producing an air gap. It will also be necessary to ensure the timbers are adequately ventilated so that any moisture that is absorbed can be breathed off. Closed cavities or water-impermeable layers over timbers at risk must therefore be carefully searched out and rectified using knowledge of historic methods of construction. Bricked-in lintels and sealed up emulsion-painted sash windows are typical examples of structures at risk in this way

Having cut off the moisture source to a moisture reservoir and protected the 'at-risk' timbers it is next necessary to provide safe 'sinks' for the moisture. This will ensure that the reservoir is dried out in the long term. In some cases, the reservoir can be removed entirely, for example damp pugging can be dug out and replaced. In most cases it is a matter of promoting ventilation around a wicking surface on the reservoir and ensuring that the moisture-laden air can be vented to the outside. Dry lining systems can be useful for this purpose as can the good old-fashioned chimney. Raising the temperature will promote the process of wicking and evaporation. General house heating can help but care must be taken to ensure that water vapour is not being 'pulsed' into other parts of the building by a sequence of evaporation and condensation down a temperature gradient. Heating can be especially useful if it is possible to heat the reservoir material itself. We have devised special systems for heating large section timbers and masonry for this purpose but again the old-fashioned fire-place and chimney is very useful

In some cases, dehumidifiers can be used in the short to medium term, but care must be taken. They often require special 'tenting' and monitoring so that moisture is removed from the appropriate material and not from the world at large. They also require high air temperatures and high RH's to extract moisture efficiently

In all cases most of the remedial building works that may be required are quite within the capacity of the general contractor. Most are traditional repairs though some may take advantage of new materials or techniques such as dry lining, joist hangers and tanking. New and potentially useful products are coming into the building market all the time, for example, time controlled automatic fans, hollow ventilating plastic skirting boards, plastic masonry drains, roof space ventilating systems and moisture permeable paints. All such products and techniques can be used to help in making the environmental control of timber decay even more efficient and economical. All that is required is careful analysis of each situation and a little scientific understanding

© Copyright Hutton+Rostron, 2022

Appendix D

MAINTENANCE AND MONITORING

The investigation and building works described in the previous appendices should put a building back into a state of structural and environmental health. The environmental control approach will also mean that a building is less likely to develop problems in the future. This is because the effect of minor building failures should be 'buffered' by the robustness of the systems established. Fortunately, most traditional systems are robust in this way. This is why older buildings may tolerate a considerable amount of neglect and abuse before developing severe problems. However, the long-term health of the building will always depend on adequate maintenance. This is no less true of buildings treated with timber preservatives

A detailed investigation carried out as part of an environmental control policy provides an excellent basis on which to plan the most cost-effective maintenance program. Indeed, the building works required for environmental control are often best integrated into such a program. Short-term 'emergency' measures can be taken to simply halt further decay and measures to replace damaged structures or prevent future problems can be delayed to fit into a longer term plan of works. This flexibility in scheduling work as a result of the environmental approach allows further saving of costs and inconvenience

A maintenance program must also include provision for the routine inspection of all significant parts of the building at appropriate intervals. This should aim to detect and correct problems developing before they cause significant damage. Again the information gained in the investigation can be used to decide on the most cost effective inspection interval

In many cases remote monitoring systems can be very useful in increasing the efficiency and reducing the cost of maintenance programs. They can be especially useful for checking the moisture content of inaccessible timbers in roof spaces, behind decorative finishes and in walls. H+R have developed the Curator building monitoring systems for this proposal

Sensors can be placed at all critical points after the investigation or after the remedial building works. Areas can then be closed up and finishes re-applied, for example sensors may be placed in lintels, joist ends, valley gutter soles or in damp walls to monitor drying. It is important to use enough sensors and to place them with an understanding of the moisture distribution processes because conditions can vary even in a small area. It is these local variations in conditions that produce the environmental niches which decay organisms exploit

If more than 30 sensors are deployed, taking the readings can become onerous and this may result in human error or negligence. In these situations automatic monitoring systems become desirable. H+R have developed a number of specialised 'Curator' data logging systems to do this. With larger systems, the wiring of sensors can also become a problem. For systems requiring 100 or more sensors we can use a 'Curator A' unit working via a single 4-core main cable connecting up any number of nodes, each supporting 4 sensors. This system can be programmed with logging intervals and alarm limits for each sensor and can be read via the telephone system via its own modem. Data from the system can then be analysed using CAD and programs for statistical interpretation on a remote computer

