Ms Joanne Wavish
Building Surveyor
Directorate of Estates & Facilities
The University of Manchester

Whitworth Art Gallery, Manchester, M15 6ER
North Stair Window - Inspection of North Stair Window Joinery

Diagnostic, Non-destructive, Environmental Damp, Dry Rot, Wet Rots, Beetle Infestation & Timber Decay Survey

Recommendations for Sustainable Conservation Solutions & Environmental Control of Dry Rot, Wet Rots, Timber Infestation, Damp & Decay

Site Visit: 1st June 2022

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Site Visit: 1st June 2022

Prepared by:.....
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BSc MSc PhD CFIBiol FRSH FRSA
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Job No: JS/HL/BC/1990/013
Reference: JS/pk
Date: June 2022

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1 Introduction

Environmental Building Solutions Ltd (EBS) carried out a Diagnostic, Non-destructive, Environmental Damp, Dry Rot, Wet Rots, Beetle Infestation & Timber Decay Survey of the North Stair Window Joinery at the Whitworth Art Gallery, Manchester on 1st June 2022.

During this site visit mortar sample and testing of the walls of the first floor north room was also undertaken as requested on site.

This Diagnostic survey was carried out in accordance with verbal and email instructions dated 23rd May 2022 from Ms Joanne Wavish, Building Surveyor, Directorate of Estates, The University of Manchester, and EBS proposal dated 6th August 2021 and site visit email dated 1st June 2022.

The following report contains details of our observations and recommendations.

The front entrance to the building was taken as east for the purposes of orientation in this report.

1.1 Limitation of Survey

The investigation was carried out to accessible areas of the North Stair Window Joinery only.

It must be stressed at the outset that EBS has prepared this report only for the consideration of the parties concerned in the process of resolving the problem.

This report does not constitute an investigation of the potential structural and design defects identified at Whitworth Art Gallery, Manchester and must not be taken as such. The report is not intended as a definition of structural damage for the purposes of litigation or as a specification for the remedial works.

An inspection of a property of this age and type of construction is subject to restrictions. As EBS has not inspected the building at other stages during the refurbishment, we cannot comment upon the workmanship in areas that are now covered or otherwise concealed.

Concealed timbers and cavities have not been investigated. The condition of some 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 the structure to be ascertained with certainty and this destroys what it is intended to preserve. Specialist non-destructive investigative techniques are therefore employed as aids to the surveyor.

No such technique can be 100% reliable, but their use allows deductions to be made about the most probable conditions of materials at the time of examination.

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No formal risk assessment of residual moisture has been carried out in the building, however limited mortar sampling & mould sampling has been undertaken.

1.2 EBS Experience

EBS has considerable experience in investigating timber decay, residual moisture, damp, moulds and insect/pest risk assessment and environmental health problems in building, please visit EBS web site www.ebssurvey.co.uk

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2 Executive Summary

2.1 Preliminaries

Environmental Building Solutions Ltd (EBS) carried out a Diagnostic, Non-destructive, Environmental Damp, Dry Rot, Wet Rots, Beetle Infestation & Timber Decay Survey of the North Stair Window Joinery at the Whitworth Art Gallery, Manchester on 1st June 2022.

During this site visit mortar sample and testing of the walls of the first floor north room was also undertaken as requested on site.

This Diagnostic survey was carried out in accordance with verbal and email instructions dated 23rd May 2022 from Ms Joanne Wavish, Building Surveyor, Directorate of Estates, The University of Manchester, and EBS proposal dated 6th August 2021 and site visit email dated 1st June 2022.

The following report contains details of our observations and recommendations.

The front entrance to the building was taken as east for the purposes of orientation in this report.

2.2 Observations

2.2.1 First Floor Northeast Room

Mortar sampling (sample 1 surface, and sample 1 depth) in the south east corner of the first floor north east room indicated that the wall was dry.

Active dry rot, (Serpula *lacrymans)* was found in the south east corner of the first floor north east room, see laboratory analysis.

Fungal testing of the dry rot sample in the south east corner of the first floor north east room indicated that the dry rot is still active.

