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Chew Magna Property Level Protection Scheme Evaluation

Final Report

August 2013

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Revision History

Revision Ref / Date Issued	Amendments	Issued to
Draft Report – 14th June 2013		Stela Klebankiewicz (B&NES) Vicky Durston (EA)
Final Draft – 8th July 2013	Updates following comments on draft report from B&NES & EA	Tom Redfern (B&NES) Vicky Durston (EA)
Final Report – 16th August 2013	Final review amendments	Kelvin Packer (B&NES) & Vicky Durston (EA)

Contract

This report describes work commissioned by Stela Klebankiewicz, on behalf of Bath and North East Somerset (B&NES) Council, by an email dated 2nd February 2013. B&NES' representatives for the contract were Steve Moore and Stela Klebankiewicz of the Flood and Water Management team, and Richard Looke of Emergency Planning. The Environment Agency representative was Vicky Durston. Peter May and Phil Emonson of JBA Consulting carried out this work.

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Purpose

This document has been prepared as a Final Report for B&NES. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

Acknowledgements

JBA are very grateful for the assistance of Steve Moore, Stela Klebankiewicz and Richard Looke of B&NES, and Vicky Durston of the Environment Agency. In addition we have benefitted from and are grateful for the helpful cooperation and contributions from: Sarah Vaughan, John Attridge and Tom Jarrett of UK Flood Barriers; Mike Lake of Capita Symonds; and James Gambs of Bath Spa University and for their assistance in undertaking this investigation.

JBA would like to thank the many residents of Chew Magna who have assisted us through interviews and accounts and the provision of photographs, which have contributed enormously to this investigation.

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Executive Summary

In May 2010 the village of Chew Magna was selected as one of the 63 sites chosen across England under the Government's two year pilot property-level protection (PLP) grant scheme. The objectives of the scheme were:

- To create demonstration areas that will promote the benefits of property-level flood risk mitigation, encouraging further take-up.
- To stimulate the supply of high quality flood risk mitigation surveys by competent and independent surveyors.
- To encourage the development of new and innovative flood protection measures.

Chew Magna is located in a rapid response catchment with challenging flood management issues but also a great willingness by all parties to explore all possible options to help reduce flood risk in the village, including the innovative use of PLP. Thanks to significant efforts to secure the necessary funding, Bath and North East Somerset Council (B&NES) was successful and awarded £325,000 in two phases to provide surveys and individual flood protection measures to a total of 69 properties at significant flood risk in the village. At the time this was the largest of all the pilot schemes, seen as a good example of partnership working between B&NES, the Environment Agency and Chew Magna Parish Council, together with Capita Symonds and UK Flood Barriers, the appointed property surveyor and product supplier respectively. The scheme was completed in March 2011 but as with all the pilot schemes, the measures were not required or put to the test for over a year, until one of the wettest years on record led to widespread flooding in Chew Magna during September and November 2012.

The Flood and Water Management Act 2010 states that the Council, as Lead Local Flood Authority, has a duty to investigate flood events that occur within its area, to the extent that it is necessary or appropriate. B&NES has established that it will carry out a flood investigation under Section 19 of the Act when either five or more properties suffer internal flooding at any urban location, or when two or more properties suffer internal flooding at any rural location. It was deemed necessary to complete separate investigations into the various flood incidents at both Chew Magna and neighbouring Chew Stoke as many properties were flooded internally, resulting in damage, distress and local concern. These were conducted to determine the cause of the flooding and assess the likelihood of a recurrence, along with the need for measures to manage that risk. A further independent review was also required of the performance of the Chew Magna PLP scheme, under the original terms of the Defra funding, in order that experiences, problems and best practice can be identified and shared. This has resulted in the production of a number of related reports:

- Chew Magna Property-level Protection Scheme Review (this report).
- Chew Magna Flood Investigation Report 2011 – 2012.
- Chew Magna Flood Investigation Technical Report.
- Chew Stoke Flood Investigation Report.

Despite the implementation of the PLP scheme in Chew Magna, around half of the 69 properties provided with individual property protection measures suffered flood inundation and damage, leading to anger and concern. Although the PLP measures helped protect some properties, many residents have expressed their concerns over the scheme and over future flood risk.

This report presents the findings of an independent investigation into the PLP scheme delivery and performance, gathering evidence and feedback from residents and project partners. It has also made reference to the data analysis undertaken for the formal Section 19 reports mentioned above, to better understand the flooding mechanisms and relative scale of the flooding experienced. The investigation has concluded that the problems experienced were likely to have arisen due to the coincidence of interacting factors: particularly severe flooding; a failure to recognise the risk posed by floodwater rising up through the floors of properties; the lack of provision of dewatering pumps to mitigate this risk; leaking barrier seals reported at some properties; and inappropriately raised expectations of the standards of protection that might be expected from PLP measures. In particular, the investigation has found:

- The extreme conditions experienced during 2012 led to severe, extensive and repeat flooding. Preliminary analysis suggests that the flooding witnessed on the Winford

Brook during September 2012 had a 1% chance of happening in any given year, to only be expected on average once in 100 years. This rarity of flooding resulted in 13% of the flooded properties experiencing floodwater levels above the top of the barriers and hence exceeded the standards of protection offered.

- Although the flooding was severe, the PLP measures did not provide the degree of protection that had been expected, with 31 properties flooded and suffering damage.
- The principle inundation route at these properties was floodwater rising up through the floors (at 45% of the flooded properties) and floodwater leaking past the lower door barrier seal (at 30% of the flooded properties).
- Groundwater flood risk and the potential for floodwater to rise up through the floors was not sufficiently recognised, assessed or mitigated in the original PLP project. Only two properties, on the advice and insistence of the owners, were provided with a dewatering pump to help control and manage this risk. Other properties experienced inundation up through the suspended timber floors, but without pumps had no means to reduce the water depth or damage. At some, a sudden inrush of floodwater was witnessed, this is considered likely to have resulted from the sudden failure of the timber floors and an equalisation of the hydrostatic pressure.
- The automatic airbricks and the majority of non-return valves were considered to have functioned correctly, providing protection and helping to mitigate flood damage.