© Copyright Hutton+Rostron, 2022

Appendix E

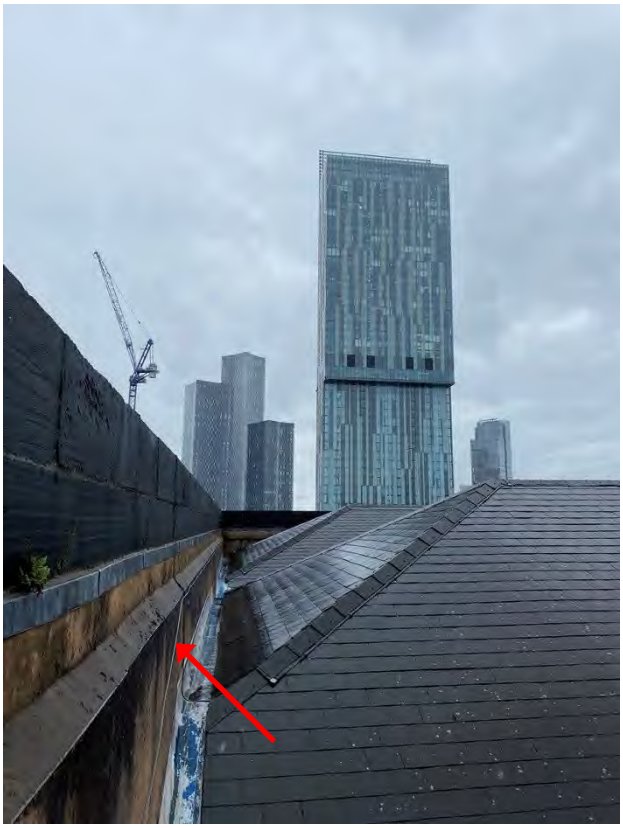


Fig 1:

Roof; showing a general view of the slate covered hipped roofs with single-ply EPDM gutters. Access over the roofs was via the parapet gutter and aided by a steel wire rope handrail secured to the parapet wall



Fig 2:

Roof; showing blue anti-slip paint applied over the pitched parapet gutters. Note the damaged slates and slate patch repairs

Great Northern, Manchester
Photographs
30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk
 © Copyright Hutton+Rostron 2022



Fig 3:

Roof; showing separation of the parapet gutter flashing from the wall. The plywood upstand and gutter deck were spongy and decayed by wet rot (see Fig 37-38 below)



Fig 4:

Roof; showing failure of the render to the central parapet and plant growth within the brickwork. Note there was no damp-proof course beneath the coping stones to the central parapet wall

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 5:

Roof; showing separation of the lead flashing from the central parapet wall.



Fig 6:

Roof; showing Buddleia growth from the parapet masonry. Root growth had slightly displaced these parapet stones

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 7:

Roof; showing an example of isolated broken slates towards the south-east corner of the roof. Damage appears to be caused by a glass bottle thrown from the neighbouring Great Northern Tower apartments. However, in the short term the presence of a roofing membrane beneath the slate battens should stop any water penetration due to broken slates



Fig 8:

Roof; showing an example of disturbed broken slates

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 9:

Roof; showing failure of the render to the central parapet and plant growth within the brickwork



Fig 10:

Roof; showing broken slates and debris build-up causing water to pool within the valley gutter. Note the raised outlet spigot drain

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 11:

Roof; showing failure of the render to the central parapet and Buddleia growth within the brickwork



Fig 12:

Roof; showing example of patch repairs to the roof pitches using a synthetic slate restrained by aluminium tingles

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 13:

Roof; showing shrinkage related craze cracking throughout the rendered parapet



Fig 14:

Roof; showing a single broken slate to the north-east corner of the roof. Damage appears to be caused by a glass bottle presumably thrown from the neighbouring Great Northern Tower apartments

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 15:

North elevation; showing a general view of the principal elevation



Fig 16:

North elevation; showing the rock asphalt damp-proof course

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 17:

North elevation; showing the valley gutter to the canopy roof. The valley gutter was vulnerable to blockage if not maintained from above the canopy



Fig 18:

East elevation; showing the canopy roof over the entrance to Manchester 235 Casino. The valley gutter was vulnerable to blockage if not maintained from above the canopy

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 19:

East elevation; showing 'bridging' of the damp-proof course due to raised footpath level. Also note the washed-out mortar in the lower courses of brick



Fig 20:

South elevation; showing areas of mechanical damage and cracking through the stonemasonry

Great Northern, Manchester
Photographs
30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk
 © Copyright Hutton+Rostron 2022



Fig 21:

South elevation; showing a general view of the rear elevation as viewed within the steel glazed link. There was no evidence of water penetration via the junction of the glazed roof

