



A Preliminary Study of Flood Remediation in Hebden Bridge and Appleby

Prepared for Historic England by
Dr Brian Ridout, Chris Wood and Iain McCaig

Discovery, Innovation and Science in the Historic Environment



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Front cover: Flooding in Hebden Bridge, Boxing Day, 2015 (Chris Rattcliffe [copyright] Hebden Bridge Web)

FOREWORD

Historic England is frequently called upon to give advice about remedial works and repair after incidents of flooding. Conventional approaches to remediation usually require extensive removal and replacement of building fabric, such as timber floors, joinery and plasterwork. This is costly and can result in substantial harm to the heritage significance of a building. In addition, buildings may remain unusable for extended periods, disrupting the lives and businesses of occupants. The research project described in this report forms part of a programme of investigation to understand better the resilience of older buildings to flooding, and assess the effectiveness of property level resilience and differing approaches to remediation. The aim is to provide information that will enable informed, evidence-based decisions to be made about measures to minimise the impact of flooding on the historic built environment.

SUMMARY

This report presents some preliminary findings of site visits to properties in Hebden Bridge, West Yorkshire, and Appleby-in-Westmorland, Cumbria, ten months after the severe flooding that occurred in December 2015. The purpose of the visits was to investigate different responses and remediation methods, and assess how successful they have been.

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1 INTRODUCTION

On the 10th and 11th October 2016, Chris Wood (team leader) and Iain McCaig of the Building Conservation and Research team at Historic England, together with consultant Brian Ridout, visited Hebden Bridge, Yorkshire and Appleby-in-Westmorland, Cumbria.

Both of these towns had been severely flooded during December 2015 and the purpose of our visit was to investigate the different responses and remediation methods employed and to assess how successful these had been.

Building owners or occupiers were asked a series of questions about the flood, its effects, their responses including the remedial measures used, and the outcome over the past ten months.

2 HEBDEN BRIDGE

Flooding occurred on 26th December 2015. An idea of the depth of water is gained from a marker on the wall of the Yorkshire Soap Co shop (indicated by the arrows in the image below). The lower mark was the height of the previous flood water and was used to select the height of flood barriers. Unfortunately barriers that were supposed to keep water out helped to keep it in when water went over the top.



Figure 1: Shop front in Hebden Bridge showing levels reached by flood water in 2012 and 2015.

2.1 William Holt, Greengrocer

Building construction: Solid stone-faced walls; terrazzo/stone flag floors.

Duration of flood: 48 hours.

Approximate depth of water above ground floor level:

1m (indicated by arrow in Figure 3).

Were any property level protection measures in place?

No.

Was there an opportunity to remove moveable items to safety?

Nothing saved.

How soon after the flood were you able to start remedial actions?

As soon as flood water receded.

What remedial actions were taken? (e.g. Cleaning – how? Disinfecting – with what? Details of any heating, ventilation or dehumidification provided at this time)

Cleaned out mud and swabbed walls and floor with an agricultural disinfectant. Three dehumidifiers used over a 3-week period. (Back rooms have un-plastered stone walls. All rooms have solid floors).

How soon after the flood were you able to reopen for business?

3 weeks.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

Dehumidifiers kept running for a further 4 weeks.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

No.

Are stored items becoming damp or damaged? (This is generally easy to see with paper)

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable for habitation or trading?

Yes.



Figure 2: Shopfront of William Holt, greengrocer.



Figure 3: Arrow indicates the approximate depth of water above ground floor level.

2.2 Earth Spirit, Gallery

Building construction: Solid stone-faced walls; concrete floor.

Duration of flood: 48 hours.

Approximate depth of water above ground floor level

1m.

Were any property level protection measures in place?

Flood barrier at door.

Was there an opportunity to remove moveable items to safety?

Some items saved.

How soon after the flood did were you able to start remedial actions?

As soon as water receded.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Mud cleared and surfaces disinfected. Laminated floor finish had floated and was easily removed. Dehumidifiers used. (Walls were replastered with a 'waterproof' plaster (?) after the previous flood in 2012).

How soon after the flood were you able to reopen for business?

6 weeks. Merchandise transferred from Spirals (see Section 2.3).

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

Not clear, but probably none because air fresheners needed to disguise damp smell.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

None.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

Premises now being redecorated; stock removed temporarily.

Have any other remedial actions become necessary over the recent weeks?

Now being redecorated.

Is the property still useable for habitation or trading?

Yes.



Figure 4: Shopfront of Earth Spirit, gallery.

2.3 Spirals, Shop

The same owners or tenants as Earth Spirit.

