Department
for Environment
Food & Rural Affairs

Supporting the uptake of resilient repair during the recovery process (FD2706)

Appendix 6: Eden Bridge House Case Study

July 2019

Funded by the joint Flood and Coastal Erosion Risk Management Research and Development Programme (FCERM R&D). The joint FCERM R&D programme comprises Defra, Environment Agency, Natural Resources Wales and Welsh Government. The programme conducts, manages and promotes flood and coastal erosion risk management research and development.

This is a report of research carried out by carried out by a research consortium comprising The University of the West of England, Bristol; Mary Dhonau Associates; Cunningham Lindsay; Kingston University and Collingwood Environmental Planning, on behalf of the Department for Environment, Food and Rural Affairs.

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Appendix 6: Eden Bridge House Case Study

REVIEW OF DEFRA EDEN BRIDGE HOUSE PROPERTY FLOOD RESILIENCE IMPLEMENTATION

Background

Between 5 and 6 December 2015, unprecedented flooding occurred in Carlisle. The flooding was one of the effects of Storm Desmond, which caused a period of prolonged, intense rainfall across Northern England. The rain fell on saturated catchment areas and led to high river levels and flooding throughout Cumbria and beyond. On the 6 December the flow in the River Eden in Carlisle was the highest ever recorded, which led to flood levels in some locations approximately 600mm higher than those experienced during the previous record set in January 2005 (Environment Agency and Cumbria County Council, 2016).

In response to the 2005 flood event, defences in Carlisle had been designed to protect the city from an event more severe than that experienced in on that occasion, and took account of both climate change and freeboard (this being an additional contingency allowance to take account of uncertainty) (Environment Agency, 2001). The river levels experienced in December 2015 exceeded the design level of the existing defences, resulting in the extensive flooding of the city. Approximately 2,100 properties were directly affected by the flooding (Environment Agency and Cumbria County Council, 2016).

Defra's regional offices for both the Rural Payments Agency (RPA) and the Animal and Plant Health Agency (APHA) operate from Eden Bridge House, which is in the Hardwick Circus area of Carlisle. The River Eden forms the northern boundary of the area. The office block was built in the 1960s and had been affected by the flooding in 2005, but reinstatement had been undertaken 'as was'. The extent of the flooding in 2015 and the position of Eden Bridge House in relation to that flooding are shown in Figure 1 and Figure 2. The progression of events in the Hardwick Circus area are listed in Table 1.

Saturday 5 December 2015	
1528	Flood Warning Issued
1734	Severe Flood Warning Issued
1800	Flooding from drains reported in Hardwick Circus area
Sunday 6 December 2015	
0000-0030	Overtopping of defences between Bitts Park and Hardwick Circus
0215	Sands Centre defences overtopped
0215	Evacuation of properties on Corporation Road
0915	River Eden peak at Sheepmount – 7.80m

Table 1 – Timeline of flooding events in Hardwick Circus area of Carlisle in December 2015

