M Design

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JOB NUMBER: **MD1573**

PROJECT: **HOTT SCHOOL HOUSE FRA**

CLIENT: MR & MRS ROBSON

REPORT NUMBER: MD1573/rep/001

REPORT TITLE: **FLOOD RISK & DRAINAGE ASSESSMENT**

Prepared with reasonable care and attention:

[redacted]

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EXECUTIVE SUMMARY

M Design were commissioned by Mr and Mrs Robson to undertake a Flood Risk Assessment (FRA) to support a planning application for the extension of Hott School House, Tarset.

The existing building is a two storey dwelling, the proposals is to place a small extension to the front and rear.

The site is shown to be on the edge of flood zone 3 of the watercourse to the north. Therefore the client will need to take all practicable steps to reduce the risk to its occupiers should flooding occur. This will be discussed within this report.

CONTENTS

1 INTRODUCTION

1.1 Background

M Design were commissioned by Mr and Mrs Robson to undertake a Flood Risk Assessment (FRA) to support a planning application for the extension of Hott School House, Tarset.

The planning process requires an assessment to be made of any flood risks related to proposed developments. In particular this involves two key issues; whether the development itself would be at risk of being flooded or whether the development would increase the risk of flooding elsewhere. This assessment is contained within this report which has been prepared to be submitted with the planning application.

1.2 Scope of Report

The following tasks were undertaken in the preparation of this report:

- An assessment was made in order to identify any risks of flooding to the site, identify drainage patterns, receiving watercourses, and to identify any constraints to the drainage system that may restrict the proposed development;
- Liaison with the Environment Agency was undertaken to establish occurrences of flooding in the area;
- Evaluation was made of how the proposed development would affect the existing surface water runoff.

1.3 Consultations and Data Sources

The following tasks were undertaken in the preparation of this report:

- Environment Agency Flood Maps;
- CIRIA Document 624 ‘Development and Flood Risk’
- Environment Agency
- Improving the Flood Performance of New Buildings

2 Site Description

2.1 Site Location

The proposed development is situated in Tarset, Northumberland, at a grid reference of approximately NY 775 858.