In addition to the findings related to the actual measures, there is evidence that the expectations and understanding of residents had been raised inappropriately, with many believing that the PLP measures would provide standards of flood protection beyond what could reasonably be expected. As a result, some people had stopped their practices of moving valuable items upon receipt of a flood warning, in the belief that the risk of flooding had been removed. Individual responsibility for the correct maintenance, storage and deployment of the measures was eroded by the decision for the PLP measures to remain the property of Chew Magna Parish Council, rather than becoming the responsibility and ownership of the property owner.

Residents were not provided with an individual PLP report, which would have described the scheme objectives and limitations, as well as outlining individual resident responsibilities, survey findings and recommendations. Opportunities were also missed to more clearly explain the scope and limitations of PLP measures, through initial questionnaires, follow-up flood fairs, or letters. The inappropriate sense of security from flooding was exacerbated by a letter, or certificate of completion, issued to each resident, quoting standards of protection of up to a 1 in 1000 year return period in some instances. There were no cautionary remarks or advice that flooding could, and should, still be expected and planned for and no advice given about the importance of preparing an individual flood emergency plan. The completion certificate also only addressed fluvial flood risk, omitting risks from surface water and groundwater.

It should be remembered that the Chew Magna PLP scheme was completed over two years ago, under very tight deadlines as part of the Defra pilot phase, with the intention of identifying learning points to take PLP forward. Many of the findings have since been adopted as good practice. The findings from this investigation however have been drawn together into a series of recommendations that are made to help manage future flood risk in the village. They have also been compiled in order to submit to Defra and the Environment Agency, as part of the ongoing reporting and development of best practice in the use and deployment of PLP measures. Lessons learned from flood events provide opportunities to refine procedures, measures and plans for this important and evolving cost effective option of managing local flood risk.

It is recommended that an enhanced audit and package of PLP measures, together with an awareness campaign to develop revised flood warning and emergency PLP deployment plans, are completed. These emergency plans should be developed in light of the formal Section 19 Flood Investigation Reports, to be taken forward in conjunction with the residents of Chew Magna and the Parish Council. Any works will be subject to funding availability and will need to be developed and approved in partnership. To ensure progress is made with these and other actions, it is recommended that B&NES maintain their coordinating role and responsibility as the LLFA and establish a flood risk management partnership group, to take a strategic view of the whole catchment system. Such a partnership group will allow discussion and agreement over the collaborative approach required and the means to best monitor progress. It will also provide a focus for effective, coordinated and two-way communication with the community in managing future flood risk.

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Glossary & abbreviations

Term or Abbreviation	Definition
ABI	Association of British Insurers
AEP	Annual exceedance probability - The probability of a flood greater than Q occurring in any year. This is simply the inverse of the return period.
B&NES	Bath and North East Somerset Council.
BSI	British Standards Institute – products awarded Kitemark performance certificate.
Catchment	An area that serves a river with rainwater. Every part of land where the rainfall drains to a single watercourse is in the same catchment.
Defra	Department for Environment, Food and Rural Affairs.
EA	Environment Agency.
FCERM	Flood and coastal erosion risk management.
Flood	The temporary covering by water of land not normally covered with water.
FMfSW	Flood Map for Surface Water.
FWA	Flood warning area.
Groundwater	Water which is below the surface of the ground and in direct contact with the ground or subsoil.
Hysteresis	For the same stage the discharge (flow) is higher on the rising limb of the hydrograph than on the falling limb. For some rivers this will manifest as distinctive loops in the stage-discharge relationship.
Intensity	The total rainfall depth (mm) divided by the total storm duration (hr). 1hr intensity is determined by calculating the rainfall total for one hour from the start of the storm, then moving on one 15-minute data interval and calculating the rainfall total for the hour, and so on. The 1hr intensity value quoted is the highest 1hr intensity over the whole storm duration. The 3hr intensity is calculated using the same principle.
Lag time	The time between the peak of the river flow or stage (or centre of peaks if the hydrograph is multi-peaked) and the centre of the rainfall.
LIDAR	Light detection and ranging.
LLFA	Lead Local Flood Authority.
Local flood risk	Flood risk from sources other than main rivers, the sea and reservoirs, principally meaning surface runoff, groundwater and ordinary watercourses
Main River	A watercourse shown as such on the Main River Map, and for which the Environment Agency has responsibilities and powers.
Ordinary watercourses	All watercourses that are not designated Main River, and which are the responsibility of Local Authorities or, where they exist, IDBs.
PLP	Property-level protection.
Return period	The average interval between years containing one or more floods exceeding a flow Q.
SFRA	Strategic Flood Risk Assessment.
SMD	Soil moisture deficit - the amount of rain needed to bring the soil moisture content back to field capacity. Field capacity (SMD=0) is the amount of water the soil can hold against gravity. Negative SMD indicates a water surplus which will be drained over time through infiltration or overland flow or both. Saturation is reached when SMD=-10mm, i.e. a water surplus of 10mm. Positive SMD is below field capacity and rain can infiltrate to the capacity of the SMD amount. In saturated soil all available pores are full of water but water will drain out of large pores under the force of gravity.

1 Introduction

1.1 Background to the property-level protection scheme

In December 2008, the Department for Environment, Food and Rural Affairs (Defra) announced a £5 million Property-level Flood Protection (PLP) Grant Scheme as part of the Government's response to Sir Michael Pitt's review of the 2007 summer floods. This funding specifically sought to demonstrate on a large scale the use of innovative flood protection measures in cases where flooding occurs frequently but where other flood management solutions are not viable. Previous research had shown that despite a developing range of new flood protection products most communities continued to rely on sandbags. Barriers to wider uptake of these new measures were found to include funding, an uncertain insurance response and a general lack of awareness. The Defra scheme aimed to address these barriers and had three main objectives:

Property-level Flood Protection Scheme aims

- To create demonstration areas that will promote the benefits of property-level flood risk mitigation, encouraging further take-up
- To stimulate the supply of high quality flood risk mitigation surveys by competent and independent surveyors
- To encourage the development of new and innovative flood protection measures

Local authorities were invited to apply for funding to identify and subsidise measures to provide property flood protection for high risk communities in their areas. The Scheme was implemented in two phases, between 2009 and 2011, and at the close of the 2 year programme in March 2011, over £5.2 million had been awarded to 63 individual property-level flood protection schemes across England.

In general for all these schemes, four main types of flood resistance products were routinely used in combination, according to the specific requirements of each property in a scheme:

- Barriers for doorways and airbricks
- Non-return valves for domestic and foul drainage systems
- De-watering pumps
- Waterproofing and sealants

Homeowners were provided with flood risk surveys and reports as part of these schemes, identifying the main points where water can enter their property and highlighting suitable flood protection measures that were then selected and installed.

