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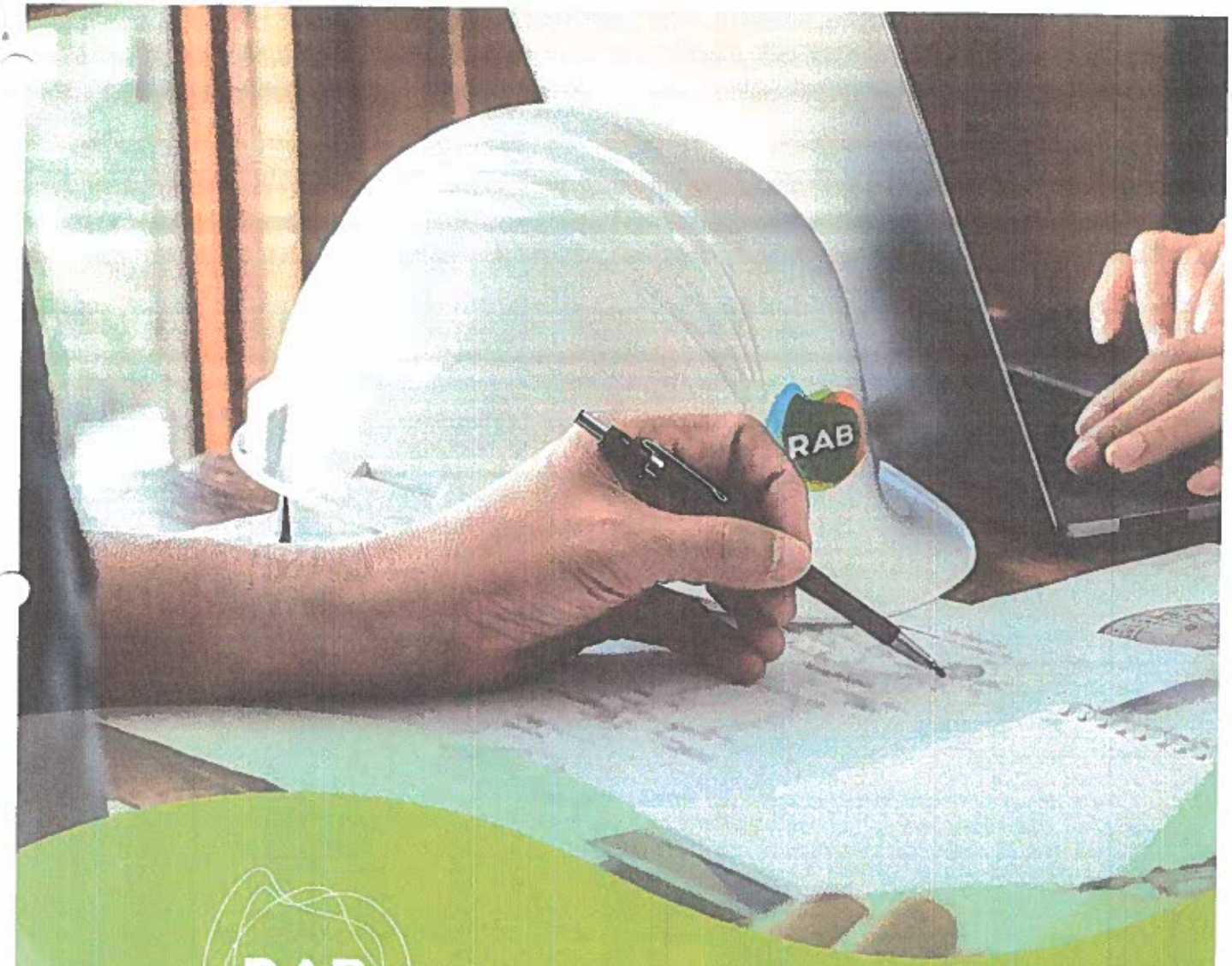