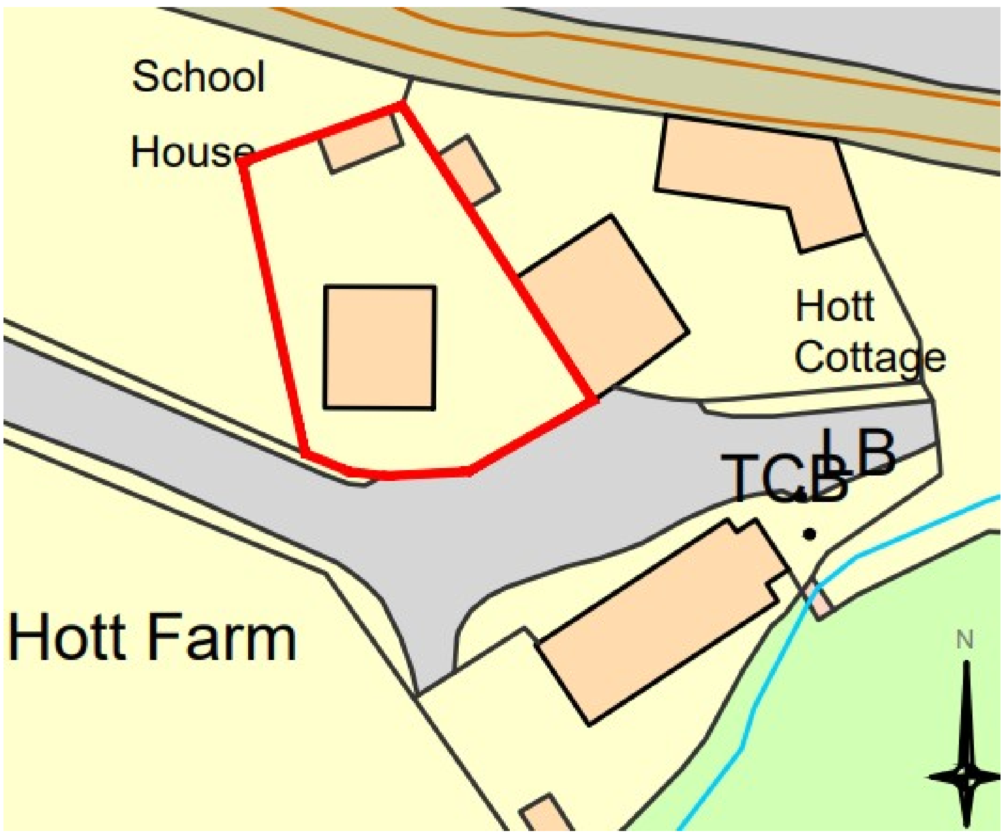


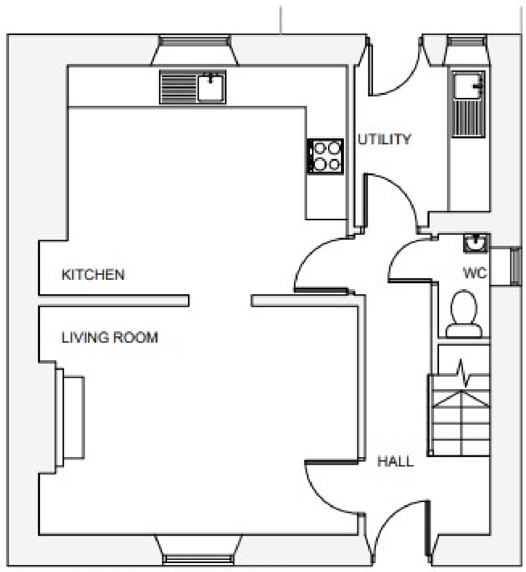
Fig 2.1 Location of Proposed Works.

The site is surrounded mainly by field, dwellings and agricultural buildings. The River North Tyne flows approximately 280 to the north.

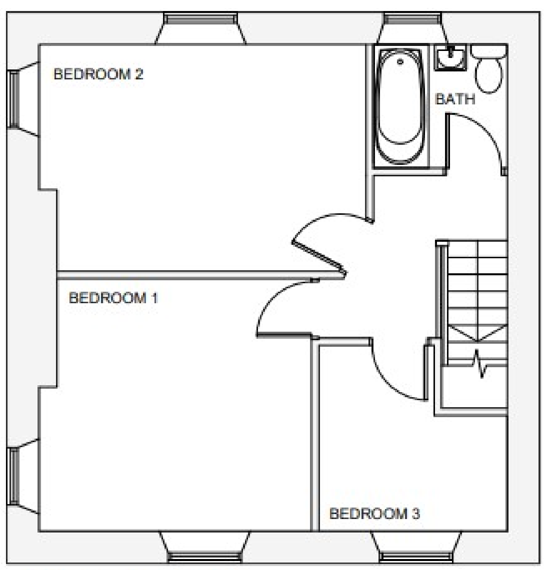
An aerial photographic image is included within this report as Appendix A.

2.2 Site Details

The existing dwelling is a 2 storey house with no ground floor sleeping.