1.2 Chew Magna property-level protection scheme

Chew Magna is located in a rapid response catchment with challenging flood management issues and there was a great willingness by all parties to explore all possible options, including the innovative use of PLP, to help reduce flood risk in the village. Significant efforts were made to secure the necessary funding and in 2010 Chew Magna Parish Council and Bath and North East Somerset Council (B&NES) made a successful application under the second round of funding for Chew Magna to be included in the Defra scheme. Initial funding of £150,000 was awarded in May 2010, providing surveys and measures for 33 properties. Further grant funding of £110,000 was supplemented by an additional £65,000 from the Environment Agency (EA), allowing a second phase to commence in January 2011.

A feature of all the Defra Pilot Schemes was the very tight timescales and strict budgetary constraints within which all works had to be completed. Although this ensured as many locations as possible were provided with measures within a short period, the tight deadlines created significant pressures for delivery. This was recognised as a particular problem for the installation stage.

By the end of the Chew Magna scheme in March 2011, a total funding allocation of £325,000 had allowed the provision of protection measures to 69 properties across Chew Magna. At the time this was the largest of all the Pilot Schemes and was recognised as a good example of all partners working positively together to find solutions to reduce flood risk in a challenging location. Successful delivery reflected the close and successful partnership working achieved between the five organisations involved; namely B&NES, the EA and Chew Magna Parish Council, together with Capita Symonds and UK Flood Barriers, the appointed property surveyor and product supplier respectively.

The average cost per property of the survey and measures combined was £4,118.30. Adding the administrative costs, this figure increased to an average of £4,710.14. A summary of the protection measures installed in the 69 properties is given in Table 1.

Table 1-1 Summary of property-level protection measures provided to 69 properties in Chew Magna

Protection Measure	Number provided
Single Door Flood Barriers	136
Double Door Flood Barriers	80
Window Flood Barriers	32
Self Closing Airbricks	374
Non-return Valves (in sewers)	42
Non-return Valves (other)	157
Toilet Bungs	64
Sump & Pump	2
External Wall Treatment (Waterstop)	69

Although the works were completed in March 2011, it wasn't until the widespread flooding experienced during 2012 that the scheme was called into action, with the measures and emergency plans being put to the test. Unfortunately many properties were flooded despite the property protection measures. An independent investigation was therefore undertaken into both the scheme delivery and the performance of the protection measures.

1.3 Flood investigation

The Flood and Water Management Act 2010 (the Act) established unitary and upper tier local authorities as the Lead Local Flood Authority (LLFA) for their area. Under the Act, B&NES is designated as the LLFA and as such has a number of responsibilities in relation to flood risk management and flooding, including a duty to investigate flood events within its area, as it deems necessary:

Section 19: Flood and Water Management Act 2010.

- 1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate —
 - which risk management authorities have relevant flood risk management functions; and
 - whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.
- 2) Where an authority carries out an investigation under subsection (1) it must —
 - publish the results of its investigation; and
 - notify any relevant risk management authorities.

B&NES has determined that a formal Section 19 flood investigation will be carried out when a threshold is reached when five or more properties suffer internal flooding at any urban location, or when two or more properties suffer internal flooding at any rural location.

Following the extensive flooding experienced during 2012 in the Chew Valley area, and in discussion with other flood risk management authorities, it was deemed necessary to complete a formal flood investigation report into the flood incident. This reflects the number of properties affected and the possible multiple sources of flooding.

In partnership with the EA, B&NES appointed JBA Consulting to undertake the formal Section 19 investigation into the flood events in the Chew Valley, covering a two year period from January 2011. Two separate Flood Investigation Reports have been produced for flood events in both Chew Magna and Chew Stoke. In conjunction with these wider Section 19 flood investigations, B&NES and the EA also commissioned an independent investigation into the performance of the Chew Magna Property-level Protection (PLP) scheme. Investigations indicated that approximately 30 of the 69 properties that were provided with protection measures were affected by internal flooding during events in September and November 2012. This report presents the findings of the independent investigation into the delivery and performance of the Chew Magna PLP scheme.

1.4 Scope of commission

Undertaking the formal Section 19 investigations has helped gain an understanding of the nature, causes and effects of the flood events that occurred in Chew Magna during 2012. This in turn has informed the independent assessment and investigation into the delivery and performance of the Chew Magna PLP scheme.

The specific requirements and tasks of the PLP investigation included:

- A review of the suitability of products and implemented solutions, based on the property surveys, installation records and resident interviews;
- An assessment of the extent that surveys looked at the walls of the property as a route of water entry to the building;
- Consideration of the measures to make walls more resistant such as re-painting and water-proofing treatments to external walls, both above and below damp proof courses.
- A review of the available information to determine the mechanism of flooding, including how effective PLP measures were;
- Sensitive and targeted engagement with residents as necessary, noting that they have already been asked about flooding in many cases;
- The collation and review of photographs and flood records for comparison with the recorded flood event;
- A focus on ingress routes beneath suspended floors and the capacity/suitability of the supplied pumps to control flood water;
- A review of soil maps and available information on groundwater levels to determine whether flood risk was likely to result from surcharging of groundwater level during flood events and whether PLP would still be effective if properties are on permeable soils, including consideration of floor construction;
- Consideration of the duration for which flood water had surrounded a property and its impacts on the effectiveness of PLP;
- A review and consideration of whether the product design and quality were appropriate for both the property and for the residents;
- A review of whether the residents were well informed about the effectiveness and level of protection provided by the PLP measures; and
- To review whether the residents received adequate training on how to deploy the PLP measures and the effectiveness of the training provided.

Under the requirements of the Defra Grant scheme, a post flood event performance report is required, in order to help identify areas of best practice and share any learning outcomes for the wider benefit of future PLP schemes. This current investigation report is therefore intended to capture evidence and outcomes from a review of the scheme delivery as well as an assessment of the performance of the measures and action plans. It therefore serves to fulfil this objective as well, to be submitted to Defra and the appropriate national EA policy team lead.