RAB

8 Ellesmere Close, Ruislip, HA4 7PQ
Property Flood Resilience Report

06/01/2023
Version 3.0
RAB: 3005

RESILIENCE & FLOOD RISK

8 Ellesmere Close, Ruislip, HA4 7PQ
06/01/2023
V3.0

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Quality Control

Action	Name
Prepared	Olivia Coffer BSc (Hons) MSc
Checked	David Clarke
Approved	Russell Burton

Revision History

Version	Date	Amendments	Issued to
1.0	3/11/2022	First Issue	Environment Agency
2.0	08/12/2022	Addressing EA comments	Environment Agency
3.0	06/01/2023	Addressing EA comments	Environment Agency

Contents

1.0 Introduction

We have been instructed by the Environment Agency to undertake a Property Flood Resilience (PFR) survey at 8 Ellesmere Close, Ruislip, HA4 7PQ in accordance with the Environment Agency PFR Framework Lot 1 scope and the following CIRIA C790A Code of Practice for Property Flood Resilience standards:

- Standard 1 – Hazard assessment
- Standard 2 – Property survey
- Standard 3 – Options development

Property Information	
Property Address	8 Ellesmere Close, Ruislip, HA4 7PQ

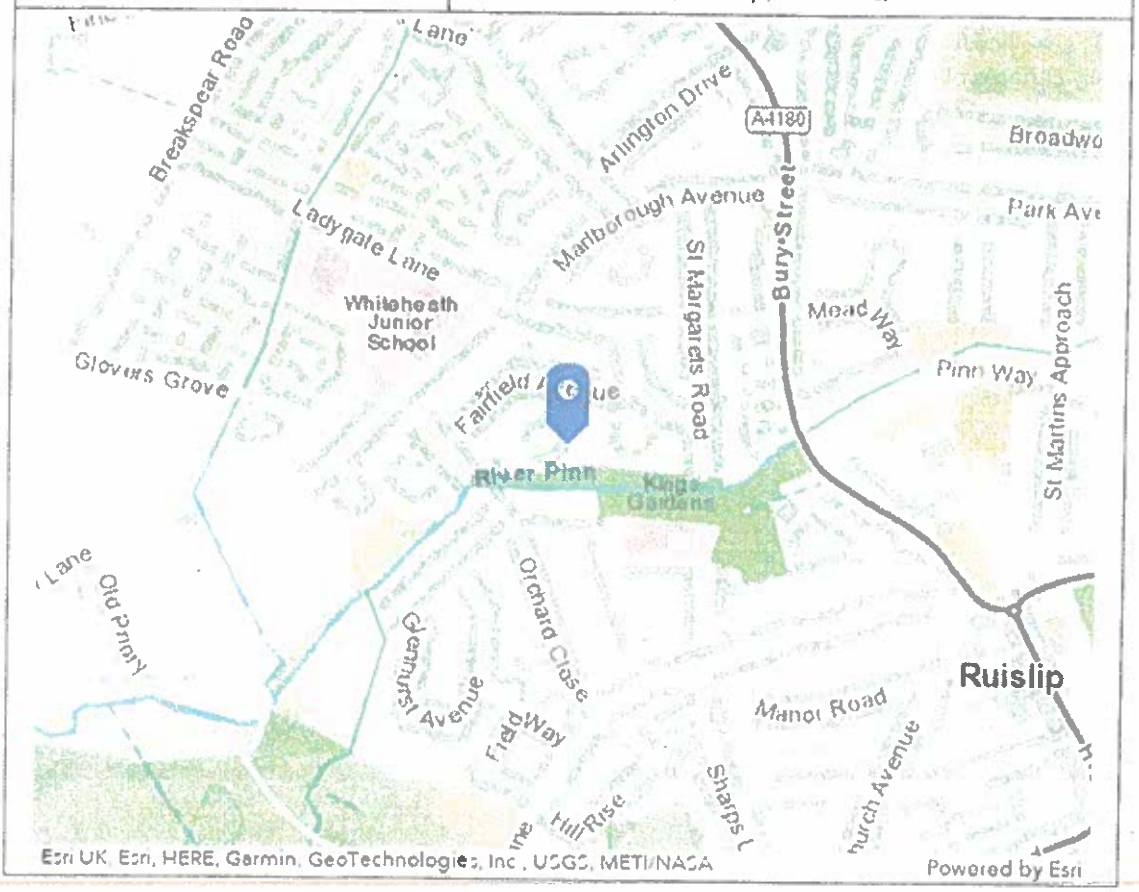

FIGURE 1: PROPERTY INFORMATION

2.0 Property Flood Resilience

PFR, by definition, includes measures that provide a way to reduce the risks to people and property enabling households and businesses to reduce flood damage, speed up recovery, reoccupy flooded buildings and potentially obtain insurance cover more easily and affordably. Such measures are aimed at reducing the amount of water from entering properties (known as **resistance measures**), or limiting the damage caused if water does enter a building (known as **recoverability measures**).

Resistance: the use of materials and approaches to mitigate water entry into the property. Passive resistance products will provide some protection without needing human activation (e.g. flood doors). Active resistance refers to items that need deployment prior to flooding, so require human activation (e.g. flood barriers). Products which meet BS 851188-1:2019 and PAS 1188-1 (Specification Part 1: Building aperture products) should be used where possible.

The hydrostatic pressures exerted by flood water can cause sudden or long-term structural damage and undermine the foundations of a building or cause leakage through the walls, floor or sub-floor, unless the building is specifically designed to withstand such stresses. Typically, residential buildings are not structurally capable of excluding flood water above 600mm deep[1].

Recoverability: the use of materials, products and construction methods that prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood.

[1] BS851188-1:2019. Flood resistance products Part 1: Building products – specification

3.0 Standard 1 – Hazard Assessment