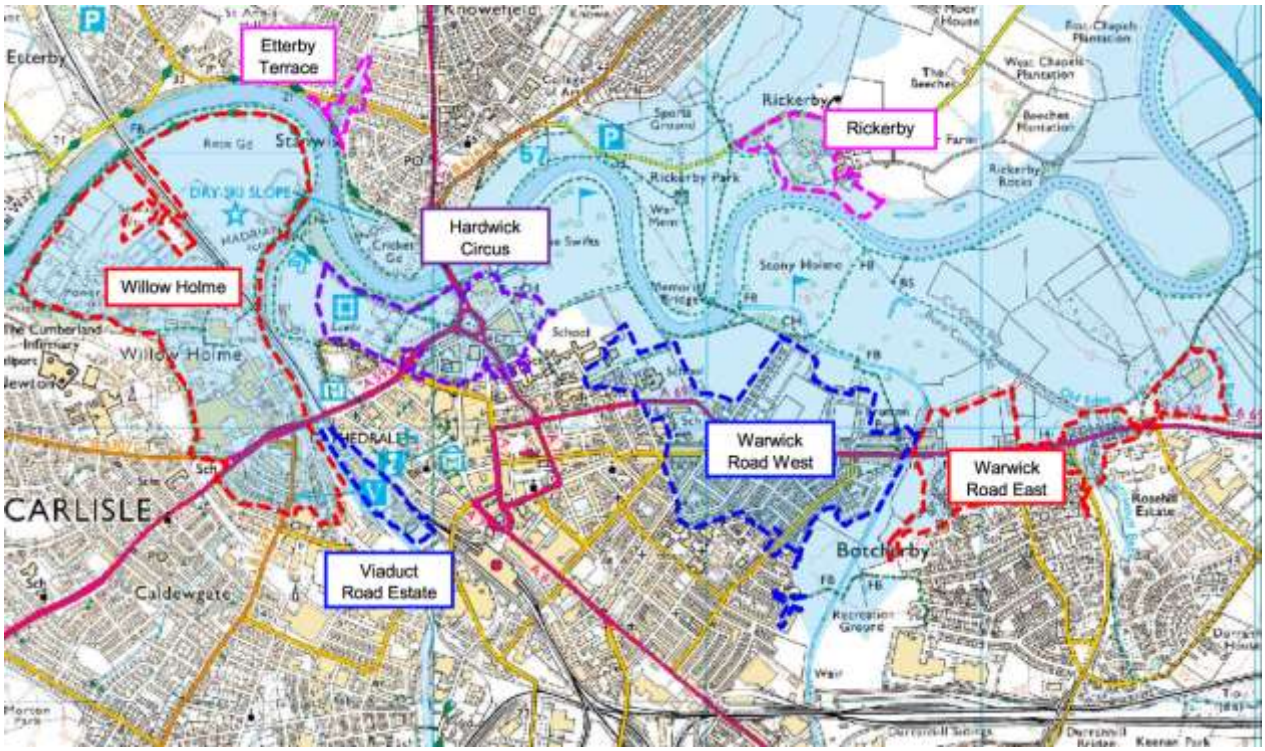

Figure 1 – Carlisle: Identification of areas flooded December 2015 (Environment Agency & Cumbria County Council, 2016)

Figure 2 – Location of Eden Bridge House and landmarks in Hardwick Circus area of Carlisle. (Environment Agency & Cumbria County Council, 2016)

Eden Bridge House, along with other properties in the Defra property portfolio, is managed by Interserve FM (Facilities Management), which is part of Interserve PLC, a UK based support service and construction company (Interserve PLC, 2018). In December 2015, Interserve FM had reached the mid-point of a fifteen-year contract for the management and support of the Defra's property portfolio. Oversight of Interserve FM activity in Defra's Northern Region, which includes Carlisle, is provided by the Defra FM Group Service Delivery Team, which is based in Newcastle upon Tyne.

Effect of Flooding on Eden Bridge House

The lower ground floor of Eden Bridge House was flooded early on 6 December. The water depth reached approximately 1.4m at the peak. Offices, storage facilities (archives etc) and the building's plant room were flooded. Immediate action was taken to secure the building and local contractors were speedily brought in to pump out and clean-up the lower ground floor. Access to those services was partly based on enabling arrangements between Interserve and its tiered suppliers, as well as the ability to raise purchase orders through the Company's Procurement Department much faster than 'normal'. Although there was risk of exploitative pricing for access to pumps, standby accommodation and other facilities in the wake of the flooding, the close (and already well-established) working relationships between Interserve and its contractors minimised that risk.

Although Interserve FM kept in close contact with the customer (Defra's FM Service Delivery Team) during initial recovery of the building, the company had significant freedom of manoeuvre to take actions to secure and then re-occupy the building as soon as possible. Much of that freedom was based on its access and input to the business continuity plans of the organisations operating from Eden Bridge House. It was clear that Interserve FM understood the priorities of each of the agencies for reinstatement of appropriate levels of service. The immediate action and recovery phase of Eden Bridge House was completed in just over one week, allowing agencies to re-occupy the top four floors of the building. It is certain that disruption to business services provided by those agencies would have been greater if they had had to set-up in alternative accommodation, such as porta-cabins, for any length of time.

Resilient Repair/ Refurbishment

The next phase of the building recovery, entitled refurbishment, then slowed. A key reason for the delay was a review of how the building was used, as well as the development of a plan to improve resilience of the building. The decision to repair the building using resilient measures was taken by the Executive Committee of Defra. This decision was informed using information from a number of consultants that made it clear that the building was likely to suffer further flooding in the future.