2 Location and flood investigations

2.1 Study area

Chew Magna is located to the north of Chew Valley Lake, to the south of Bristol in North East Somerset and close to the northern edge of the Mendip Hills (Figure 2-1). There are two major watercourses flowing into Chew Magna, both classified as Main River, with their confluence to the south-east of the village: the River Chew which flows into the village from the south-west; and the Winford Brook which enters the village from the north-west and is a tributary of the River Chew.



Figure 2-1: Chew Magna location map

Both catchments are markedly different in terms of scale and response. Both are also influenced to varying extents by on-line reservoirs. The Winford Brook drains a small catchment of approximately 20km² to the confluence with the River Chew and has steep topography which leads to a rapid response to rainfall, with water levels rising quickly in the village. Chew Magna Reservoir is located on the Winford Brook at the upstream extent of the village. This is a small reservoir with a volume of about 70,000m³ and at high flow would fill from empty in around an hour.

The River Chew, in contrast, drains a larger catchment of about 71km² to the Winford Brook confluence. The Chew Valley Lake dominates the catchment, located approximately 2km upstream of Chew Magna and with a volume of about 20,000,000m³ is nearly 300 times larger than Chew Magna Reservoir. Despite the fact that the Winford Brook catchment is approximately one-third of the size of the River Chew catchment to Chew Magna, it is steeper and more rapidly responding than the River Chew catchment.

2.2 Flood investigations

There is a long history of flooding in Chew Magna, most notably the devastating floods of 1968. A flood defence pre-feasibility review report¹ states that approximately eight flood events had occurred since 1960 at the time of writing (2004). It mentions that three flood events occurred in 1999 and 2000 but the main flood event in Chew Magna occurred in July 1968, which is detailed in the EA summary report of the event². Studies have subsequently been carried out to identify possible flood defence schemes but these investigations concluded there is no environmentally acceptable or economically viable flood alleviation scheme that can be developed.

This lack of any viable flood alleviation scheme, combined with the ongoing significant flood risk, made Chew Magna an ideal candidate site for the Defra PLP Grant Scheme. Following scheme completion in March 2011, the weather remained settled as a drought developed in the region. The measures and emergency plans were only put to the test after a dramatic turnaround in the weather during 2012, from drought to one of the wettest years on record. This led to a series of flood events that caused property flooding in Chew Magna during September 2012 and November 2012.

The formal Section 19 Flood Investigation Report identified five separate flooding events that triggered flood warnings during the two year assessment period, two of which resulted in property flooding during September 2012 and again in November 2012. Property flooding was caused by a number of sources: fluvial (Main River and Ordinary Watercourses), pluvial, and groundwater. The river catchments respond rapidly to heavy rainfall, with onset of flooding occurring typically within an hour or less, leading to challenges in issuing timely flood warnings. These events are illustrated in the plots of river flow and rainfall shown in Figure 2-2 and Figure 2-3 and are summarised in Table 2-1.

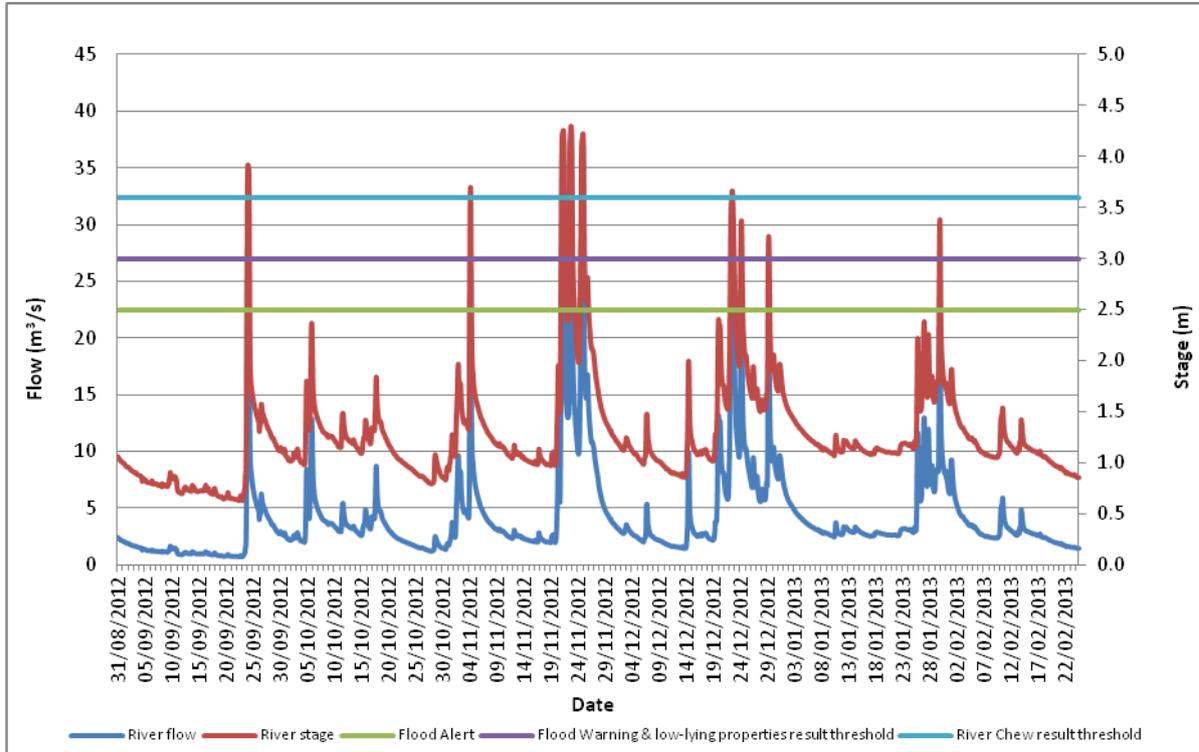


Figure 2-2 River Chew at Compton Dando flow, stage & flood warning service levels

¹ Babbie Brown & Root. September 2004. Chew Magna Flood Defence Scheme. Pre-feasibility Study Review. Final Report (Rev A02).

² Environment Agency. June 2008. The Chew Valley floods of 1968.