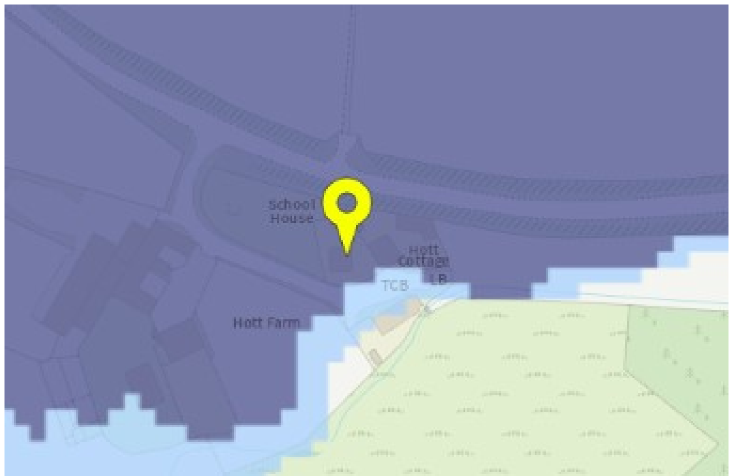
GROUND FLOOR PLAN



FIRST FLOOR PLAN

2.3 Site Flooding Potential

The development is shown by the Environment Agency flood maps to lie within **Flood Zone 3** (Appendix C). The Environment Agency's definition of Flood Zone 3 is stated below:



<u>**Zone 3 High Probability**</u>

Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses
The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.
The highly vulnerable uses in Table D.2 should not be permitted in this zone.
The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements
All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims
In this zone, developers and local authorities should seek opportunities to:
i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;
ii. relocate existing development to land in zones with a lower probability of flooding; and
iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage

To establish if the proposed development is appropriate within Flood Zone 3 the vulnerability of the site is to be assessed. Although not referred to directly in the table below the proposed works are thought to be classed as “**More Vulnerable**”.

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations.
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.19
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children’s homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non–residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste.20 • Sites used for holiday or short-let caravans and camping, **subject to a specific warning and evacuation plan**.
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non–residential institutions not included in ‘more vulnerable’; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working).

Table D.3: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)	Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	YES	YES	YES	YES	YES
Zone 2	YES	YES	Exception Test Required	YES	YES
Zone 3a	Exception Test Required	YES	NO	Exception Test Required	YES
Zone 3b 'Functional Floodplain'	Exception Test Required	YES	NO	NO	NO

As shown previously the site is within **Flood Zone 3** and is classed as **More Vulnerable**. Table D.3 confirms that the development is appropriate, but an exception test is required. As this application is for an extension of use then an exception test may not be required. The site does however fulfil the 3 main points of the test.

1) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk

2) the development should be on developable previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable previously developed land; and

3) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

In relation to the above we would like to make the following comments:

- The flood risk will be managed on site and will not increase the flood risk over the current situation.
- The development is on previously developed land
- This report will prove that the flood risk will be managed and not increase the likelihood of flooding elsewhere. The development just a minor extension so should have no major affect on the flood risk in the area.

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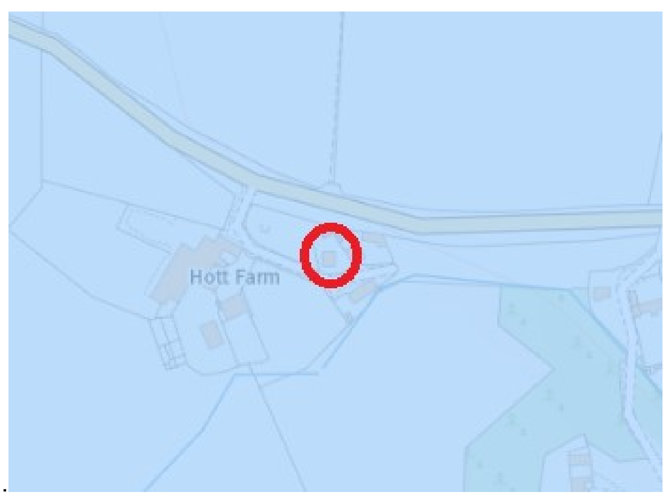
Surface Water Flooding

M Design have also considered other forms of flooding. The below plan shows that there is no risk of surface water flooding for storm event up to a 1 in 1000 year event.

The risk of flooding from a local reservoir failing has also been investigated. Shows that if the local reservoir was to fail there could be flooding on site. However, the Environment Agency state that this is an extremely unlikely event.