Prior to the flooding in December 2015, the lower ground floor provided both office accommodation, canteens and archive facilities. A significant impact of the flooding was the loss of paper records belonging to the Rural Payments Agency. A key outcome of the review of building usage was to move archive facilities to higher floors and move meeting and conference rooms that were previously interspersed across the building to the lower

ground floor. Meeting rooms and canteen space were chosen as the least disruptive to be out of use of an extended period of time. Although both these facilities being out of action would disrupt business operations, they were more easily transferable to other temporary locations than other operations.

Interserve were also asked to draw up a study of resilience options to refurbish the ground floor using a method that would, in the event of future flooding, allow the building to be re-occupied in a matter of weeks rather than months/years. As part of this study a small team reviewed numerous resilience measures and met with suppliers to discuss different products.

Although the cost of refurbishment was an important decision factor, the review also prioritised speed of recovery and the availability of materials and products within the period of the expected future recovery time. This thinking was reinforced by the knowledge that many fixtures and fittings in the offices will be expected to be replaced regularly as part of a normal refurbishment cycle. A key member of the team described it:

> *"We looked at the lead times for products being proposed and reviewed cost effectiveness with a principle that if a product could be re-ordered and delivered in a similar timescale to that required to dry out the flooded building, it would not be worth paying over three times as much for a resilient option."*

This resulted in a final design that enhanced the recoverability of the building fabric using new materials and elevation strategies, but took a sacrificial approach to many of the fixtures and fittings.

Materials chosen to be sacrificial and replaced in event of flooding included:

Carpet – cheaper than tiles, paint or other resilient flooring, also aesthetically better than other solutions given that this will be a working office environment.

Fire doors – timber fire doors and door frames were significantly cheaper than resilient options, due to the standard sizes used, these doors can be replaced within 6wks.

Kitchen – The canteen kitchen is made from standard chipboard. The unit sizes are off the shelf and can be replaced within a few weeks. A flood resilient option made from solid grade laminate was over 5 times more expensive.

Furniture – A number of solutions for flood resilient furniture were reviewed as part of the design, however these were all very expensive. New meeting room furniture could be procured within the 6wk drying/cleaning period. At the time of refurbishment, Defra was able to relocate unused furniture from other parts of the estate which gave a very cost effective solution. Where possible to use conference and meeting room furniture that can be easily dismantled and moved to safety.

Materials chosen to be flood resilient included:

Wall render – the wall render was chosen because it does not soak up water and harbour bacteria. As per the guidance in PAS64, after the 2015 flood over 100 swab samples were taken around the lower ground floor and the existing wall plaster was found to be harbouring bacteria in quantities that would not normally be found in an office environment. It was decided that any replacement wall coating should prevent this in the event of future flooding. The Sika render chosen can simply be washed down in the event of future flooding. It can also be repaired if damaged, has a method for retrospective penetrations to be made if required and, although expensive compared to conventional plaster, is relatively cheap given its 20yr guaranteed life and an assumption of 1 in 5 year flooding.

Partitioning – a number of partitioning methods were reviewed, including sacrificial plasterboard, mineral board, blockwork and glazed. The decision was taken to use a mixture of blockwork and glazed. Blockwork gave the most cost effective flood resilient solution, however, it was felt to use this for all walls would not have given a great aesthetic and would have created a dark space. Therefore, glazed partitioning was used for the corridor walls. The single glazed units can simply be cleaned down in the event of flooding. Extensive conversations were held with glazed partitioning manufacturers around guarantees that the rubber seals on units could withstand being submerged in water, although these could not be given, a model was chosen due to the ease of replacement of these seals if required. This model had the added benefit of being available as a single glazed fire rated unit as the standard double glazed units would harder to clean in the event of flooding.

Toilets - The toilets are now resilient to flooding due to the materials used to fit them out. The walls around most of the area has been rendered with the Sika product, however due to its rough final surface, it was decided this would be unhygienic and difficult to clean in ‘splash risk’ areas so tiles with a waterproof adhesive and grout were used. The toilet cubicles has previously been standard chipboard units, these have been replaced with solid grade laminate. This was more expensive, however cubicle manufacturers could not guarantee a 6wks lead time on replacements. Although there was a possibility that other toilets in the building could be used for an extended period if those on the lower ground floor were taken out of action by flood, it was decided that the solid grade product was worth the extra cost, particularly as it is more durable than standard chipboard and would have a longer life.