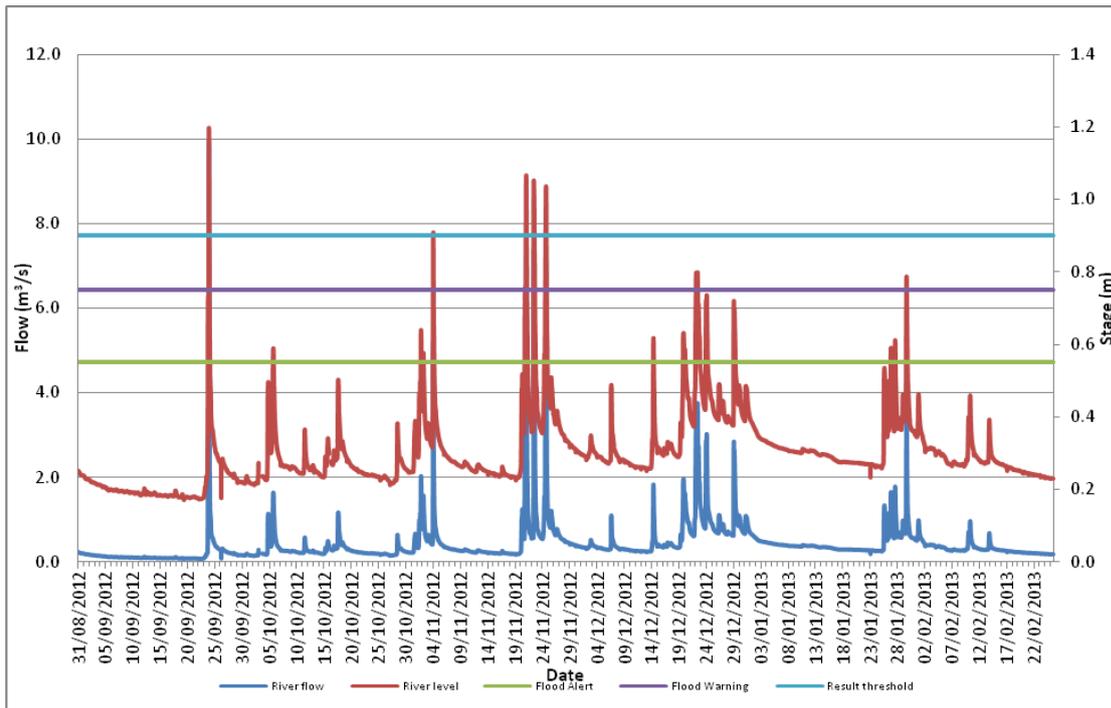


Figure 2-3 Winford Brook at Chew Magna Reservoir flow, stage & flood warning service levels

Table 2-1: Flood events in Chew Magna

Date of event	Known property flooding
24 th September 2012	Yes
4 th November 2012	No
21 st -25 th November 2012	Yes
22 nd -29 th December 2012	No
30 th January 2013	No

As these plots illustrate, the flooding in September was more severe on the Winford Brook rather than the River Chew, affecting The Batch and Streamleaze area. The converse occurred during the November flooding, when the River Chew reached higher levels, causing flooding in the Tunbridge Close/Dumpers Lane area of Chew Magna. The consequences and impacts of the flooding are described in more detail in Section 3. Both flood events led to the need for residents to deploy the PLP measures which were required and given their first real test. However, around half of the properties fitted with PLP measures suffered flooding during September and approximately one third in November.

2.3 Data collection

An investigation by JBA Consulting has allowed for data capture, analysis and scrutiny of the differing experiences with, and consequences of, the PLP scheme. These are described in more detail in Section 3. Interviews, meetings and written exchanges were held with all key partners:

- B&NES
- EA
- Capita Symonds (property surveyor)
- UK Flood Barriers (product supply and install)

Telephone conversations and meetings were held with as many of the affected residents of Chew Magna as possible. Where it was deemed necessary a subsequent property visit was arranged to help discuss and identify the protection provided at each property, ingress routes and the experiences of the residents during the flooding of 2012. These conversations and property visits provided valuable accounts and insights into the scheme process, with many of the residents providing photographs. As of May 2013 many of the residents were still housed in temporary accommodation whilst renovation works were being completed, limiting the contact and rendering the subsequent discussions difficult.

3 Consequences of 2012 Flooding

3.1 Winford Brook catchment

This is the fastest responding catchment, and poses the highest flood risk, of the two watercourses. Phase 1 of the Chew Magna PLP scheme was centred on the Winford Brook and some properties on The Batch are at risk of flooding more than once a year from the Brook (anecdotally, according to residents). The Winford Brook responds much faster than the River Chew but is reported to be frequently 'locked' by the rising River Chew. There is local concern about the angle of confluence of the two rivers and the Parish Council have lobbied the EA to consider reforming the channel approach. The current modelling commissioned by the EA suggests that there is a backwater influence from the River Chew which propagates further upstream producing higher water levels in the Winford Brook.

The two ordinary watercourses to the north of the Winford Brook are also believed to have affected properties along Butham Lane and The Batch during the September and November 2012 flood events. Figure 3-1 illustrates the extent of flooding on The Batch.



Figure 3-1 Flooding on The Batch in Chew Magna (courtesy B&NES)

Information from resident questionnaires and EA flood reconnaissance allowed a flood extent to be defined in Figure 3-2 for the September 2012 flood.