2.2.2 North Staircase Windows

Active dry rot, (Serpula *lacrymans),* (see laboratory analysis) was found in the following locations;

- Upper picture rail in the staircase north wall and
- Lower picture rail in the staircase north wall

Active mould infestation, see laboratory analysis, was found to the window joinery at ceiling level to the north staircase window.

Mortar sampling (sample 2, 3, 4, 6 & 6 surface and sample 2, 3,4, 5 &6 at depth) in the north wall of the north staircase indicated that the wall is dry in the areas inspected.

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Moisture meter readings of masonry in many locations indicated dampness (See photographic documentation).

Moisture meter readings of timber in many locations indicated dry (See photographic documentation).

The results of mortar sampling indicated low residual moisture in the building fabric tested areas and high levels of hygroscopic salts indicated chronic water ingress.

2.2.3 Lath & Plaster Sampling

Two samples were undertaken (see marked plans showing sampling locations for testing anthrax) in the animal hair incorporated in the lath and plaster of the building fabric of this age and construction of the building.

These samples have been sent for analysis and the results will be forwarded in due course.

2.3 Recommendations

Conservation works are required to the following elements;

- Upper picture rail in the north staircase north wall, ensure to Isolate the Upper picture rail from dry rot infested masonry on a damp proof membrane

- Lower picture rail in the north staircase north wall, ensure to Isolate the lower picture rail from dry rot infested masonry on a damp proof membrane

- Isolation of the north staircase upper window frame from dry rot infested masonry on a damp proof membrane

- Isolation of the north staircase lower window frame from dry rot infested masonry on a damp proof membrane

This is detailed in the report.

Allow for removal of salt damaged lath and plaster from the north staircase wall around the window frame and picture rail areas and reinstate like for like.

It is recommended to monitor the reinstatement works in progress.

2.4 Further Inspection

It is recommended to monitor the plaster work opening up and reinstatement works in progress, so that appropriate recommendations can the be provided as deemed necessary.

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3 Observations

3.1 Exteriors

3.1.1 North East Elevation



The downpipe in the south east corner on the exteriors of the north room appeared to be sound. An overflow had been added at hopper head level.

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There was however plant, moss and algal growth on the top of the cornice and strung courses on the elevations, which may indicate water penetration.

The cause of dampness and salt efflorescence on the interiors to the north staircase wall may be due to defects to the north east elevation as shown in photograph above and in photographic documentation, see general observations 3.2.1.

3.2 First Floor - North Room

A brief inspection of this room was made as requested on site by the client.

1 Mortar Sampling

Mortar sample 1 surface and depth was taken from the south end of the east wall to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry with a high hygroscopic salt content, indicating past chronic water penetration.

2 Timber Infestation Sampling

Fungal infestation sampling (F1) was undertaken in the south east corner of the room, this indicated active dry rot, see marked plan showing fungal infestation sampling location and laboratory analysis results in appendices.



3 Window

The south window in the east wall was inspected. The window frame and associated window joinery was damaged by dry rot along the south side of the window and to the window sill at the south end.

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Localised dampness to the wall to the south of the window may be sustaining the dry rot.

4 Walls



There was visible salt efflorescence and old dry rot mycelium on the south end of the east wall behind the dry lining.



There may be localised dampness to the south end of the east wall south of the window and the east end of the south wall.

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3.3 North Staircase

3.3.1 General

There were visible signs of extensive salt efflorescence and bubbling and flaking of painted finishes to the north wall of the north staircase.



3.3.2 Upper Window

1 Mould infestation

There was extensive mould infestation to the top of the window frame below the cornice at ceiling level.



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The mould infestation sampling F4 and F5 indicated that the mould infestation was active and this may be due to localised dampness.

2 Upper Picture Rail

There was active dry rot in the wall behind the upper picture rail. Dry rot mycelium and strands were evident in the opened up locations behind the upper picture rail, see photograph below.

There was dry rot to the picture rail and fixings.



3 Mortar Sampling

Mortar sample 2 surface and depth was taken from the north wall at ceiling level to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry with a high hygroscopic salt content, indicating past chronic water penetration.