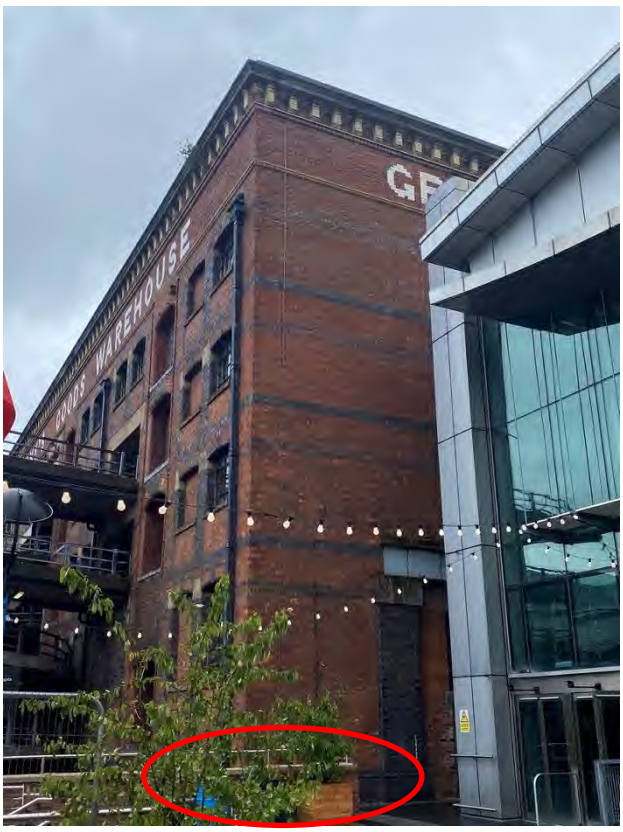


Fig 22:

South elevation; showing the location of defective surface water drainage from the podium deck (see Fig 23)

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 23:

South elevation; showing defective drainage to the south-west corner causing erosion of the stone string course and wash-out of the mortar to the brickwork

Note that the loose stable pavers reported in 2017 had been replaced with concrete with a lead flashing



Fig 24:

West elevation; showing leadwork applied over timber sills to the bricked-up loading doorways. Timber sills are vulnerable to decay

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 25:

West elevation; showing defective render concrete lintel. Note that access onto the 4th floor was restricted



Fig 26:

West elevation; showing water penetration via the valley gutter to the glazed roof extension

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 27:

West elevation; showing electrics directly beneath the area subject to water penetration. Pooling water was also noted on the corridor floor



Fig 28:

West elevation; showing area of water penetration and plant growth beneath the northern end of the valley gutter

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 29:

Fourth Floor, NCP car park; showing a general view of the roof structure that was a softwood construction. All floors were of 'fireproof' brick-arch and riveted steel construction



Fig 30:

Fourth Floor, NCP car park; showing water penetration via the valley gutter

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 31:

Fourth Floor, NCP car park; showing water penetration via the central parapet (directly below Fig 9)



Fig 32:

Fourth Floor, NCP car park; showing water penetration via the central parapet (directly below Fig 11)

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 33:

Fourth Floor, NCP car park; showing an example of a steel flitch plate repair to the bearing end of the roof truss. This indicates a history of water penetration and decay



Fig 34:

Fourth Floor, NCP car park; showing water penetration via the valley gutter

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 35:

Fourth Floor, NCP car park; showing water penetration via the valley gutter



Fig 36:

Fourth Floor, NCP car park; showing water penetration via the valley gutter

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 37:

Fourth Floor, NCP car park; showing water penetration via the parapet gutter (directly below Fig 3)



Fig 38:

Fourth Floor, NCP car park; showing decayed parapet gutter boards and probable decay in the bearing end of the truss. The truss should be propped immediately

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 39:

First Floor, Manchester 235 Casino; showing undulations beneath the vinyl floor coverings where high moisture readings were taken



Fig 40:

First Floor, Manchester 235 Casino; showing high moisture reading beneath the vinyl. This may be caused by a plumbing leak or entrapped moisture from wet mopping

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 41:

First Floor, Manchester 235 Casino; showing water staining to the timber cabinetry beneath the Female W.C. sink.



Fig 42:

First Floor, Manchester 235 Casino; showing defective seal to tap allowing water to leak below

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 43:

Ground Floor, Manchester 235 Casino; showing an old plumbing leak from the W.C. cistern. Joinery was partially decayed



Fig 44:

Ground Floor, Manchester 235 Casino; showing evidence of numerous historical leaks from the disused Kitchen

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 45:

Ground Floor, Manchester 235 Casino; showing a high moisture reading in the timber joinery beneath the W.C. sink. Timbers were partially decayed by active wet rot fungus due to the ongoing plumbing leak



Fig 46:

Ground Floor, Manchester 235 Casino; showing wet rot fungus to the floor beneath the sink