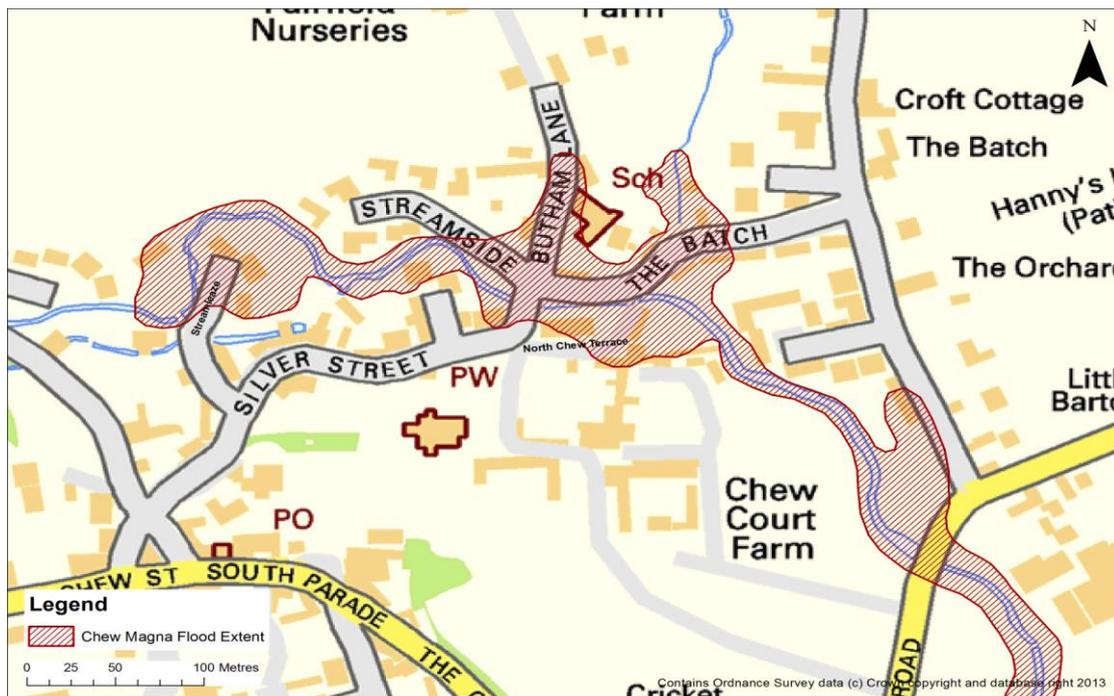


Figure 3-2: Chew Magna approximate flood outline for 24th September 2012 (Winford Brook catchment)

In Streamleaze, off Silver Street, two of the three properties were significantly affected in both September and November 2012. Reports of barrier seals operating well, and protecting from ingress at one property, contrast with a neighbouring property where barriers were bypassed through leaking seals, coupled with water rising through the substrate (saturated floodplain soils) and entering the property via unprotected floors (i.e. no sump pump provided). Internal flood depths reached 400mm. Two of the three properties affected on Streamleaze required considerable renovation following the floods, with residents forced to secure temporary accommodation, causing significant and ongoing distress and upheaval for families.

However, on both occasions, the most significant flood depths, velocities and hazards to people from the Winford Brook were experienced at the junction of Streamside and Butham Lane, and continuing along The Batch. Photographic, wrack mark and anecdotal evidence suggests a maximum flood depth on The Batch, adjacent to the North Chew Terrace footbridge, of approximately 800mm as illustrated in Figure 3-3 and Figure 3-4. The depth and velocity of the flow were demonstrated by the fact that a garden shed became lodged under the footbridge linking The Batch to North Chew Terrace as shown in Figure 3-5.



Figure 3-3: Looking south on The Batch towards the Winford Brook (source: Environment Agency)



Figure 3-4: Debris trash mark on The Batch - note higher level as indicated in photo (source: JBA Consulting)



Figure 3-5: Garden shed lodged under the North Chew Terrace footbridge (source: Environment Agency)

The Ordinary Watercourse which flows from the north towards The Batch, drains via a culvert and grill that is the responsibility of the Parish Council. This became blocked and surcharged, adding to the main flooding already occurring from the Winford Brook.

Internal property flooding along The Batch, back upstream towards the Silver Street road bridge, reached a depth of 600mm, with up to 800mm externally. On The Batch the door barriers provided via the PLP scheme were generally reported to have allowed flood water ingress due to a reported failure of the barrier lower seals. Flood water is also reported to have directly entered properties via unprotected floors and airbricks / vents. This is also the

case along North Chew Terrace. The church hall and public house are also reported to have suffered flooding in the September event, as was the Chew Magna Primary School (albeit only in the grounds).

The flood warning for the Winford Brook at Chew Magna flood warning area (FWA) in September was issued by the EA with only a 49 minute lead time before the result threshold was reached, giving very little response time for residents. During these floods it is understood (anecdotally) that one resident of The Batch vacated their flooded property via a window directly into waist-high flood waters (combined depths and velocities posing a hazard to people), likely to have been exacerbated by surface water draining along Butham Lane. Many months after the flood events of September and November 2012, residents of The Batch are still emotionally affected by the events: many reported of their distress at the time and throughout the lengthy recovery period, with many still not back in their homes.

On The Batch a number of residents were forced to vacate their properties whilst the renovation works were completed. Although for some properties this was completed before Christmas 2012, the majority of renovation works were still being completed in May 2013, six months after the last of the flood events.

The total number of properties affected in the September and November floods is summarised (as best available data allows) in Section 4. The breakdown of properties flooded from each watercourse is not provided, but on the Winford Brook the September 2012 flood was the most significant in terms of flood depth, hazard, number of properties flooded and impact.

3.2 River Chew catchment

The River Chew drains a much larger catchment than the Winford Brook, with the Chew Valley Lake located upstream of Chew Magna. This results in the response of the River Chew to rainfall being less rapid than the Winford Brook. Phases 2 and 3 of the PLP scheme were focused more on properties affected by the River Chew. Figure 3-6 shows the approximate flood extent for the September 2012 flood.