Mortar sample 3 surface and depth was taken from the north wall below the upper picture rail to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry with a high hygroscopic salt content, indicating past chronic water penetration.

4 Timber Infestation Sampling

Fungal infestation sampling (F2) was undertaken in the north wall of the staircase in the opened up upper picture rail location, see marked plan showing fungal sampling location. The sampling indicated active dry rot, see laboratory analysis in appendices.

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5 Window

There were no visible signs of fungal infestation and decay to the window joinery.

The window lintel at ceiling level was found to be of stone construction.

The window joinery moisture contents ranging between 9% and 13%. This indicated that the window joinery is dry.

3.3.3 Lower Window

1 Lower Picture Rail

There was active dry rot in the wall behind the lower picture rail. Dry rot mycelium and strands were evident in the opened up locations behind the upper picture rail, see photograph below.

There was dry rot to the picture rail and fixings.

2 Mortar Sampling

Mortar sample 4 surface and depth was taken from the north wall at above the lower picture rail to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry with a high hygroscopic salt content, indicating past chronic water penetration.

Mortar sample 5 surface and depth was taken from the north wall below the lower picture rail to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry

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with a high hygroscopic salt content, indicating past chronic water penetration.

Mortar sample 6 surface and depth was taken from the north wall at ground floor to test for dampness, see marked plan showing mortar sampling location. This indicated that the wall was dry with a high hygroscopic salt content, indicating past chronic water penetration.

3 Timber Infestation Sampling

Fungal infestation sampling (F3) was undertaken in the north wall of the staircase in the opened up lower picture rail location, see marked plan showing fungal sampling location. The sampling indicated active dry rot, see laboratory analysis in appendices.



4 Window

There were no visible signs of fungal infestation and decay to the window joinery.

The window joinery moisture contents was ranging between 9% and 13%. This indicated that the window joinery is dry.

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4 Recommendations

4.1 Exteriors

4.1.1 External Elevations

Rectify defects leading to water retention in the external elevation.

Remove plant and moss growth and repoint, ensure that there is no further penetration.

4.2 Interiors

4.2.1 Upper Window and Upper Picture Rail

Conservation works are required to the following elements;

Ensure to remove all dry rot infected fixing timbers of the upper picture rail in the north staircase north wall and isolate the Upper picture rail from dry rot infested masonry on a damp proof membrane.

Allow for isolation of the north staircase upper window frame from dry rot infested masonry on a damp proof membrane.

4.2.2 Lower Window and Lower Picture Rail

Conservation works are required to the following elements;

Ensure to remove all dry rot infected fixing timbers of the lower picture rail in the north staircase north wall and isolate the lower picture rail from dry rot infested masonry on a damp proof membrane.

Allow for isolation of the north staircase lower window frame from dry rot infested masonry on a damp proof membrane.

4.2.3 Plaster Work

Allow for removal of salt damaged lath and plaster from the north staircase wall around the window frame and picture rail areas and reinstate like for like.

This will also help to kill the dry rot in the north wall of the north staircase.

It is recommended to monitor the reinstatement works in progress.

4.2.4 Damp & Residual Moisture

Generally damp and saturated masonry will take years to dry out naturally and this makes the existing structural timbers and new timbers in contact with damp masonry vulnerable to fungal infestation and decay.

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Therefore, it is recommended to expose dry infected masonry to discourage the fungal infestation and decay and remove or isolate timbers in contact with dry rot infested masonry.

4.3 Chemical Treatments

No chemical treatments for fungal and insect infestation are required.