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022

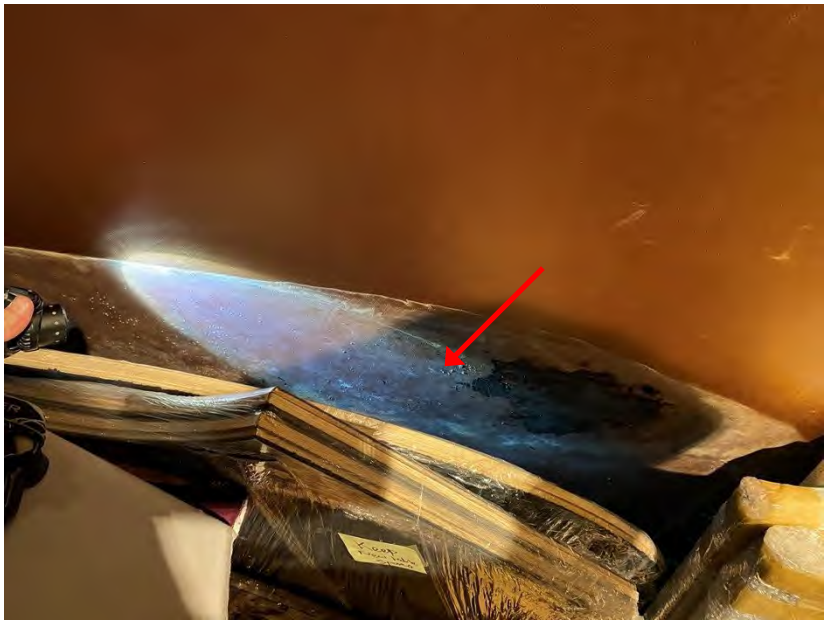


Fig 47:

Ground Floor, Manchester 235 Casino; showing damp and mould growth to the plaster finishes on the other side of the W.C. sink



Fig 48:

Ground Floor, Manchester 235 Casino; showing decay and warping of the timber floor finishes

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



Fig 49:

Ground Floor, Manchester 235 Casino; showing the location of an old plumbing leak



Fig 50:

Ground Floor, Manchester 235 Casino; showing surface mould contamination to the wall finishes beneath the sink

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022

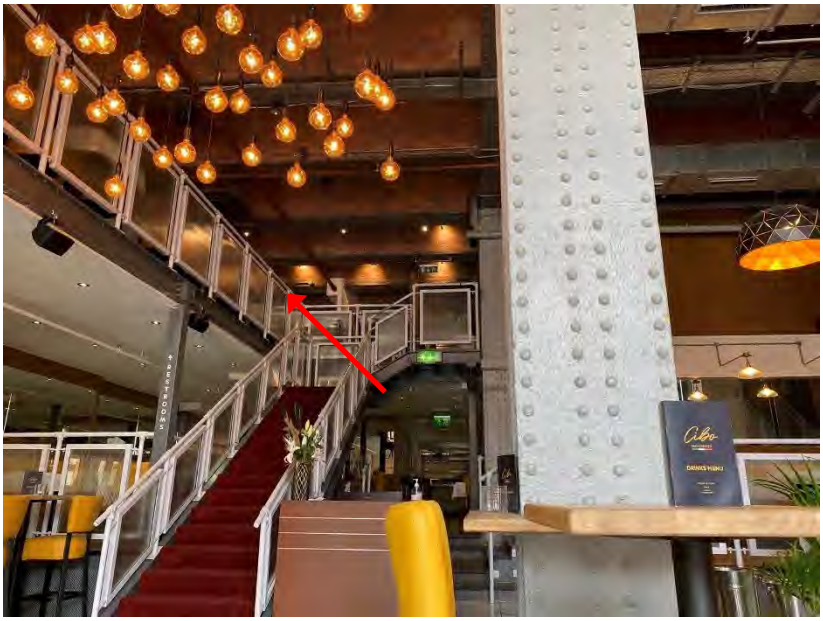


Fig 51:

Ground Floor, CIBO; showing the Mezzanine where there was an ongoing plumbing leak in the Male W.C.



Fig 52:

Ground Floor Mezzanine, CIBO; showing the plumbing leak from the water tank above the urinals