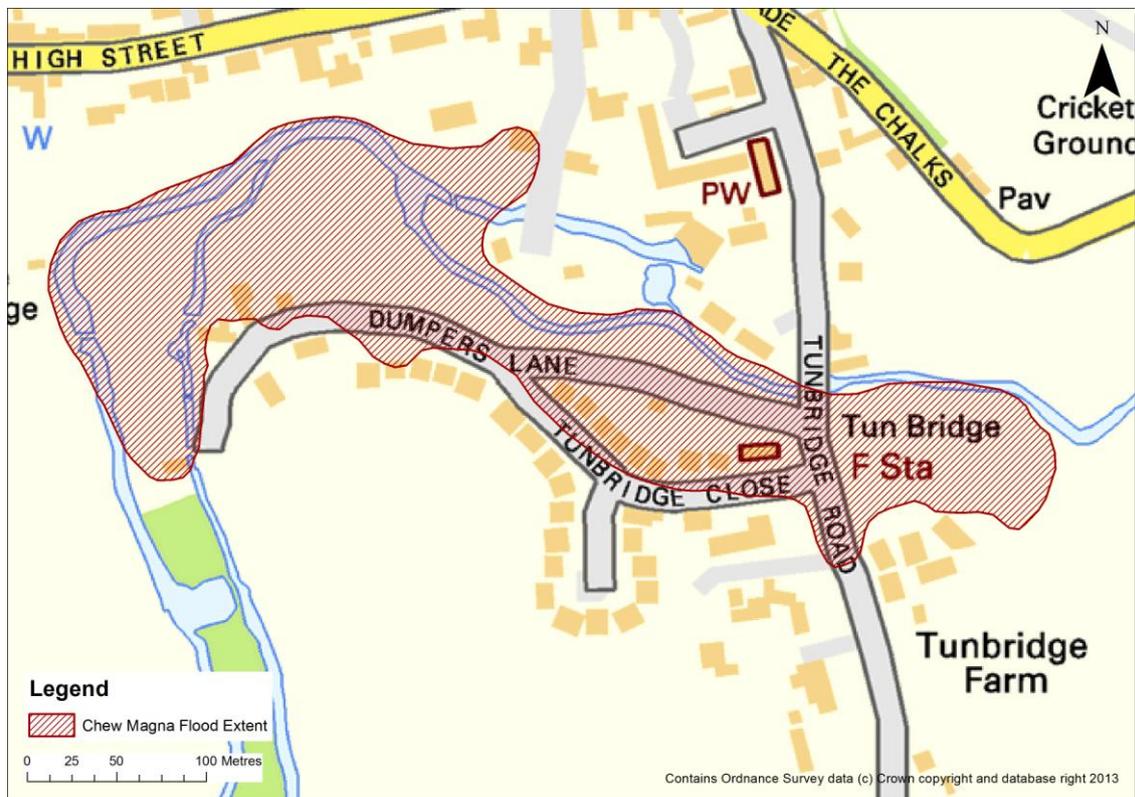


Figure 3-6: Chew Magna approximate flood outline 24th September 2012 (River Chew catchment)

Along the River Chew, property flooding in September and November was experienced in Dumpers Lane, Tunbridge Close, Madam's Paddock and also to the Fire Station at the junction of Tunbridge Close and Tunbridge Road. The Fire Station, which serves as critical infrastructure and of course provides an important emergency response to the village with respect to flooding, was reported to have experienced 25mm of flooding internally. The November flood event resulted in the more significant impacts in terms of depth and consequence in the vicinity of Tunbridge Close, Dumpers Lane and the Tun Bridge. This contrasts with the September event when the impacts were more severe along the Winford Brook (Section 3.1).

The greatest flood depths in the River Chew catchment were along Dumpers Lane, specifically the low points north of Tunbridge Close where depths in excess of 1m were reported. Along Tunbridge Close, whilst there were reports of flood barriers being bypassed by leaking seals, the majority of properties were also affected by water rising up through unprotected floors. None of the properties along Tunbridge Close were provided with dewatering or sump-pumps through the PLP scheme, and although they had concrete sub-floors evidence suggests that flooding via the floors was a significant contributing factor to the damage (through weak joints and cracks).

As with those residents in the vicinity of the Winford Brook, the renovation process to properties along the River Chew was lengthy, distressing and forced many families to find temporary accommodation (many until at least May 2013). There remain ongoing concerns, with many of the residents along Tunbridge Close and Dumpers Lane reporting a helpful response from their existing insurance companies, but most having seen a considerable increase in insurance premiums. Increases in insurance excess or premium, or not being able to get flood insurance cover at all, is also a concern for residents on the southern side of Tunbridge Close; although not directly flooded since these properties are situated at a higher elevation than to the north, they are liable to be included through post code associations.

3.3 Severity of flooding

There are a number of uncertainties with regard to the flow data which are being taken forward by the EA for further review and analysis. At this stage it is not possible therefore to assign reliable return periods to the peak flows which occurred during the assessment period. Preliminary estimates must therefore be treated with caution but would suggest that flows during the September 2012 flood potentially had a 1 in 100 chance of occurrence (1% AEP) for the Winford Brook; indications are that this was somewhat lower for the River Chew. The November 2012 floods had a lower probability of occurrence but are likely to have exceeded the 1 in 10 chance of occurrence (10% AEP) for all three floods for both watercourses.

4 Appraisal of PLP Scheme

4.1 Summary of PLP performance in 2012 flood events

The following table summarises the number of properties flooded and not flooded in the September and November flood events. Data from B&NES, the EA and discussions with residents has been used to compile this table. Where suitable information permits, an assessment has been made of the mechanism of flooding.

Table 4-1: Summary of property flooding in Chew Magna

Performance	September 2012 event	November 2012 event(s)
Total no. of properties with PLP	69	69
Total confirmed as flooded	31	17
Total confirmed as not flooded	9	4
Total presumed not flooded	29	48
Breakdown of flooding mechanism:		
Flooded: Sump-pump failure (pre-known fault)	1	-
Flooded: Generally flooded by water ingress through floors	14	1
Flooded: Single skin property extension leaking water	1	-
Flooded: Failure of non-return valves	1	-
Flooded: Failure of barrier lower sills	9	3
Flooded: Barriers overtopped	4	2
Flooded: Unconfirmed mechanism	7	11

Note: a comprehensive dataset of all properties flooded was not available. Also, properties recorded as having suffered flooding may have been exposed to multiple flooding mechanisms. Where there were no reports available it was presumed that the property had not flooded.

Table 4-1 highlights the difficulties in compiling a comprehensive, confirmed log of those properties flooded and not flooded in each event. Around half of the properties fitted with PLP measures suffered flooding during September and approximately one third in November. Although there are difficulties in compiling accurate flood records, it is reasonable to assume all those who were flooded made this fact known to B&NES and the Parish Council.

It was recognised that many residents had been interviewed and asked about their flooding experiences on a number of occasions and many were still understandably coming to terms with the devastating impacts and progressing with the recovery. So, wherever possible, much of the information and evidence already collected was summarised for inclusion to inform this review (for example, the Bath Spa University study) to avoid yet further interviewing.

It is worth noting that collecting and recording evidence of property flooding during future events would benefit from being undertaken on a more systematic basis, perhaps coordinated through flood wardens and the local Parish Council, or through the use of social media and the internet. After the 2012 events, there was an opportunity to ask and record if residents had been affected by flooding through a related mail-shot to around 500 residents in Chew Magna. Had this question been added to the letter, the results would have informed and significantly improved the overall picture of the flooding and its impact. The incomplete record, specifically in relation to the November event, is in part due to the difficulties in successfully contacting residents. During these investigations many residents of Chew Magna were still housed in temporary accommodation with properties uninhabited and undergoing renovation.

Although the PLP measures helped protect some properties, this investigation has shown that other properties flooded due to a coincidence of factors: a particularly severe flood event causing overtopping of some barriers; a failure to recognise the risk posed by floodwater rising up through the floors; the lack of provision of dewatering pumps to mitigate this risk; and leaking barrier lower seals reported at some properties.