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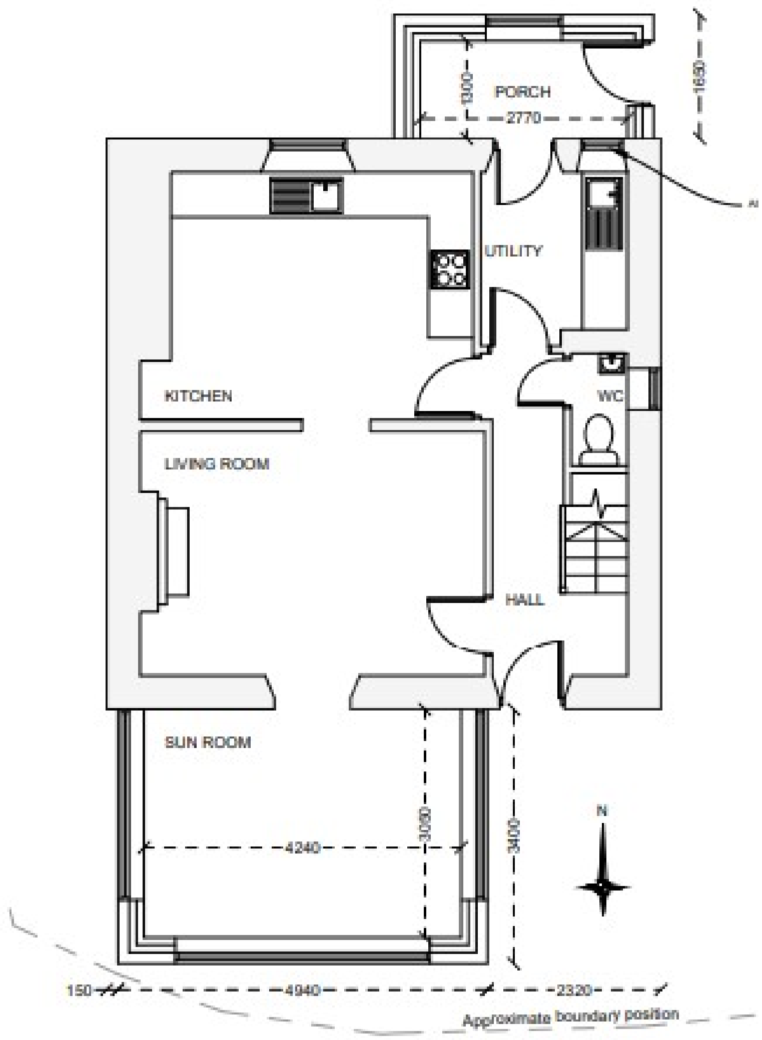
3 Proposed Development

3.1 Proposed Development Description

The proposed application is to construct a small extension to the front and rear of the building. The extension is less than 25m2 so classed as a minor extension. There will be no sleeping accommodation within the extension.



GROUND FLOOR PLAN

3.2 Proposed Development Surface Water Runoff & Proposals

There will be a small increase in impermeable area. The client will investigate the possibility of using soakaways as a method to discharge the additional flows. Investigations will be carried out on site to confirm of the ground conditions are suitable for the use of soakaways. If they are found not to be viable then the extension will connect into the drainage system for the existing house.

3.3 Risk and Resilience

As the site is within a flood zone it is important to ensure the users of the building are kept as safe as possible. If it is not already the case the occupiers should sign up to the Environment Agency early flood warning system. This will give advanced warning of potential flowing so they can prepare or evacuate to higher ground. The house is on the edge of the flood zone and approximately 100m away from flood zone 1.

The flood risks and evacuation route from the property should be included within the deeds of the house so future occupiers are aware of the risks. As the building is 2 storey the users could seek refuge on the higher floors if required.