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5 Further Inspection

5.1 Monitoring Moisture, Infestation and Decay

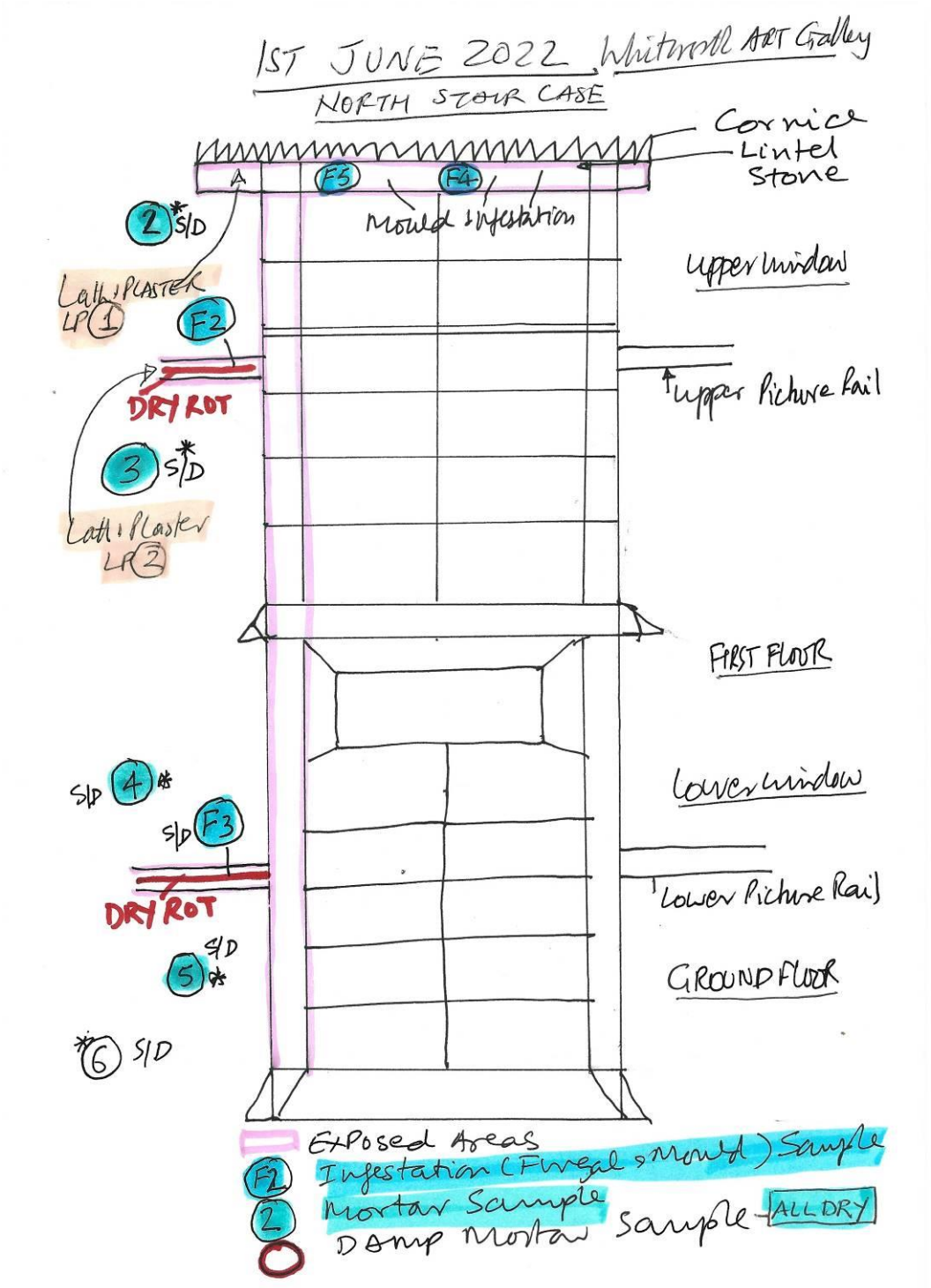
It is recommended that EBS inspect any areas that were not exposed and accessible during the survey, so that appropriate recommendations can then be provided as deemed necessary.

It is recommended to monitor the plaster work opening up and reinstatement works in progress, so that appropriate recommendations can then be provided as deemed necessary.

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Appendix 1: Marked Plans Showing Damp and Decay

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Appendix 2: Photographic Documentation

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Photograph No 1 Showing fungal sampling from southeast corner of the first floor north room.



Photograph No 2 Showing dry rot damage to window frame and mycelium and strands on wall in the southeast corner of the first floor north room.



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Photograph No 3 Showing dry rot mycelium and strands on wall in the southeast corner of the first floor north room.



Photograph No 4 Showing dry rot mycelium and strands on wall in the southeast corner of the first floor north room.