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022



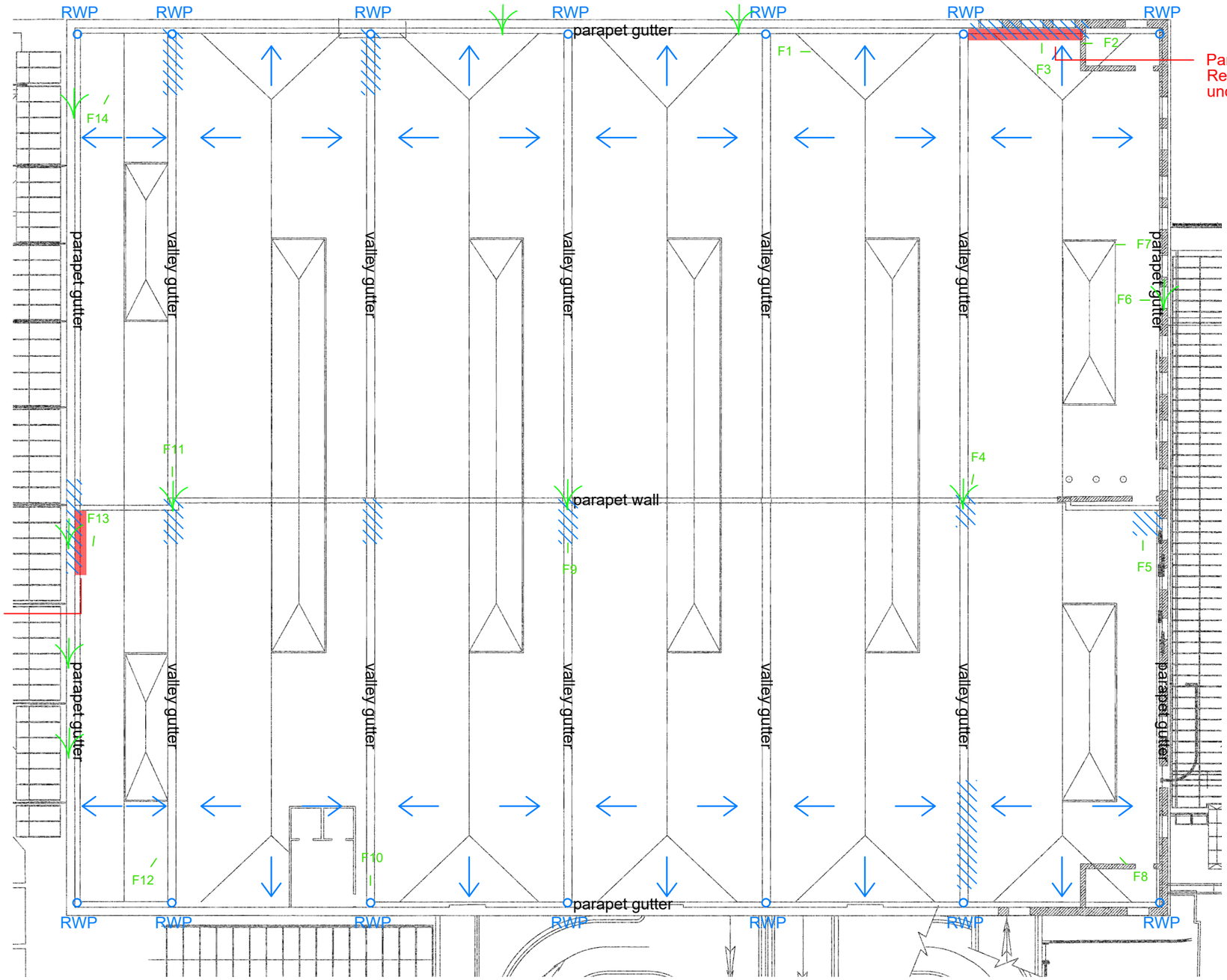
Fig 53:

Ground Floor Mezzanine, CIBO; showing the plumbing leak from the water tank above the urinals

Hutton + Rostron Environmental Investigations Ltd, Netley House, Gomshall, Surrey, GU5 9QA
Tel: 01483 203221 Fax: 01483202911 email: ei@handr.co.uk

 © Copyright Hutton+Rostron 2022

Appendix F



Key:

- RWP ○ Rainwater downpipe
- — F1 Photograph location
- ← Roof pitch
- Area subject to water penetration - timbers at risk of decay
- Parapet gutter boards decayed
- Plant growth