CGL 2007 Improving Flood Performance of New Buildings document recommends that the construction should adopt a flood resilient approach if the water is below 600mm deep and prevent water entering the building. The exact depths are not known but it is assumed to be below 600mm as the site is near the edge of the flood zone. The document shows a number of mitigation measures which have been shown below. The client will incorporate any that are feasible for this development.

Foundations

General advice for resilient design

Where concrete ground floor slabs are used, the blockwork substructure is often the weakest point in terms of water penetration from the ground into a dwelling. Whereas there is a general perception that water can ingress through the blockwork structure of the external face of a wall into the property, it is less apparent, but equally possible, that water will penetrate from the ground on the inside of the property. Figures 6.2 and 6.3 illustrate these flow paths for two types of ground floor (ground bearing floor and suspended concrete floor), and different types of foundation (typical for construction in England).

Concrete blocks used in foundations should be sealed with an impermeable material or encased in concrete to prevent water movement from the ground to the wall construction.

Floors

General advice for resilient design

Ground supported floors are the preferred option and concrete slabs of at least 150mm thickness should be specified for non-reinforced construction. Hollow slabs are not suitable if the elements are not effectively sealed.

Suspended floors may be necessary where ground supported floors are not suitable, namely in shrinkable/expanding soils (e.g. clay) or where the depth of fill is greater than 600mm. Uplift forces caused by flood water may affect the structural performance of a floor. Suspended floors are generally not recommended in flood-prone areas, for the following reasons:

- the sub-floor space may require cleaning out following a flood, particularly a sewer flood. In order to aid this process and where accumulation of polluted sediment is expected, the sub-floor space should slope to an identified area and be provided with suitable access
- if cleaning is required, floor finishes may need to be removed to provide access to the sub-floor space. Cheaper, sacrificial, finishes would be the best option.
- the steel reinforcement in the concrete beams of 'beam and block' floors may be affected by corrosion and its condition may need to be assessed following repeated or prolonged floods.

Suspended timber floors, particularly when including timber engineered joists, are not generally recommended in flood prone areas because most wooden materials tend to deform significantly when in contact with water and therefore may require replacement. Rapid drying can also cause deformation and cracking.

Reinforced concrete floors are acceptable but may be prone to corrosion of any exposed steel in areas of prolonged flooding.

Hardcore and blinding: good compaction is necessary to reduce the risk of settlement and consequential cracking.

Damp Proof Membranes (d.p.m.) should be included in any design to minimise the passage of water through ground floors. Impermeable polythene membranes should be at least 1200 gauge to minimise ripping. Effective methods of joining membrane sections are overlaps of 300mm, and also taping (mastic tape with an overlap of 50mm minimum). Care should be taken not to stretch the membrane in order to retain a waterproof layer. Experience in Scotland has indicated that welted joints in the d.p.m. are an effective jointing solution.

Insulation materials: Water will lower the insulation properties of some insulation materials. Floor insulation should be of the closed-cell type to minimise the impact of flood water. The location of insulation materials, whether above or below the floor slab, is usually based on either achieving rapid heating of the building or aiming for more even temperature distribution with reduced risk of condensation. Insulation placed above the floor slab (and underneath the floor finish) rather than below would minimise the effect of flood water on the insulation properties and be more easily replaced, if needed. However, water entry may cause insulation to float (if associated with low mass cover) and lead to debonding of screeds.

No firm guidance can be provided on best location for insulation where the primary source of flooding is from groundwater. For other types of flooding, placing insulation below the floor slab may be adequate but it is important to recognise that the characteristics of the insulation may be affected by the uplift forces generated by the flood water.

Floor finishes: suitable floor finishes include ceramic or concrete-based floor tiles, stone, and sand/cement screeds. All tiles should be bedded on a cement-based adhesive/bedding compound and water resistant grout should be used. Concrete screeds above polystyrene or polyurethane insulation should be avoided as they hinder drying of the insulation material. Suitable materials for skirting boards include ceramic tiles and PVC. Ceramic tiles are likely to be more economically viable and environmentally acceptable.