The following desktop Flood Risk Assessment (FRA) has been based on freely available information including online flood maps, open-source data, and historical flooding reports.

3.1 Flood history

Fluvial and surface water flooding has occurred in the London Borough of Hillingdon many times historically. Key events include the floods of August 1977 and May 1988 and more recently the June 2016 event where water from the River Pinn and surface water caused flooding to properties in multiple locations in Ruislip.

TABLE 1: OCCUPANT REPORT ON HISTORICAL FLOODING

Occupant report on historical flooding	
How long has the occupant lived in the property?	11 years
How many times has the property flooded internally?	0
What was the date of the worst flooding event?	June 23, 2016
Was the occupant present during this event?	Yes
Estimated internal flood depth (mm)	0
Estimated external flood depths (mm)	300
Flood history details	The resident has stated that water from the River Pinn at the rear has previously flooded the garden. The property has not been flooded internally although water has entered the sub-floor void.

3.2 Risk of flooding from rivers and sea

Hydraulic modelling of the River Pinn has been undertaken by the Environment Agency and this confirms the property is within the 5% Annual Exceedance Probability (AEP) (1 in 20 year) flood risk area (see Figure 2). The River Pinn flows east to west and is located approximately 45m south of the property.

TABLE 2: ENVIRONMENT AGENCY MODELLED FLUVIAL FLOOD DEPTHS

AEP	Estimated internal flood depths (mm)	Estimated external flood depths (mm)
5% AEP	0	235
2% AEP	79	379
1% AEP	214	514
0.5 % AEP	353	653
0.1% AEP	993	1,293

3.3 Risk of flooding from surface water

3.3.1 Surface water risk

The risk of flooding from surface water map[2] reports the property is in a 'Low' risk area (see Table 3 for classifications) and is within a surface water flow path from the north (see Figure 3). The map is generated using a broadscale methodology applied at the national scale. The model utilises generalised information on infiltration, sewerage infrastructure, rainfall events and catchment topography to route rainfall over a ground surface model and does not take individual property threshold heights into account. As a result, the map shows areas that may potentially flood but cannot accurately predict the impacts of surface water events on individual properties. Consequently, these maps cannot definitively show that an area of land or property is, or is not, at risk of flooding, and the maps are not therefore suitable for use at an individual property level. The Risk of Flooding from Surface Water map therefore only provides a guide regarding the areas that may be vulnerable to this source of flooding and to what extent and depth. Table 3 below shows the Environment Agency's flood risk categories.