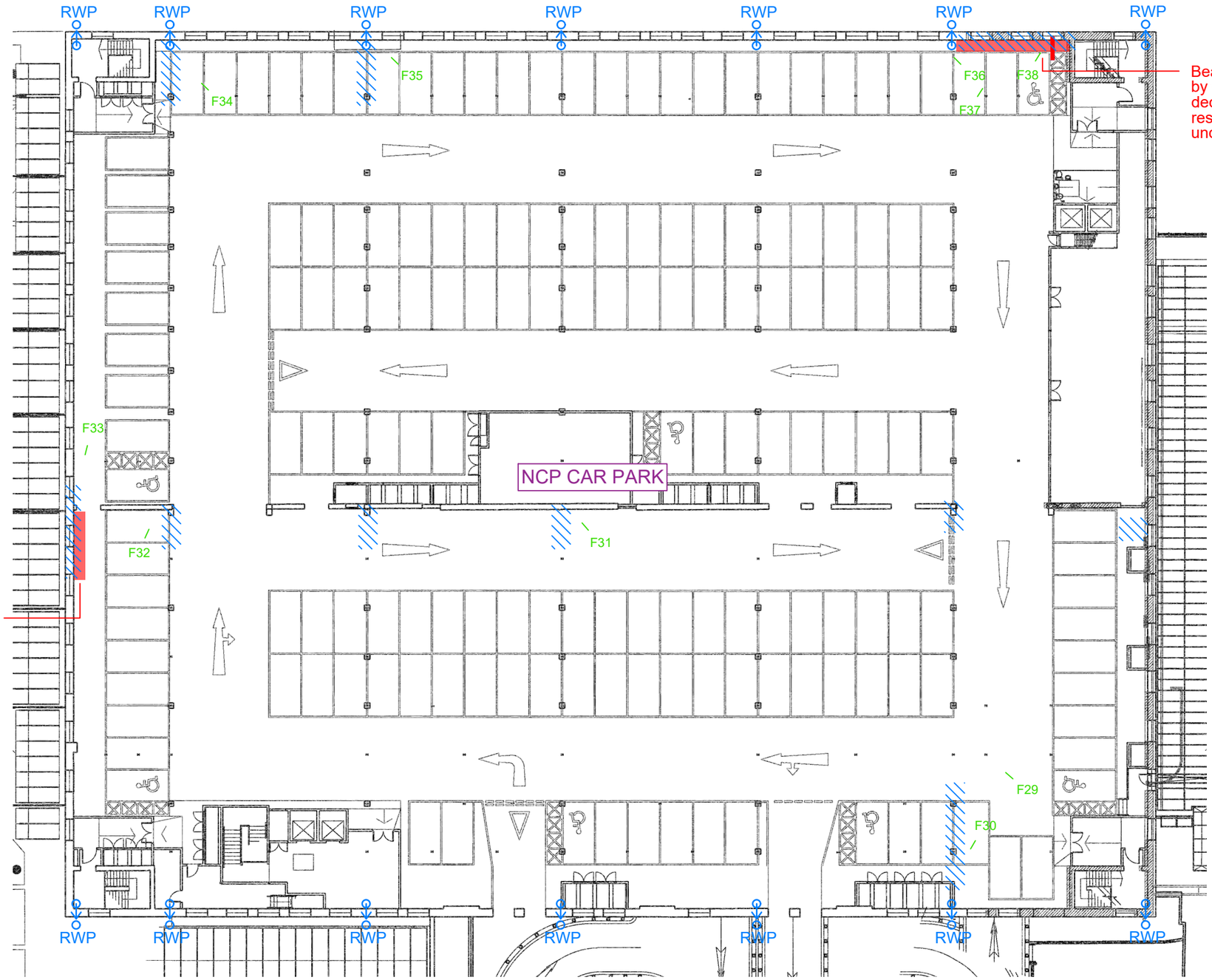
H+R

Great Northern, Manchester - Roof coverings

2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY

30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221
211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022



Great Northern, Manchester - Fourth Floor
2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY
30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221
211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022

Key:

- RWP — Rainwater downpipe
- F1 — Photograph location
- Area subject to water penetration - timbers at risk of decay
- Parapet gutter boards decayed
- Roof timber structurally decayed



Key:

RWP ○ Rainwater downpipe

— F1 Photograph location

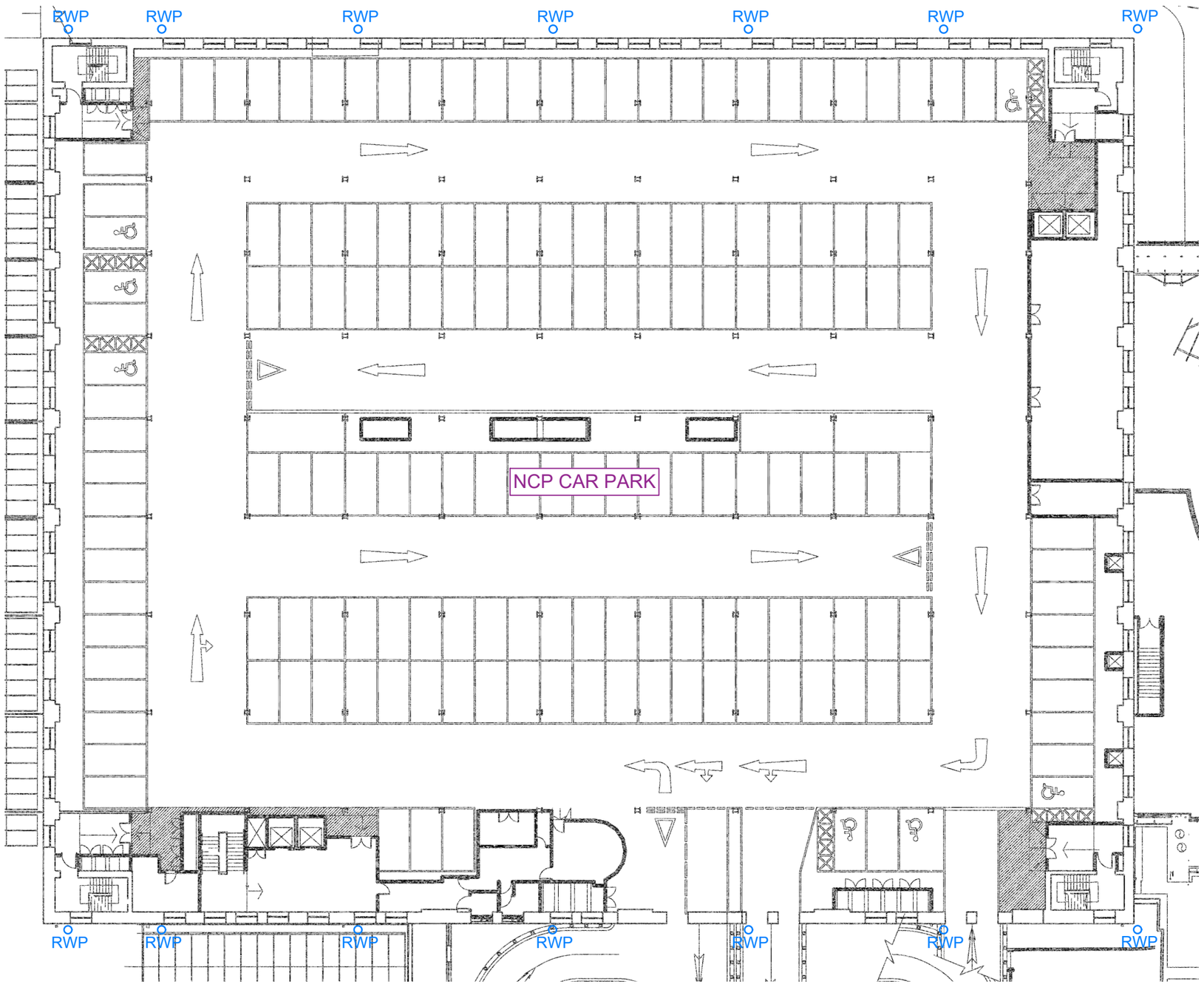
Great Northern, Manchester - Third Floor