Building construction: Solid stone-faced walls; suspended timber floors.

Duration of flood

48 hours.

Approximate depth of water above ground floor level

1m.

Were any property level protection measures in place?

Flood barriers at doors (installed after 2012 floods).

Was there the opportunity to remove moveable items to safety?

Some items saved.

How soon after the flood were you able to start remedial actions?

Not clear. There were initial delays whilst insurers agreed to works.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Professional drying. Heaters and dehumidifiers used. The timber floor was removed and replaced with stone flags on a concrete slab (Figure 6) and plaster was hacked from the walls to a height of 1.5m.

How soon after the flood were you able to reopen for business?

7 months.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

None mentioned. Shop signed-off as dry.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

Some mould on items in upstairs store room.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable for habitation or trading?

Yes.



Figure 5: The shopfront of Spirals.



Figure 6: The timber floor was removed and replaced with stone flags.

2.4 Mark Hurst, Opticians

Building construction: Solid stone-faced walls; concrete floors.

Duration of flood

Not clear, but shop is on the banks of the river (Figure 8) so that flood water would have drained as soon as the river dropped.

Approximate depth of water above ground floor level

About 1.5m.

Were any property level protection measures in place?

No barriers, but the floor was tiles, on asphalt, on concrete. Floors had drains to allow water out, but these probably also allowed water in.

Was there the opportunity to remove moveable items to safety?

No.

How soon after the flood did you able to start remedial actions?

As soon as water level dropped.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Cleaning and disinfectant. Dehumidifiers used.

How soon after the flood were you able to reopen for business?

4 days.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

Dehumidifiers ran for 3 weeks whilst the shop was open.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

No.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable for habitation or trading?

Yes.



Figure 7: The shopfront of Mark Hurst, opticians.



Figure 8: The shop is located on the banks of the river.

3.0 APPLEBY-IN-WESTMORLAND

The floods in Appleby occurred on the 5th–6th December 2015 as a consequence of Storm Desmond. This provided 316.4mm of rainfall over the 24-hour period, thus causing the River Eden to overflow, inundating 176 properties.

Flood levels reached up to 1.7m higher than the previous record in 2005 so that flood remedial measures were inadequate. The flood protection system also incorporated pumps, but unfortunately the supply sub-station was at a low level so that power had to be disconnected.

3.1 St Lawrence's Church

Building construction: Solid stone-faced (composite) walls; stone flag/tile floors. Timber flooring beneath pews.

Duration of flood

Approximately 12 hours.

Approximate depth of water above ground floor level

660 mm.

Were any property level protection measures in place?

The church was protected by a bund, but the water pushed its way through.

Was there the opportunity to remove moveable items to safety?

Not known – probably few moveable items.

How soon after the flood did were you able to start remedial actions?

All under the control of the insurers, but commenced in 1 week.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Professional drying. Dehumidifiers and fans ran for seven months.

How soon after the flood were you able to reopen?

Less than three weeks.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

None – building considered to be dry. Moisture content in floorboards beneath pews was measured at 16% (11.10.16). The floorboards showed little sign of ever having been wet (Figure 10).

Moisture contents in the base of the panelling around the wall measured 19% (dropping to 13% @ at 0.75m) but this may have been the same prior to the flood.



Figure 9 (left): St Lawrence's Church.

Figure 10 (right): The floorboards within the pews showed little sign of ever having been wet.

Did mould or fungal growth appear on wall surfaces or other parts of the building? Please give details of locations

There is no mould growth, but the textile linings in the Corporation Pews (Figure 10) were considered to be contaminated by the flood water and are to be removed. This recommendation was made by the assessor for the insurance company although no testing has been undertaken.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable?

Yes.

3.2 Jak & Co, Shop

Building construction: Solid stone-faced walls; suspended timber floors.

Approximate depth of water above ground floor level

1m.

Duration of flood

Water left next day – approximately 12 hours.

Were any property level protection measures in place?

Only the nearby church flood protection, which failed causing water to come over the back window sill (Figure 12).

Was there the opportunity to remove moveable items to safety?

Some.

How soon after the flood did you able to start remedial actions?

Some delay while insurance details completed.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

The floor was removed. Three dehumidifiers and three radiant heaters were used for 6 weeks. Plaster subsequently removed from the lower 1.5m of walls to encourage drying, and use of the equipment was continued. Floor reinstated (concrete slab).

How soon after the flood were you able to reopen for business?

3 months (4th March 2016).



Figure 11: The shopfront of Jak & Co.



Figure 12: The interior of the shop.