TABLE 3 – ENVIRONMENT AGENCY FLOOD RISK CATEGORIES

Flood Risk Category	Annual Exceedance Probability (AEP)
Very Low	< 0.1% (less than a 1 in 1000 years)
Low	Between 1% and 0.1% (1 in 100 years and 1 in 1000 years)
Medium	Between 1% and 3.3% (1 in 100 years and 1 in 30 years)
High	> 3.3% (greater than or equal to 1 in 30 years)

[2] Learn more about this area's flood risk - GOV.UK (check-long-term-flood-risk.service.gov.uk)

REF	Route of Ingress Photograph	Resistance Measure	Dimensions (mm) / area (m2) / no. / dia		m2/ Quantity	Level Above Ground (mm)
			X	Y		
N/A	Photo not available	Flood door (BS851188) to internal door to main house in lean to	900	2,050	1	350

5.0 Standard 3 – Options development

5.1 The 5R's

The 5R's is a hierarchy of flood resilience options that should be considered in turn to help identify the preferred solution, which may include elements of them all.

TABLE 8 – THE 5R'S

	**REALIGN** Realigning the pathway includes drainage improvements, SuDS, Boundary walls and gates, landscaping Realigning the receptor includes raising floors, changing to a less vulnerable use, building a second or mezzanine floor.
	**RESISTANCE** Resistance products and measures that resist water entry to the building, such as flood doors, airbricks, water resistant paint/mortar, tanking etc.
	**REDUCE** Products and measures that reduce the impact and manage the water that may still leak or seep through the building fabric and/or flood resistant products, e.g., Sump & puddle pumps, cavity drainage systems etc.
	**RECOVERABILITY** Materials, products and construction methods that prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood e.g. Flood recoverable kitchen units, floor coverings, doors, skirtings, raised electric sockets etc.
	**RESPOND** End User actions to protect the building, its contents and the occupants, e.g., deploying flood resistance measures, raising objects above the flood level, evacuating the building, turning off electricity, gas and water, starting backup power/heating etc.

5.2 Realign

5.2.1 Pathway

There are existing boundary walls to the front of the property, although additional works would be required to increase the height of the walls to 600mm. The construction and condition of existing boundary walls would need investigating by a Civil Engineer prior to the implementation of this option. A realign option would be disruptive, require investigations into the potential increased flood risk to neighbouring properties and is likely to be cost prohibitive. Furthermore, a boundary solution would not be viable to protect the rear of the property

5.2.2 Receptor

Raising floor levels above 600mm equivalent to the maximum estimated depths for the surface water 0.1% AEP event and would involve significant disruption and costs. Changing the property to a less vulnerable use is also unrealistic and unlikely to be supported by the current occupants.

5.3 Resistance

The majority of the property shows no signs of subsidence and is suitable for flood resistance measures up to 600mm as detailed in Table 7 to increase flood resilience from all identified sources of flooding up to the fluvial 1% AEP and surface water 0.1% AEP. However, a large uPVC conservatory containing the kitchen has been constructed on the rear of the property which is not suitable for flood resistance. Either the conservatory would need to be replaced with flood resistant materials or flood doors/barriers provided on the internal doorways leading to the main house, so leaving the kitchen unprotected.

In addition, the hydraulic modelling of the River Pinn shows flooding up to 993mm may impact the property during the 0.1% AEP fluvial flood event and this could exert hydrostatic pressures that may cause structural damage.

The End User has confirmed they are available and physically capable of deploying active flood resistance measures however passive measures are preferable given no surface water flood warning is currently available to trigger the deployment of active measures prior to the onset of flooding. Ground floor windows do not open to provide an alternative emergency evacuation route should passive measures be installed.