2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY

30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221

211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022



Key:

RWP ○ Rainwater downpipe

— F1 Photograph location

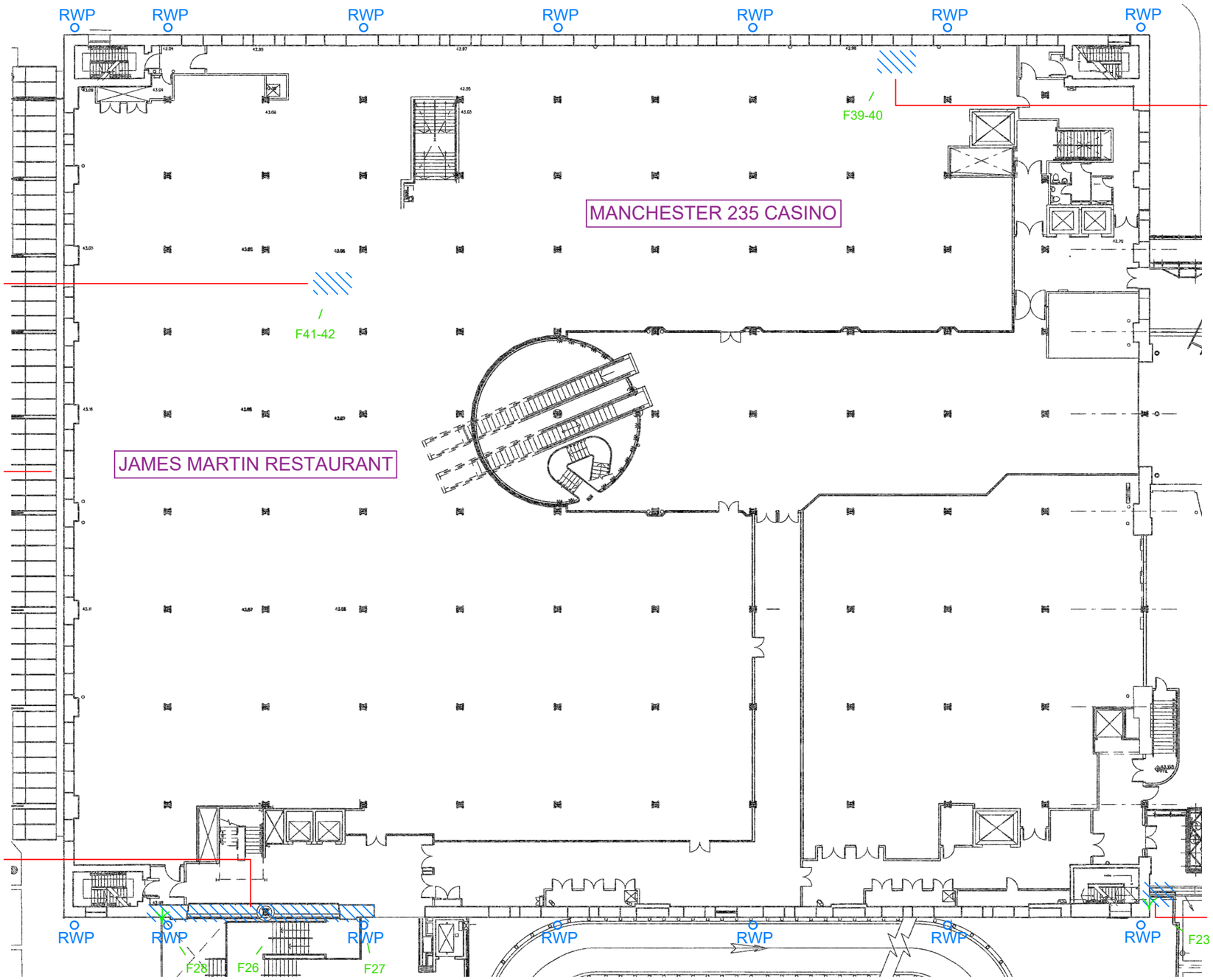
Great Northern, Manchester - Second Floor