Floor sump: provision of a sump and small capacity automatic pump at a low point of the ground floor is recommended in cases where the expected probability of flooding in any one year is 20% or a frequency of flooding of more than once in five years (see Section 4). This system will help the draining process and speed up drying but it may only be effective for shallow depth flooding. The dimensions of the sump and its operational procedure would be calculated and agreed with the planning authority based on the predicted volumes of water to be drained.

Services: under floor services using ferrous materials should be avoided.

Walls

General advice for resilient design

Ensure high quality workmanship at all stages of construction.

Masonry walls:

Ensure mortar joints are thoroughly filled to reduce the risk of water penetration. If frogged bricks are used, they should be laid frog up so that filling becomes easier and coverage more certain. Bricks manufactured with perforations should not be used for flood resilient design.

Where possible, use engineering bricks up to predicted flood level plus one course of bricks to provide freeboard (up to maximum of 0.6m depth above floor level); this will increase resistance to water penetration. Blocks (and dense facing bricks) have much improved performance when covered with render.

Aircrete blocks allow less leakage than typical concrete blocks but concrete blocks dry more quickly. Therefore, design of blockwork walls needs to take into account these two opposite types of behaviour and consider whether drying or resistance to water is most relevant in each situation. For a "water exclusion strategy", the expected amount of leakage is minimal and therefore, Aircrete blocks are recommended, although they may retain moisture for longer than concrete blocks, Compared with heavier blocks, Aircrete may offer less restraint to floor/slab edges which under the action of uplift forces could promote the opening up of floor/wall junctions.

Do not use highly porous bricks such as hand made clay bricks.

Solid masonry walls are a good option but will need to be fitted with internal or external wall insulation in order to comply with Building Regulations.

Clear cavity walls, i.e. with no insulation in the cavity, have better flood resilience characteristics than filled or part filled cavity walls as they dry more quickly. The requirements for insulation can be satisfied by external insulated renders or internal thermal boards.

There is evidence that thin layer mortar construction (or thin joint, as it is also commonly known) is a good flood resilience option.

Framed walls: Avoid timber framed walls containing construction materials that have poor performance in floods, for example oriented strand board and mineral fibre insulation. Timber framed walls are not recommended in a "water exclusion strategy". Steel framed walls may offer a suitable alternative option but specialist advice needs to be sought on how to incorporate resilient materials/construction methods in the design, in particular with regard to the insulation.

Reinforced concrete wall/floor construction should be considered for flood-prone areas, i.e. where the frequency of flooding is predicted to be high (see Chapter 4). This form of construction is effective at resisting forces generated by floodwater and will provide an adequate barrier to water ingress (provided service ducts and other openings into the building are adequately sealed). Design details for this type of construction are beyond the scope of this document.

External renders are effective barriers to water penetration and should be used with blocks (or bricks) at least up to the predicted flood level plus the equivalent of a course of bricks as freeboard. Structural checks may be necessary to ensure stability, because of the external water pressures that could occur for design flood depths above 0.3m. External cement renders with lime content (in addition to cement) can induce faster surface drying.

Insulation:

External insulation is better than cavity insulation because it is easily replaced if necessary.

Cavity insulation should preferably incorporate rigid closed cell materials as these retain integrity and have low moisture take-up. Other common types, such as mineral fibre batts, are not generally recommended as they can remain wet several months after exposure to flood water which slows down the wall drying process. Blown-in insulation can slump due to excessive moisture uptake, and some types can retain high levels of moisture for long periods of time (under natural drying conditions).

Internal linings:

Internal cement renders (with good bond) are effective at reducing flood water leakage into a building and assist rapid drying of the internal surface of the wall. The extent to which render prevents drying of other parts of the wall is not currently clear. This may be important, particularly for solid wall construction. This applies also to external renders.

Avoid standard gypsum plasterboard as it tends to disintegrate when immersed in water. Splash proof boards do not necessarily offer protection against flood waters, which may remain for some time and exert pressure on the board.