Costs for resistance measures (excluding the conservatory) are estimated to be between £13,236 and £17,738 (excluding VAT).

5.4 Reduce

This includes measures to mitigate the risk of water entry through the building fabric and/or leakage through flood resistant products.

Sump pumps have been included as a recommendation in Table 7 given the suspended floor construction within the habitable spaces to mitigate the risk of groundwater and hydrostatic pressure causing water to rise beneath floor boards. The sump pump should provide connectivity between the sump and the sub-floor void. Creating a sump pump within a concrete floor may create new routes of water ingress which do not exist currently.

Puddle pumps are recommended in Table 7 to manage limited water leakage through the floor, walls and installed flood resistance measures.

Alternatively, a proprietary cavity drain system may be installed which is a water management system to control water after it has penetrated the structure. It is made up of a membrane applied to the walls and floor with a channel at the wall/floor junction. The channel directs the water to a sump pump which is situated below the slab. The sump pump will then remove the water ingress to the ground level drains. However, installation is very disruptive and expensive, requiring replacement of internal plaster on walls and floors, and is not funded by the Environment Agency under this scheme.

5.5 Recover

The recoverability recommendations in Appendix C are based on information collected during the property survey and will help prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood.

If resistance measures were provided for the main house but not the conservatory containing the kitchen, it would still be possible to make the kitchen area recoverable.

Recoverability measures are not eligible under this scheme and estimated costs are provided in Appendix C.

5.6 Respond

Includes measures to prepare for and respond to flooding:

- Make a household flood plan to reduce the risk to the occupants, the property, and its contents. The Environment Agency has a template here.
- Join a formal Community Flood Action Group and develop a Community Flood Plan to help the community prepare for flooding and respond, including support for vulnerable residents and regular testing and deployment of flood mitigation measures.
- Sign up to receive the Environment Agency's Flood Warning Service for this area.

6.0 Conclusion

We have carried out a PFR survey at this property and provided options to increase flood resilience considering the flood risk, property construction, and occupants.

The Environment Agency's hydraulic modelling of the River Pinn shows the property is within the 5% Annual Exceedance Probability (AEP) (1 in 20 year) flood risk area with the River Pinn located 35m to the South. There are no formal flood defences between the watercourse and the property.

The risk of flooding from surface water map shows the property is in a 'High' risk area, with a chance of flooding greater than 1:30 (3.3%) in any one year. Flood depths were reported to be 300mm externally in a previous flood event. The property is within the maximum extent of flooding should a reservoir fail. The property is in an area with a less than 25% groundwater susceptibility.

The range of flood resilience options available are described in Section 5.0 using the 5R's hierarchy.

A boundary solution to realign the flood pathway is likely to be prohibitively expensive and therefore not viable. Similarly, raising floors or changing the use away from residential would be both disruptive and unacceptable to the occupants.

The property shows no signs of subsidence, and the original brick building is suitable for flood resistance measures up to 600mm to increase flood resilience for up to and beyond the 1% fluvial and 0.1% AEP surface water events. However, the uPVC conservatory containing the kitchen is not considered suitable to withstand any hydrostatic pressure. Flood depths may also reach 993mm internally during the 0.1% AEP fluvial event. Therefore, any design should ensure that there is a means to allow floodwater to enter the property to reduce the risk of structural damage from hydrostatic pressure should flood depths exceed 600mm above ground level.

Passive measures are preferable given no surface water flood warning is currently available. Ground floor windows do provide an alternative emergency evacuation route should passive flood doors be unusable when under load during a flood. In addition, puddle pumps are required to manage residual water leakage via the building fabric and installed flood resistance measures.

Recoverability measures would help prevent the internal fabric of the property from being unduly damaged by flood water and allow it to recover quickly after a flood.

A household flood plan is essential to ensure the safety of residents and effectiveness of the flood resilience measures in all circumstances. You should always follow the advice of the emergency services and your Local Authority during a flood.

7.0 Design proposal

The following recommendations are provided for review by the End User, Installation Contractor and the Environment Agency so that all parties can agree the design proposal in accordance with the PFR Code of Practice (Stage 4, step 2).