There is also a shower area on the lower ground floor, this was fitted out as a wetroom to be fully resilient.

Electrical/data installation – The distribution method for the electrical and data systems was designed to be resilient and, in part, sacrificial. Due to the high level of past flooding, it was agreed that, to be truly resilient, electrical and data systems would need to be mounted so high on the walls as to be impractical for use. Therefore it was agreed that the main infrastructure would be distributed within the ceiling, with connection points above the ceiling in each room. Connections would then be taken from these and run to socket

distribution in dado trunking around the walls – in very basic terms, like an extension lead from the ceiling sockets. In the event of flooding, the ‘extension lead’ would be discarded, the trunking cleaned out and a new set of ‘extension leads’ replaced. This method would save the time and disruption of having to replace the whole electrical/data infrastructure but would also allow the distribution of sockets in usable locations.

Electrical infrastructure – the mains electrical panel was located on the lower ground floor. As part of the works, this was relocated upstairs, above the predicted flood level. A generator connection was also added to this panel which would enable a temporary electrical supply to be given to the building in the event that local electrical network distribution had been knocked out by the flood.

Ongoing annual maintenance/refurbishment repair budget

This was reviewed as part of the options into materials/methods used as was the estimated lifetime of the materials used which informed the decision on cost effectiveness of resilient solutions. It was important that there would not be an unjustified increase in annual maintenance as a result of the works. It is not expected that any of the methods or materials used caused an increase to the maintenance budget. As a result of the incumbent FM contractor being involved in the total redesign of the floor, systems were relocated to ensure future maintenance would be easier.

[Decision still to be reached regarding protection of plant room per se – either installation of flood barrier across doors into plant room, or across top of external stair well leading to plant room. Some services remain vulnerable, such as gas boiler – electronic control unit fitted to the lower part of boiler].

A Notice of Tender calling for refurbishment of Eden Bridge House was issued on 14 July 2016, calling for responses by 5 August 2016 (Tenders Direct, 2016). Refurbishment of Eden Bridge House was completed May 2017, approximately eighteen months after flooding. The cost of refurbishment and installation of property flood resilience was £1.3M. The cost was ‘self-funded’ (government department budget).

Reaction to Refurbishment

The refurbishment of the lower ground floor of Eden Bridge House has created a clean and open conference and meeting room space. The openness is heightened by the use of glass panels with appropriate privacy screening rather than traditional partition walls. Some users have been critical of the space calling it ‘sterile’; there has also been disappointment at the restrictions placed on fixing noticeboards/whiteboards etc to the wall (restriction imposed as means of maintaining integrity of the Sika waterproof membrane system).

Figure 3 - Eden Bridge House – Refurbished Lower Ground Floor

Figure 4 – Eden Bridge house = Refurbished Meeting room

Expected benefits of making the building flood resilient

In the event of future flooding there will be significantly reduced downtime for the lower ground floor this would have the following benefits:

Business operations – due to the redistribution of office/meeting room space, the building could continue to deliver normal business operations immediately after a flood event.

Electrical supply – due to the addition of a generator connection socket to the main panel, a temporary electrical supply could be given to the building immediately after a flood event if the local mains supply had been knocked out. This would enable the building to be used even if there was not mains electricity.

Meeting room downtime – the estimated downtime for the new lower ground floor facility would be 6-8wks. Following the 2015 flood, it took this long to strip out the lower ground floor and begin the clean/drying procedures.

Conclusion

Overall, the initial recovery and subsequent refurbishment of Eden Bridge House has been done well. An impressive feature of this project was the speed of response. Agencies operating from Eden Bridge House were able to return to work in just over a week. Key factors that contributed to the swift turnaround of Eden Bridge House include the existence of comprehensive business continuity plans; the fact that Defra's FM contractor was allowed to access, and where appropriate, contribute to those business continuity plans; and the partner way of working between Defra's Service Delivery Team responsible for direction and oversight of the FM contract and Interserve FM. Although recovery of Eden Bridge House slowed following actions immediately following the flood event, the overall recovery period is still good: the lower ground floor was returned into service in just over 18 months.