2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY

30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221

211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022



Possible plumbing leak from Female W.C. toilet. High surface moisture readings beneath vinyl floor covering. Possibly entrapped water from wet mopping

Defective seal to Female W.C. sink tap causing leak beneath sink

Canopy roof gutter vulnerable to blockage and overtopping

Water ingress via valley gutter to glazed roof. No timber structures but electrics are directly beneath

Defective surface water from podium deck

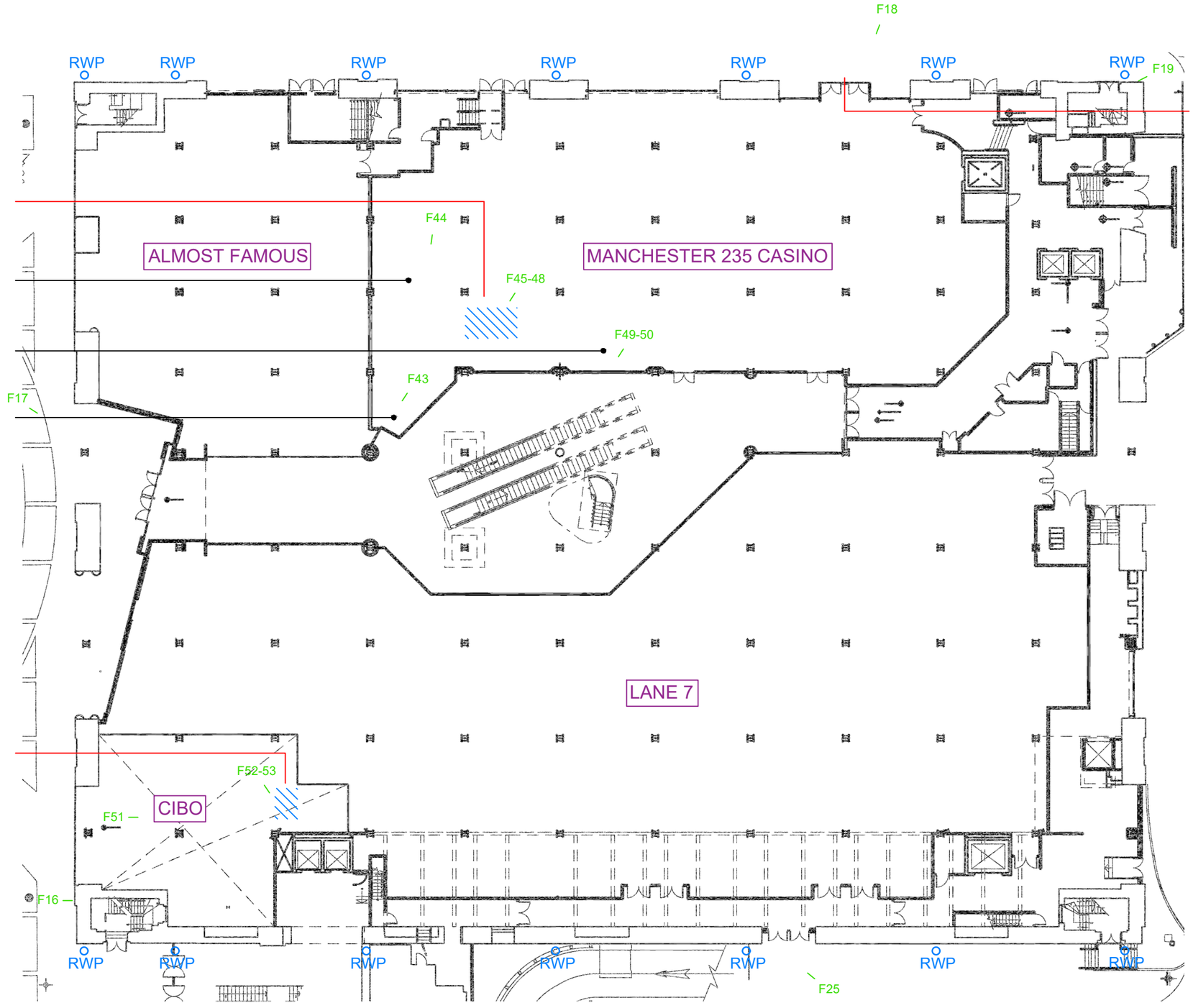
Key:

- RWP — Rainwater downpipe
- F1 — Photograph location
- Area subject to water penetration - timbers at risk of decay
- Plant growth

Great Northern, Manchester - First Floor

2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY
30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221
211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022



Great Northern, Manchester - Ground Floor
2nd RECONNAISSANCE DAMP AND TIMBER DECAY SURVEY
30 May-1 June 2022

Hutton + Rostron Environmental Investigations Ltd
Netley House, Gomshall, Surrey, GU5 9QA Tel: 01483 203221
211.18 Report -Not to scale- © Copyright Hutton+Rostron 2022

Key:

- RWP ○ Rainwater downpipe
- — F1 Photograph location
- Area subject to water penetration - timbers at risk of decay