7.1 Standard Flood Resilience Funded by the Environment Agency

Use the funding provided by the Environment Agency to increase flood resilience up to the 1% AEP fluvial and 0.1% AEP surface water events by:

a) Installing PASSIVE flood resistance measures for depths up to 600mm above ground level as listed in Table 7 (excluding the conservatory). The flood resistant doorsets should be designed to ensure that there is a means to allow floodwater to enter the property at 600mm above ground level to reduce the risk of structural damage from hydrostatic pressure.

We also recommend that the homeowner/End User:

a) Implements flood recoverability measures in the conservatory kitchen area, summarised in Appendix C

b) Makes a household flood plan to reduce the risk to the occupants, the property, and its contents.

c) Inspects (at least annually) and maintain measures in accordance with the manufacturer/supplier instructions.

7.2 Additional Flood Resilience Funded by The Homeowner

If a higher standard of flood resilience is required, the homeowner may consider the following:

a) Installing a cavity drain system.

b) Implementing the flood recoverability measures throughout the property as summarised in Appendix C.

Tidal/coastal flooding	Flooding around coasts and tidal river stretches, including overtopping and breaching of flood defences. Low atmospheric pressure systems (stormy weather) can create surges, causing water levels to be higher than tide table.
Residual risk	Risks remaining after actions have been taken to mitigate flood risk

Appendix A – Limitations and disclaimers

It is important that the homeowner recognises and acknowledges the following:

1. We have undertaken a photographic and measured survey of the property. Please note, measurements act as a guide only and formal measured surveys are to be undertaken by the appointed contractor prior to manufacture/installation.
2. Information on the flooding history, property construction and occupants has been provided by homeowners/residents via an electronic survey form for use within the report.
3. If our surveyors were unable to access parts of the property (e.g. due to dense vegetation or locked gates obstructing access etc.), such areas were not surveyed and there is the potential that routes of ingress remain in these areas. Such areas will be noted in this report, if applicable.
4. If not all of the recommended resistance measures are adopted, routes of ingress may remain and as such, the property will also remain vulnerable to flooding.
5. For terraced or semi-detached properties, the integral wall may present a route of ingress. If adjoining properties have not installed resistance measures, the property may remain vulnerable to flooding via this route.
6. Third party consultations may be required prior to installation:
    - For listed properties, a heritage expert will need to be consulted to discuss the feasibility of installing the recommended measure(s).
    - For properties with air bricks and/or vents connected to gas appliances or solid fuel burners, a gas safety engineer will need to be consulted to approve the recommended measures are suitable.
    - Where visual observations have indicated that the property is in poor condition or should the homeowner wish to increase the use of resistance measures above 600mm, a full structural survey should be undertaken to confirm the structural soundness of the building and suitability.
7. The homeowner is responsible for the use and future maintenance of any measures installed as part of this scheme.

Appendix B – Glossary of terms

Active resistance measures	These are measures which are not permanently installed into the property and will require deployment before a flood event (e.g., door barrier).
Annual Exceedance Probability	Annual Exceedance Probability (AEP) describes the likelihood of being exceeded in any given year. For instance, an AEP of 1% has a chance of being exceeded 1 in 100 in any given year.
Artificial waterbodies	Artificial water bodies often hold large volumes of water above ground level e.g., reservoirs and canals).
British Standards	Quality standards for goods and services produced by the British Standards Institution (BSI) Group (e.g., BS 851188).
Community Flood Plan	A plan to help communities plan for and respond quickly to flooding.
End user	The occupier of the property or owners – the primary user of PFR measures who is likely to deploy, operate and maintain any PFR measures. The end user might also be the client.
Event (flood)	The occurrence (at source) of a flood hazard (such as surface water, river flooding). This is often used in accordance with a probability of a flood occurring (e.g.1 in 100 flood event – or one per cent annual chance of meeting or exceeding this level).
Flood Action Group.	A core of local people who act as a representative voice for their wider community and work voluntarily to reduce flood risk by identifying key issues, mapping out their own flood plan, and working with authorities that manage flood risk.
Fluvial Flooding	Flooding from a river or other watercourse.
Groundwater flooding.	Occurs during intense, long-duration rainfall events, when infiltration of rainwater into the ground raises the level of the water table until it exceeds ground levels. It is most common in low-lying areas overlain by permeable soils and permeable geology, or in areas with a naturally high-water table.
Passive resistance measures	These are measures which are permanently installed into the property and provide some protection without needing human activation (e.g. flood doors).
Sewer flooding.	Occurs when the capacity of the underground sewer system is exceeded, which in turn can lead to surcharging and the flooding of property and/or the surrounding land.
Surface water flooding	Occurs when heavy rainfall overwhelms the local drainage capacity. This type of flooding is often short lived, following periods of intense rainfall and thunderstorms. It is also closely linked to areas which are impermeable in nature (i.e., urbanised).