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Photograph No 5 Showing extensive salt efflorescence on wall in the southeast corner of the first floor north room.



Photograph No 6 Showing extensive salt efflorescence on wall in the southeast corner of the first floor north room.



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Photograph No 7 Showing extensive salt efflorescence and dry rot mycelium on wall in the southeast corner of the first floor north room.



Photograph No 8 Showing extensive salt efflorescence and dry rot mycelium on wall in the southeast corner of the first floor north room.



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Photograph No 9 Showing extensive salt efflorescence and dry rot mycelium on wall in the southeast corner of the first floor north room.



Photograph No 10 Showing animal hair in lath and plaster work systems.



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Photograph No 11 Showing animal hair in lath and plaster work systems.



Photograph No 12 Showing mould infestation to north staircase window joinery at ceiling level.



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Photograph No 13 Showing no visible signs of dry rot in the north east opening up location at ceiling level of the top window.



Photograph No 14 Showing no visible signs of dry rot in the north west opening up location at ceiling level of the top window.



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Photograph No 15 Showing no visible signs of dry rot in the north west opening up location at ceiling level of the top window



Photograph No 16 Showing damp & decayed fixing timbers to upper picture rail.



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Photograph No 17 Showing dry rot mycelium and damp & decayed fixing timbers to upper picture rail.



Photograph No 18 Showing close up of dry rot mycelium and damp & decayed fixing timbers to upper picture rail.



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Photograph No 19 Showing salt efflorescence to opened up wall below the upper picture rail.



Photograph No 20 Showing dampness and salt effloresce to walls of north wall of the staircase at upper levels.



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Photograph No 21 Showing dry rot infestation to timber fixings of the upper picture rail.



Photograph No 22 Showing dry rot infestation to timber fixings of the upper picture rail.



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Photograph No 23 Showing no visible signs of decay to window joinery.



Photograph No 24 Showing mortar sampling location 2.



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Photograph No 25 Showing mortar sampling location 3.



Photograph No 26 Showing damp, algae and moss growth on string course.



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Photograph No 27 Showing moisture contents of wall below ceiling level indicating dry.



Photograph No 28 Showing moisture contents of wall below ceiling level indicating dry.



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Photograph No 29 Showing moisture contents of wall below ceiling level indicating dry.



Photograph No 30 Showing moisture contents of wall below ceiling level indicating dry.



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Photograph No 31 Showing moisture contents of wall below ceiling level indicating dry.



Photograph No 32 Showing lath and plaster sampling for anthrax testing.



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Photograph No 33 Showing moisture contents of upper picture rail indicating dry.



Photograph No 34 Showing moisture contents of upper window at ceiling level indicating dry.



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Photograph No 35 Showing mould infestation and moisture contents of upper window at ceiling level indicating dry.



Photograph No 36 Showing mould infestation and moisture contents of upper window at ceiling level indicating dry.



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Photograph No 37 Showing moisture contents of upper window joinery indicating dry.



Photograph No 38 Showing moisture contents of upper window joinery indicating dry.



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Photograph No 39 Showing mould contact sampling of contaminated upper window.



Photograph No 40 Showing no visible signs of dry rot to upper window joinery.



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Photograph No 41 Showing rusting to fixings of upper picture rail indicating long term water ingress.



Photograph No 42 Showing rusting to fixings of upper picture rail indicating long term water ingress.



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Photograph No 43 Showing mortar sampling location 4 and blistering and bubbling of painted finishes.



Photograph No 44 Showing blistering and bubbling of painted finishes.



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Photograph No 45 Showing paint flaking, blistering and bubbling of painted finishes.



Photograph No 46 Showing moisture contents of masonry indicating damp.



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Photograph No 47 Showing moisture contents of masonry indicating damp.



Photograph No 48 Showing moisture contents of masonry indicating damp.



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Photograph No 49 Showing moisture contents of masonry indicating damp.



Photograph No 50 Showing moisture contents of masonry indicating saturation.