Property flood resilience measures have been incorporated during the refurbishment, which will have benefit if the building is flooded again. These measures were installed after consideration was given to the future flood risk, the features of the building, the priorities of the occupiers and the operational requirements post flood. It was possible to do this because the building remained operational despite the continuing refurbishment.

A value for money judgement about installing of this range of property flood resilience measures during refurbishment cannot be made easily. A full cost benefit analysis was not undertaken. However, if those measures prove effective when the building is next flooded, then reinstatement of full business services will be even quicker, ultimately saving time and money.

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Acknowledgements

This review is based on desk study and interviews with and written responses from key actors involved in the recovery and refurbishment of Eden Bridge house within 2018. We would like to thank the professionals who gave their time and information to the project. Also thanks to Tim Berry and Mary Dhonau for collecting and preparing the case study information.

Further resources related to this case study

See Attached flyer summarising the refurbishment

INSERT LINK

A poster is available here

INSERT LINK

A Digital testimonial describing the refurbishment is available

INSERT LINK

Case Study – Eden Bridge House, Carlisle

DEFRA's regional offices of the Rural Payments Agency (RPA) and the Animal and Plant Health Agency (APHA).

1960s Office Block affected by the flooding in 2005 and reinstated without adaptation

Flooded December 2015 to approximately 1.4M. Offices, storage facilities and the building's plant room were flooded.

PFR measures included during refurbishment included

Corridor showing. Painted wall finish direct on masonry rather than plastered. replacement of partition walling with glass panel walling. 'sacrifical' carpeting.

Installation of 'sacrificial' door frames and doors that are fully compliant with building and fire standards.

Elevation of electrical and data services above 2015 flood level.

Conference and meeting room furniture that can be easily dismantled and moved to safety.

Installation of Sika Watertight Concrete System throughout the lower ground floor.

Installation of capacity to dis-connect/isolate electrical and data services in ceiling.

Why did Defra choose this approach?

A significant impact if the flooding was the loss of paper records belonging to the Rural Payments Agency.

Recognition that the building would flood despite the defences

Building did not permit the use of barriers?

How did Defra manage the recovery?

Recovery was managed for Defra by Interserve in the mid-point of a fifteen-year contract.

Well-established working relationships between Interserve and its contractors and trust between interserve and the occupiers facilitated recovery.

Collaborative business continuity plans of the organisations operating from Eden Bridge House meant Interserve FM understood the priorities of each of the agencies.

Case study created as part of Defra Project FD2670 Supporting the uptake of resilience in the recovery process.
By UWE, Bristol, Mary Dhonau Associates. With grateful thanks to Defra and Interserve

Expected consequences of the resilient reinstatement

Benefits of making the building flood resilient

In the event of future flooding there will be significantly reduced downtime for the lower ground floor this would have the following benefits:

Business operations – due to the redistribution of office/meeting room space, the building could continue to deliver normal business operations immediately after a flood event.

Electrical supply – due to the addition of a generator connection socket to the main panel, a temporary electrical supply could be given to the building immediately after a flood event if the local mains supply had been knocked out. This would enable the building to be used even if there was no mains electricity.

Meeting room downtime – the estimated downtime for the new lower ground floor facility would be 6-8wks. Following the 2015 flood, it took this long to strip out the lower ground floor and begin the clean/ drying procedures.

Ongoing annual maintenance/ refurbishment repair budget

This was reviewed as part of the options into materials/methods used as was the estimated lifetime of the materials used. The review informed the decision on cost effectiveness of resilient solutions. It was important that there would not be an unjustified increase in annual maintenance as a result of the works.

There is no expectation that the methods or materials used caused an increase to the maintenance budget.

The involvement of the incumbent FM contractor meant that services were relocated in ways that ensured future maintenance would be easier.

Case study created as part of Defra Project FD2670 supporting the uptake of resilience in the recovery process.

Produced by UWE Bristol and Mary Dhonau Associates.

With grateful thanks to Defra and Interserve.