Figure 13: The side wall is now wet.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

None but the side wall is now wet (Figure 13) and the skirting board has a moisture content of 22%. The plaster was said to have been replaced with sand and cement, but the surface is damaged.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

Some mould appeared in the upstairs rooms.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

Damp patches appearing on party wall at low level. See Figure 13.

Is the property still useable for habitation or trading?

Yes, but see Figure 13.

3.3 Copying, Printing and Stationery

Building construction: Solid stone-faced walls; suspended timber floors.

Duration of flood

Approximately 12 hours.

Approximate depth of water above ground floor level

300 mm.

Were any property level protection measures in place?

No.

Was there the opportunity to remove moveable items to safety?

Yes.

How soon after the flood did you able to start remedial actions?

As soon as the water dispersed.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Floors were cleaned out and surfaces were disinfected. A dehumidifier was used in each of the two rooms.

How soon after the flood were you able to reopen for business?

A few weeks, but with the doors open to improve ventilation.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

None.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

None.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable for habitation or trading?

Yes.



Figure 14: The shopfront of Copying, Printing & Stationery.

3.4 27–32 Church Street

Building construction: Solid stone rubble walls, rendered externally; suspended timber floors.

Duration of flood

Approximately 12 hours.

Approximate depth of water above ground floor level

150mm.

Were any property level protection measures in place?

Never flooded before. Flood cause by failure of the river flood barrier. Flood barrier failed because there was no power for pumps.

Was there the opportunity to remove moveable items to safety?

Yes. Tenants moved what they could upstairs.

How soon after the flood did were they able to start remedial actions?

Not known, but probably quickly because the houses were occupied.



Figure 15: 27-32 Church Street.

What remedial actions were taken? (e.g. Cleaning: how? Disinfecting: with what? Details of any heating, ventilation or dehumidification provided at this time).

Cleaning and dehumidification. The local authority required that the tenants move out and the suspended timber floors be replaced with concrete slab floors. At the time of our visit (11.10.16) the timber floors were in good condition with moisture contents in the range 14%–16%.

How soon after the flood were you able to reopen for business?

Building still unoccupied.

What heating, ventilation (and dehumidification, if any) has been in operation since reopening?

No.

Did mould or fungal growth appear on wall surfaces or other parts of the building?

No.

Are stored items becoming damp or damaged? (This is generally easy to see with paper).

No.

Have any other remedial actions become necessary over the recent weeks?

No.

Is the property still useable for habitation or trading?

Yes.

4.0 PRELIMINARY CONCLUSIONS

One fact that emerges strongly from this exercise is that there is no consensus of opinion as to how flood damage should be managed. Most people we spoke to seemed to be acting on the advice of insurance companies, but this advice ranged from 'clean up and dry', to 'all moveable porous materials are contaminated and should be thrown away'.

Some thought that removing timber floors in case of future flooding was a good idea, and in Appleby the local authority insisted on it (together with the removal of wall plaster) if flood resilience grant aid was sought. Other advisers were happy that timber should be cleaned and retained.

In general, those people who got out a scrubbing brush and a strong disinfectant were back in business again many weeks before those who had to rely on insurance decisions and drying companies. Certification that walls and floors were dry took several months to obtain while premises remained empty. Meanwhile, neighbouring shopkeepers opened their doors to assist ventilation, used air fresheners and were back in business within three to four weeks. Surprisingly, the only people to mention mould growth (which had occurred in first floor rooms) were those who had professional drying. It may be that additional heat caused humid air to rise up the stairs. Even at the stationery shop, the new stock did not appear to have been affected by damp or mould.

5.0 FURTHER WORK

The preliminary findings of this survey demonstrate the need for further investigation to understand better the resilience of older buildings to flooding, and assess the merits and limitations of differing approaches to remediation. Remedial works after flooding can range from highly invasive approaches (usually insurance backed) that entail extensive removal of affected building fabric, to more ‘minimalist’ approaches. These approaches have widely differing heritage, social and economic implications. The fundamental question is: How well do ‘minimal’ approaches to remediation perform compared to conventional methods that are more invasive and disruptive?

Four complementary lines of investigation are being pursued by Historic England:

- Literature review
- Case studies including site investigations and monitoring
- Laboratory assessment of factors affecting the rates of wetting-up and drying-out of building materials and elements during and after flooding
- Assessment of contamination risks and evaluation of cleaning methods to eliminate bio-hazards

These tasks could be carried out concurrently.

In addition to Historic England and collaborating research institutions and consultants, participants in this research should also include: building owners; relevant local authorities and government departments; National Flood Forum; representatives from the insurance and remediation industries, and trade bodies.



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