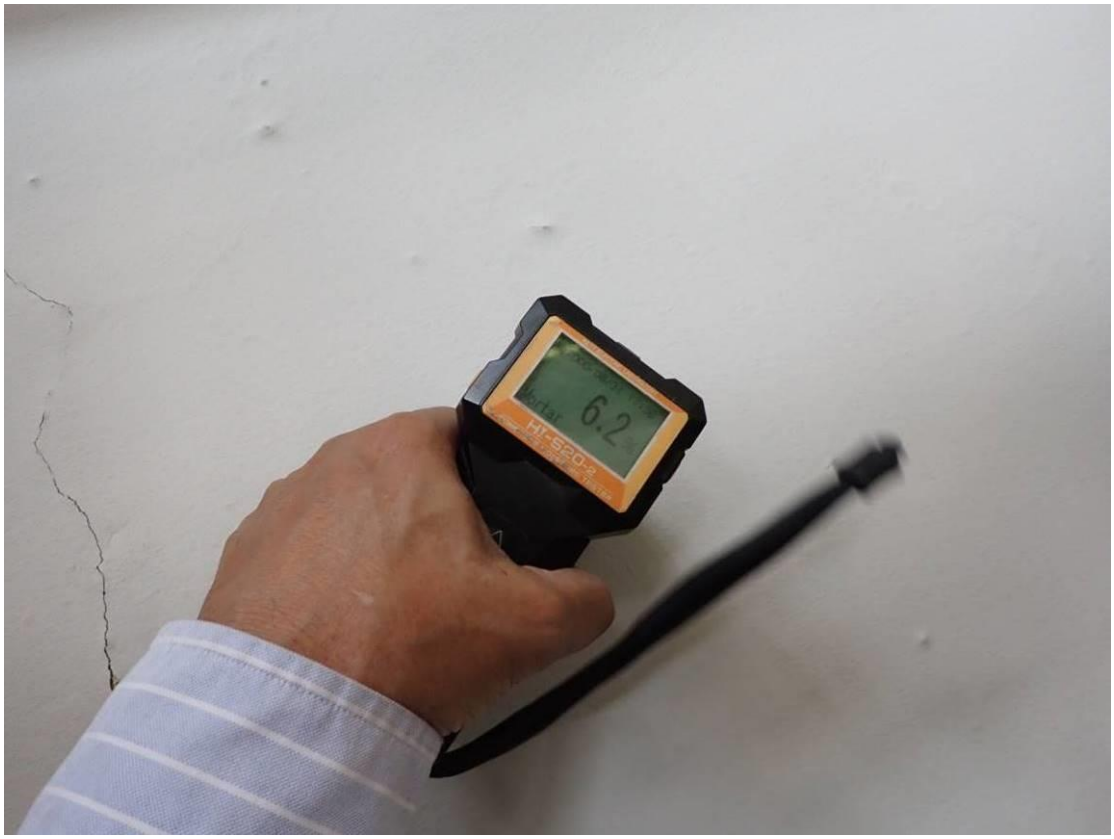


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Photograph No 51 Showing moisture contents of masonry indicating saturation.



Photograph No 52 Showing moisture contents of masonry indicating saturation.