Floodrepairable

Department for Environment Food & Rural Affairs

DEFRA FLOOD REPAIRABLE CASE STUDY

Case Study – Eden Bridge House, Carlisle

Edenbridge House, Carlisle, houses DEFRA's regional offices of the Rural Payments Agency (RPA) and the Animal and Plant Health Agency (APHA).

The building is a 1960s office block that suffered significant flood damage to the lower ground floor in December 2015, the second time in 5 years that the building flooded. Extensive repair work was required to the lower ground floor before it could be returned to use.

Floodrepairable

Department for Environment Food & Rural Affairs

Case Study – Eden Bridge House, Carlisle

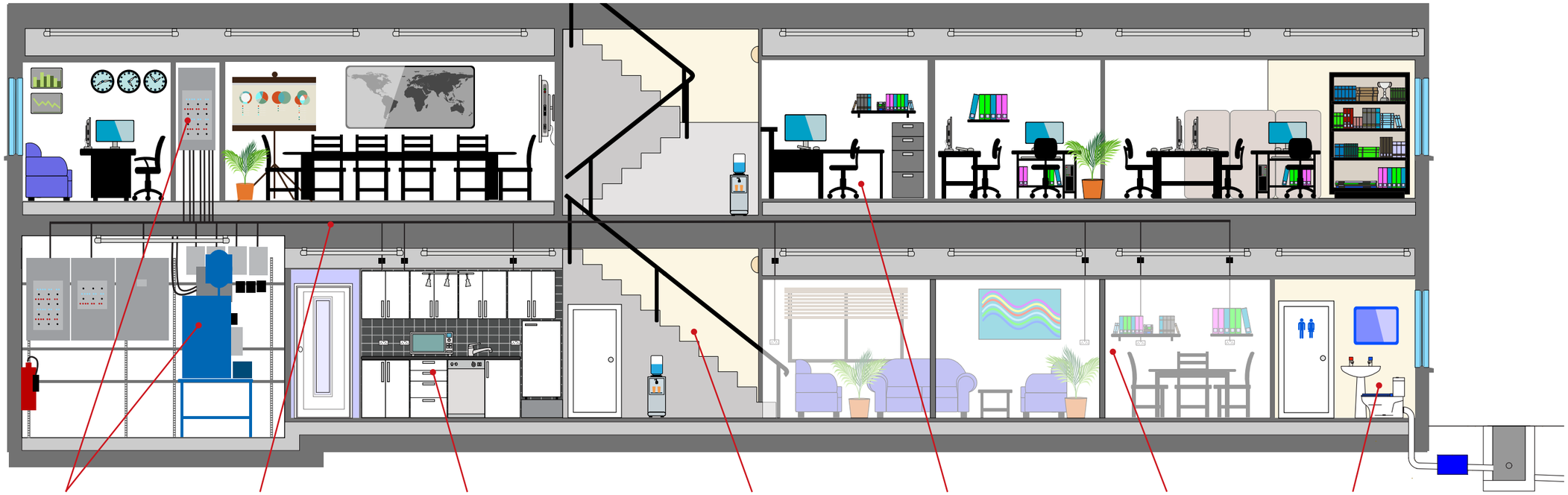
The Recovery and choice of resilient repair

The recovery was managed for Defra by Interserve in the mid-point of a fifteen-year contract, good working relationships and understanding between the parties enabled a swift reoccupation of most of the building and operations to continue. The ability to operate while repairs were ongoing allowed for a thorough review of options for reinstatement of the damaged areas. There was a recognition that the building would flood again despite the defences and that the building did not permit the use of barriers.

Therefore the decision to repair the building using resilient measures was taken by recommendations of the Executive Committee of Defra. This decision was informed using information from a number of consultants regarding future risk. The drivers were cost effectiveness but more importantly to use measures that: ***in the event of future flooding, allow the building to be re-occupied in a matter of weeks rather than months/years.***

The team reviewed numerous resilience measures and met with suppliers to discuss different products. They employed the principle that if a product could be re-ordered and delivered in a similar timescale to that required to dry out the flooded building, it would not be worth paying over three times as much for a resilient option. The resilient design employed a number of strategies:

- **Reorganisation of facilities** where possible to avoid sensitive materials being exposed to f looding
- **Raising of services** where possible to avoid damage
- **Investment in building fabric** where this will speed reoccupation after future flooding and can be justified on a cost basis
- **Sacrificial elements** where they can be replaced quickly and resilient alternatives are significantly more expensive
- **Contingency Planning** already strong but strengthened through the understanding developed in the project



Electrical supply

Electrical panel relocated upstairs. A generator connection was also added to this panel which would enable a temporary electrical supply to be given to the building in the event that local electrical network distribution had been knocked out by the flood.