Tidal/coastal flooding	Flooding around coasts and tidal river stretches, including overtopping and breaching of flood defences. Low atmospheric pressure systems (stormy weather) can create surges, causing water levels to be higher than tide table.
Residual risk	Risks remaining after actions have been taken to mitigate flood risk

RESILIENCE & FLOOD RISK

3005	Environment Agency
Property	8 Ellesmere Close
Document	Bill of Quantities

1 in 50 year Fluvial Flood Resistance Measures

Ref	Flood resistance measures	Level Above Ground (mm)	Cost Range		Quantity	Total cost range	
			Low	High		Low	High
0	Seal cable or pipe entry point	100	£6	£12	2	£12.00	£24.00
1	Auto-closing airbrick (BS 851188) on front elevation	75	£72	£120	4	£288.00	£480.00
2	Seal hole in render	150	£6	£12	1	£6.00	£12.00
3	Flood door (BS85188)	300	£2,400	£3,120	1	£2,400.00	£3,120.00
4	Seal cracks in render	300	£6	£12	1	£6.00	£12.00
5	Re-pointing	350	£24	£36	1	£24.00	£36.00
8	Water repellent render	280	£42	£60	1	£42.00	£60.00
9	Auto-closing airbrick (BS 851188) on side elevation	200	£72	£120	1	£72.00	£120.00
10	Extend pipes, block hole and seal entry points	0	£100	£200	1	£100.00	£200.00
11	Not able to inspect wall elevation	0	£0	£0	1	£0.00	£0.00
13	Auto-closing airbrick (BS 851188) on conservatory	250	£72	£120	2	£144.00	£240.00
14	Flood double door (BS851188)	600	£2,400	£3,120	1	£2,400.00	£3,120.00
16	Auto-closing airbrick (BS 851188) on side elevation	200	£72	£120	2	£144.00	£240.00
17	Flood door (BS85188)	350	£0	£0	1	£0.00	£0.00
18	Flood double door (BS851188)	300	£2,400	£3,120	1	£2,400.00	£3,120.00
19	Auto-closing airbrick (BS 851188) in lean to	300	£72	£120	1	£72.00	£120.00
20	Seal cracks in lean to	350	£6	£12	1	£6.00	£12.00
21	110mm waste water non-return valve. Installation contractor to confirm location and qu	0	£110	£150	1	£110.00	£150.00
22	Puddle pump	0	£132	£180	4	£528.00	£720.00
23	Sump/pump	0	£1,800	£2,400	1	£1,800.00	£2,400.00
24	Wall sealant along bricks on bottom of conservatory	0	£12	£18	12	£144.00	£216.00
N/A	Flood door (BS85188) to internal door to main house in lean to	350	£2,400	£3,120	1	£2,400.00	£3,120.00
		1 in 50 year Fluvial Flood Resistance Measures				**£13,098.00**	**£17,522.00**