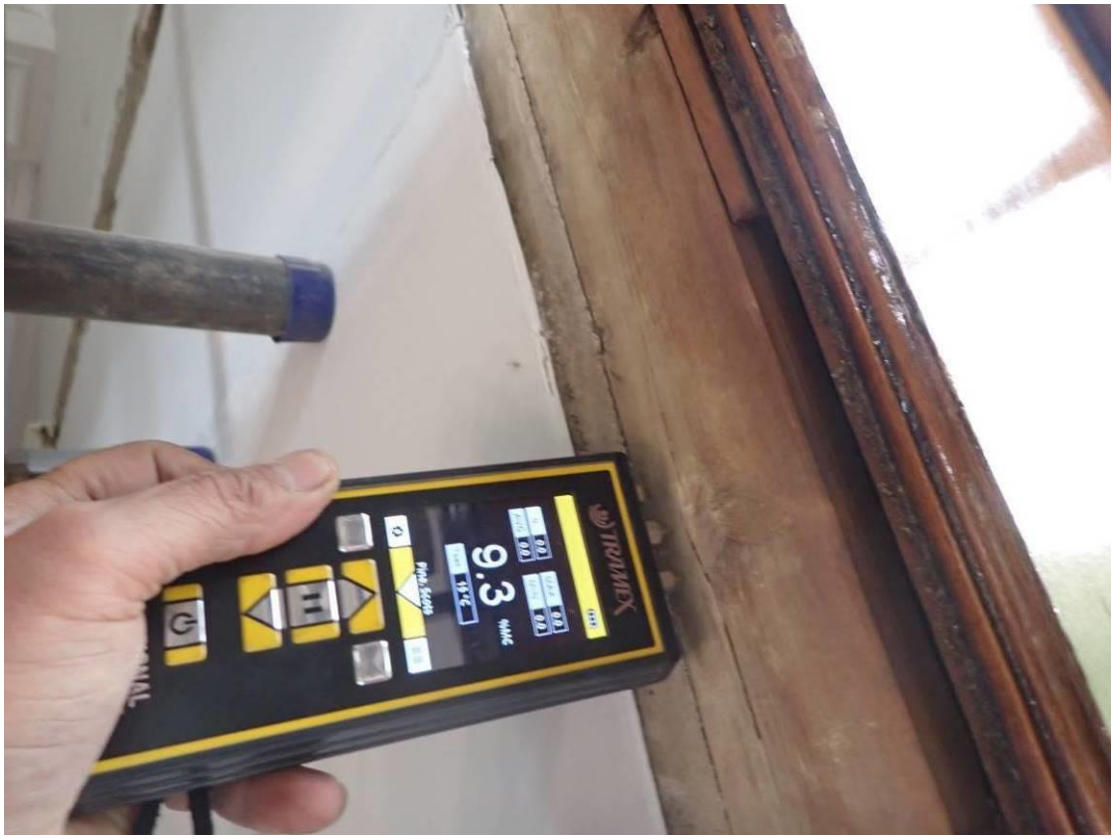


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Photograph No 53 Showing moisture contents of window joinery indicating dry.



Photograph No 54 Showing moisture contents of window joinery indicating dry.



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Photograph No 55 Showing moisture contents of masonry indicating saturation.



Photograph No 56 Showing moisture contents of masonry indicating damp.



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Photograph No 57 Showing extensive dry rot to lower picture rail.



Photograph No 58 Showing extensive dry rot to lower picture rail.



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Photograph No 59 Showing extensive dry rot to lower picture rail.



Photograph No 60 Showing extensive dry rot to lower picture rail.



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Photograph No 61 Showing extensive dry rot to lower picture rail.



Photograph No 62 Showing decay to bonding timbers and extensive dry rot to lower picture rail.



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Photograph No 63 Showing decay to bonding timbers and extensive dry rot to lower picture rail.



Photograph No 64 Showing mortar sampling location 6.



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Photograph No 65 Showing north staircase window joinery and scaffolding access.



Photograph No 66 Showing north staircase window joinery and scaffolding access.



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Photograph No 67 Showing dampness and plant growth to external north elevation.



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Photograph No 68 Showing dampness and plant growth to external north elevation.



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Photograph No 69 Showing dampness and plant growth to external north elevation.



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Appendix 3: Fungal & Mould Sample Laboratory Analysis

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ENVIRONMENTAL BUILDING SOLUTIONS LTD

Laboratory Services

Laboratory Analysis Technical Report

Reference: JS/BC/1990/013/Lab/01

Date: 21st June 2022

Location: North Staircase Window Joinery at Whitworth Art Gallery, Manchester, M15 6ER

The samples were taken on 1st June 2022 and received on 1st June 2022 and analysed for fungal viability and identification tests.