Services adaptations

Due to the high level of past flooding, it was agreed that, to be truly resilient, electrical and data systems would need to be mounted so high on the walls as to be impractical for use. Therefore it was agreed that the main infrastructure would be distributed within the ceiling, with connection points above the ceiling in each room. Connections would then be taken from these and run to socket distribution in dado trunking around the walls, like an extension lead from the ceiling sockets. In the event of flooding, the 'extension lead' would be discarded, the trunking cleaned out and a new set of 'extension leads' replaced

Kitchen adaptations

The canteen kitchen is made from standard chipboard. The unit sizes are off the shelf and can be replaced within a few weeks. A flood resilient option made from solid grade laminate was over 5 times more expensive.

Corridor adaptations
- wall membrane, finishes, doors

the wall render was chosen because it does not soak up water and harbour bacteria. As per the guidance in PAS64, after the 2015 flood over 100 swab samples were taken around the lower ground floor and the existing wall plaster was found to be harbouring bacteria in quantities that would not normally be found in an office environment. It was decided that any replacement wall coating should prevent this in the event of future flooding. The Sika render chosen can simply be washed down in the event of future flooding. It can also be repaired if damaged, has a method for retrospective penetrations to be made if required and, although expensive compared to conventional plaster, is relatively cheap given its 20yr guaranteed life and an assumption of 1 in 5 year flooding.

Timber fire doors and door frames were significantly cheaper than resilient options, due to the standard sizes used, these doors can be replaced within 6wks.

Offices

Offices relocated upstairs. Paper storage relocated upstairs. Meeting rooms and canteen space were chosen as the least disruptive to be out of use for an extended period of time. Although both these facilities being out of action would disrupt business operations, they were more easily transferable to other temporary locations than other operations.

Flood resilient furniture was reviewed, however these were all very expensive. New meeting room furniture could be procured within the 6wk drying/cleaning period. Defra was able to relocate unused furniture from other parts of the estate which gave a very cost effective solution. Where possible they used conference and meeting room furniture that can be easily dismantled and moved to safety.

Meeting room adaptations
Sacrificial carpets and furniture, glass partitions

– a number of partitioning methods were reviewed, including sacrificial plasterboard, mineral board, blockwork and glazed. The decision was taken to use a mixture of blockwork and glazed. Blockwork gave the most cost effective flood resilient solution, however, it was felt to use this for all walls would not have given a great aesthetic and would have created a dark space. Therefore, glazed partitioning was used for the corridor walls. The single glazed units can simply be cleaned down in the event of flooding. Extensive conversations were held with glazed partitioning manufacturers around guarantees that the rubber seals on units could withstand being submerged in water, although these could not be given, a model was chosen due to the ease of replacement of these seals if required. This model had the added benefit of being available as a single glazed fire rated unit as the standard double glazed units would harder to clean in the event of flooding.

Carpet – cheaper than tiles, paint or other resilient flooring, also aesthetically better than other solutions given that this will be a working office environment.

Toilet adaptations

The toilets are now resilient to flooding due to the materials used to fit them out. The walls around most of the area has been rendered with the Sika product, however due to its rough final surface, it was decided this would be unhygienic and difficult to clean in 'splash risk' areas so tiles with a waterproof adhesive and grout were used. The toilet cubicles has previously been standard chipboard units, these have been replaced with solid grade laminate. This was more expensive, however cubicle manufacturers could not guarantee a 6wks lead time on replacements. Although it was considered whether other toilets in the building could be used for an extended period if those on the lower ground floor were taken out of action by flood, it was decided that the solid grade product was worth the extra cost, particularly as it is more durable than standard chipboard and would have a longer life.

There is also a shower area on the lower ground floor, this was fitted out as a wetroom to be fully resilient.