Anecdotal evidence suggests that internal lime plaster/render can be a good solution. Lime plaster depends on contact with the air to set and harden. Because of this, full strength lime plaster, which typically requires over 6 months, was not possible to test. Consequently, no assurance can be given for its performance. Tests performed when young showed that it crumbles very easily under high water pressure.

Doors and Windows

General advice for resilient/resistant design

Doors: Raising the threshold as high as possible, while complying with level access requirements, should be considered as the primary measure. In addition, sealed PVC external framed doors should be used and, where the use of wooden doors is a preferred option, all effort should be made to ensure a good fit and seal to their frames.

Hollow core timber internal doors should not be used where the predicted frequency of flooding is high. Where sufficient flood warning is given, butt hinges, that allow internal doors to be easily removed and stored in dry areas prior to a flood, should be used. Where the frequency of predicted flooding is low or where there is no warning (e.g. overland or sewer flooding) it may be necessary to replace the doors after the flood.

Windows/patio doors: Windows and patio doors are vulnerable to flood water and similar measures to those used for doors should be taken. Special care should be taken to ensure adequate sealing of any PVC window/door sills to the fabric of the house. Of particular concern would be excessive water pressure on the glazing of patio doors. Double glazing conforming to the relevant standards would in principle adequately resist the pressures generated by flood waters; debris carrying flows may cause damage.

Air vents: special designs of air vent are available in the market to prevent water ingress in circumstances where the predicted flood depth is low (i.e. < 0.3m); e.g. periscopic air vent, see Figure 6.11. Careful consideration should be given to effectively sealing any associated joints.

Fittings

General advice for resilient design

The main principle is to use durable fittings that are not significantly affected by water and can be easily cleaned (e.g. use of plastic materials or stainless steel for kitchen units). The cost of these units may need to be balanced against the predicted frequency of flooding.

Place fittings (e.g. electrical appliances, gas oven) on plinths as high as practicable above floor so that they are out of reach of flood water.

Ensure adequate sealing of joints between kitchen units and surfaces to prevent any penetration of water behind fittings.

Ensure high quality workmanship in the application of fittings.

Services

General advice for resilient design

Where possible, all service entries should be sealed (e.g. with expanding foam or similar closed cell material).

Pipework: Closed cell insulation should be used for pipes which are below the predicted flood level.

Drainage services: Non-return valves are recommended in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness.

Water, electricity and gas meters: should be located above predicted flood level.

Electrical services: electrical sockets should be installed above flood level for ground floors to minimise damage to electrical services and allow speedy re-occupation (see Figure 6.13. Note a dado rail which provides a limit for replacement of any wall covering). Electric ring mains should be installed at first floor level with drops to ground floor sockets and switches.

Heating systems: boiler units and ancillary devices should be installed above predicted flood level and preferably on the first floor of two-storey properties. Underfloor heating should be avoided on ground floors and controls such as thermostats should be placed above flood level. Conventional heating systems, e.g. hot water pipes are unlikely to be significantly affected by flood water unless it contains a large amount of salts. The less common, hot air duct heating would remain effective provided it is installed above the design flood level.

Communications wiring: wiring for telephone, TV, Internet and other services should be protected by suitable insulation in the distribution ducts to prevent damage. Any proposed design solution for flood insulation on all potentially vulnerable wiring should be discussed with the relevant service providers.

4 Conclusions

4.1 Conclusions

The site is shown to be within flood zone 3 of the Environmental Agency flood maps. However, the use of the building is acceptable within this zone.

As the building is in a flood zone it is recommended that the residents sign up to the Environment Agency early warning system which gives advanced notice of any possible flooding.

The extension is minor works and will not have a great affect on the impermeable area of the site. The use of soakways will be investigated for the disposal of the surface water flows.

The works will not increase the risk to the users and there will be no sleeping accommodation within the extension.

Therefore the development is deemed to be acceptable in terms of flood risk.

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APPENDIX A

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