The results are attached in the analysis sheet as follows;

Signatures:

Prepared by:.....
Dr Jagjit Singh
Mycologist, Building Pathologist
& Environmental Scientist
BSc MSc PhD CFIBiol FRSH FRSA

Director
Environmental Building Solutions Ltd

Approved by: ……..
Mr Huw Lloyd
Timber Pathologist, Material &
Environmental Scientist
BSc AIWSc

Technical Director
Environmental Building Solutions Ltd

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Fungal & Mould Identification and Viability Tests

Sampling Locations with Identification of Genera Isolated

Date of Sampling: Samples were taken on 1st June 2022

Location: North Staircase window joinery at Whitworth Art Gallery, Manchester, M15 6ER

Sample No	Sample Location	Identification	Viability
First Floor Dry rot infestation to timber elements window frame/sill and walls See Marked plans F1	JS/BC/1990/013/Lab/01 C1 Photograph 1	Dry Rot decay Fungi *Serpula lacrymans*	Active
Upper Picture Rail westside Dry rot infestation to timber elements exposed Picture rail See Marked plans F2	JS/BC/1990/013/Lab/02 C2 Photograph 21	Dry Rot decay Fungi *Serpula lacrymans*	Active
Lower Picture Rail westside Dry rot infestation to timber elements exposed Picture rail See Marked plans F3	JS/BC/1990/013/Lab/03 C3 Photograph 57	Dry Rot decay Fungi *Serpula lacrymans*	Active

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Sampling Locations with Identification of Genera Isolated

Date of Sampling: Samples were taken on 1st June 2022

Location: North Staircase window joinery at Whitworth Art Gallery, Manchester, M15 6ER

Sample No	Sample Location	Identification	Viability
Top of window frame at ceiling level Dry rot infestation to timber elements window frame/sill and walls See Marked plans F4	JS/BC/1990/013/Lab/04 C4 Photograph 15	MOULD *Penicillium chrysogenum* *Aspergillus versicolor*	 Active Active
Upper Picture Rail westside Dry rot infestation to timber elements exposed Picture rail See Marked plans F5	JS/BC/1990/013/Lab/05 C5 Photograph 39	MOULD *Penicillium chrysogenum* *Cladosporium cladosporioides*	 Active Active

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Appendix 4: Mortar Sample Analysis Results

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ENVIRONMENTAL BUILDING SOLUTIONS LTD

Laboratory Services

Laboratory Analysis Technical Report

Reference: Lab/JS/BC/1990/013/MS

Date: 21st June 2022

Location: North Stair Window at the Whitworth Art Gallery, Manchester

The samples were received on 1st June 2022 and analysed for total and hygroscopic moisture content as requested.

The results are attached in the analysis sheet as follows;

Signatures:

Samples Analysed by: ----------	Checked by:----------
Dr Jagjit Singh	Mr. Huw Lloyd
BSc MSc PhD CBiol FIBiol FRSH FRSA	BSc AIWSc
Director	Technical Director
Environmental Building Solutions Ltd	Environmental Building Solutions Ltd

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Analysis Data Sheet

Location: North Stair Window at the Whitworth Art Gallery, Manchester

Date: 21st June 2022

Lab Ref	Sample Ref	Hygroscopic Moisture %	Total Moisture %
Lab/JS/BC/1990/013/MS/01	S1 (Surface)	**0.17**	0.35
Lab/JS/BC/1990/013/MS/02	S1 (Depth)	**0.33**	2.21
Lab/JS/BC/1990/013/MS/03	S2 (Surface)	**0.72**	0.84
Lab/JS/BC/1990/013/MS/04	S2 (Depth)	**0.89**	2.19
Lab/JS/BC/1990/013/MS/05	S3 (Surface)	**0.94**	0.66
Lab/JS/BC/1990/013/MS/06	S3 (Depth)	**1.23**	2.17
Lab/JS/BC/1990/013/MS/07	S4 (Surface)	**1.41**	2.63
Lab/JS/BC/1990/013/MS/08	S4 (Depth)	**1.99**	3.11
Lab/JS/BC/1990/013/MS/09	S5 (Surface)	**0.21**	1.93
Lab/JS/BC/1990/013/MS/010	S5 (Depth)	**1.22**	2.81
Lab/JS/BC/1990/013/MS/011	S6 (Surface)	**0.60**	1.54
Lab/JS/BC/1990/013/MS/012	S6 (Depth)	**1.33**	2.98

High Readings in Red Bold indicated dampness – No high readings

High Readings in Green Bold indicated high levels of Hygroscopic Salts

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