All Flood Resistance Measures up to 600mm

Ref	Flood resistance measures	Level Above Ground (mm)	Cost Range		Quantity	Total cost range	
			Low	High		Low	High
0	Seal cable or pipe entry point	100	£6	£12	2	£12.00	£24.00
1	Auto-closing airbrick (BS 851188) on front elevation	75	£72	£120	4	£288.00	£480.00

2	Seal hole in render	150	£6	£12	1	£6.00	£12.00
3	Flood door (BS85188)	300	£2,400	£3,120	1	£2,400.00	£3,120.00
4	Seal cracks in render	300	£6	£12	1	£6.00	£12.00
5	Re-pointing	350	£24	£36	1	£24.00	£36.00
6	Seal cable or pipe entry point	470	£6	£12	1	£6.00	£12.00
7	Seal holes in render	450	£6	£12	1	£6.00	£12.00
8	Water repellent render	280	£42	£60	1	£42.00	£60.00
9	Auto-closing airbrick (BS 851188) on side elevation	200	£72	£120	1	£72.00	£120.00
10	Extend pipes, block hole and seal entry points	0	£100	£200	1	£100.00	£200.00
11	Not able to inspect wall elevation	0	£0	£0	1	£0.00	£0.00
12	Seal cracks at top of render	400	£6	£12	1	£6.00	£12.00
13	Auto-closing airbrick (BS 851188) on conservatory	250	£72	£120	2	£144.00	£240.00
14	Flood double door (BS851188)	600	£2,400	£3,120	1	£2,400.00	£3,120.00
15	Raise socket	580	£120	£180	1	£120.00	£180.00
16	Auto-closing airbrick (BS 851188) on side elevation	200	£72	£120	2	£144.00	£240.00
17	Flood double door (BS851188) (protects same areas as REF 14)	350	£0	£0	0	£0.00	£0.00
18	Flood double door (BS851188)	300	£2,400	£3,120	1	£2,400.00	£3,120.00
19	Auto-closing airbrick (BS 851188) in lean to	300	£72	£120	1	£72.00	£120.00
20	Seal cracks in lean to	350	£6	£12	1	£6.00	£12.00
21	110mm waste water non-return valve. Installation contractor to confirm location and qu	0	£110	£150	1	£110.00	£150.00
22	Puddle pump	0	£132	£180	4	£528.00	£720.00
23	Sump/pump	0	£1,800	£2,400	1	£1,800.00	£2,400.00
24	Wall sealant along bricks on bottom of conservatory	0	£12	£18	12	£144.00	£216.00
N/A	Flood door (BS85188) to internal door to main house in lean to	350	£2,400	£3,120	1	£2,400.00	£3,120.00
				All Flood Resistance Measures up to 600mm		**£13,236.00**	**£17,738.00**
				Additional cost versus "1 in 50 year Fluvial Flood Resistance Measures"		**£138.00**	**£216.00**

Flood Recoverability Measures

Ref	Flood recoverability measures	Quantity	Cost range		Total cost range	
		m, m2, no.	Low	High	Low	High
N/A	Seal floor / wall joints	140	£25.00	£50.00	£3,500.00	£7,000.00
N/A	Replace gypsum plaster with lime-based/cement based plaster up to 1000mm	210	£60.00	£100.00	£12,600.00	£21,000.00
N/A	Raise electrical sockets a minimum 600mm above finished floor level	25	£100.00	£150.00	£2,500.00	£3,750.00
N/A	Replace skirting boards with flood resilient material (e.g. tricoya)	93	£50.00	£60.00	£4,650.00	£5,580.00
N/A	Replace carpet/wooden floor finishes with flood resilient materials (e.g tiles)	70	£125.00	£150.00	£8,750.00	£10,500.00
N/A	Infill suspended floor with concrete	140	£400.00	£600.00	£56,000.00	£84,000.00
N/A	Internal tanking	140	£120.00	£150.00	£16,800.00	£21,000.00
N/A	Water resilient kitchen	1	£5,000.00	£10,000.00	£5,000.00	£10,000.00
				Flood Recoverability Measures	**£109,800.00**	**£162,830.00**