The extremely wet conditions experienced during 2012 led to severe, extensive and repeat flooding. This proved to be an extremely stern test for the PLP measures. Initial analysis suggests that the flooding witnessed on the Winford Brook during September 2012 had a 1% chance of happening in any given year, to only be expected on average once in 100 years.

This rarity of flooding resulted in 13% of the flooded properties experiencing floodwater levels above the top of the barriers and hence exceeded the standards of protection offered.

Although the flooding was severe, the PLP measures did not provide the degree of protection that had been expected, with 31 properties being flooded and suffering extensive damage. The principle inundation route at these properties was floodwater rising up through the floors (at 45% of the flooded properties) and floodwater leaking past the lower door barrier seal (at 30% of the flooded properties). Groundwater flood risk and the possibility of floodwater rising up through the floors was not fully recognised, assessed or mitigated. Only two properties, on the advice and insistence of the owners, were provided with a dewatering pump to help control and manage this risk. Many of the flooded properties experienced inundation up through the suspended timber floors, but without pumps had no means to reduce the water depth or damage. At some, a sudden inrush of floodwater was witnessed, almost certainly resulting from the sudden failure of the timber floors and an equalisation of the hydrostatic pressure.

The automatic airbricks and the non-return valves were considered to have functioned correctly, providing protection and helping to mitigate flood damage. Particular mention was made of the fact that the non-return valves appear to have been effective in protecting properties from sewage flooding.

4.2 Appraisal Approach

In order to understand the factors and possible causes of the flooding that occurred, a detailed review and assessment of the PLP scheme delivery has also been undertaken. An evaluation methodology was adopted consistent with that adopted during the review of the Defra PLP Grant scheme³. This was designed to enable a series of recommendations to be compiled both for B&NES to consider with the Chew Magna community, and for submission to Defra and the EA as part of the ongoing development of best practice in the use and deployment of PLP measures. Experience from flood events provides opportunities to examine and refine procedures, measures and plans for this important and evolving cost effective option of managing local flood risk.

The evaluation methodology adopted a four stage review, as shown in Figure 4-1.

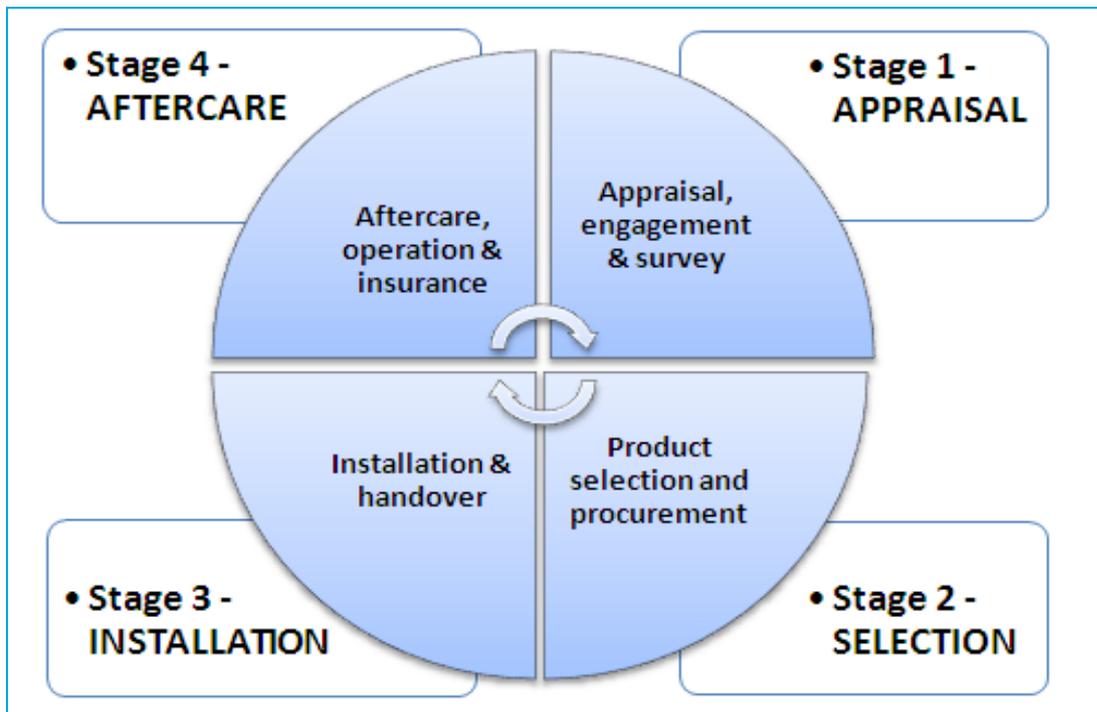


Figure 4-1 The Four Stages of Property-level Protection⁴

³ The Evaluation of the Defra Property-level Flood Protection Scheme; 25918. March 2012
2013s6940 - Chew Magna PLP Evaluation Final Report

4.3 Stage 1: Appraisal

4.3.1 Desk study

The initial £150,000 awarded to B&NES was around half the sum originally applied for, resulting in a need to identify and prioritise those properties at highest risk to which the funding could be targeted. This desk study risk assessment was performed prior to individual property surveys by the appointed surveyor, Capita Symonds. This sought to improve the understanding of the sources and pathways of flooding, and, in the absence of targeted homeowner questionnaires, to collate evidence of flood history (from historic flood outlines and flood event reports). Additional funding ultimately allowed a further phase of PLP surveys and installation to include most of the properties originally identified for consideration.

It is notable that targeted homeowner questionnaires were not issued as part of the appraisal process. These are generally considered beneficial and an essential component of PLP schemes, used to capture first-hand property specific information and flood histories, to augment those community-wide records contained in official accounts. They also serve to gain early buy-in with residents, providing an opportunity to outline the objectives of the scheme and to share individual experiences. The understanding gained from the compilation and review of such information is of huge value, providing benefits that help inform the subsequent property flood risk survey phase.

To help the initial appraisal process, an existing topographic threshold dataset was reviewed by Capita Symonds. This was available for approximately 80% of properties in the overall scheme, and dated from the 1994 Chew Magna Flood Alleviation Scheme Feasibility Study. Where such threshold data were not available, data were extracted from a digital ground model (LIDAR) dataset. LIDAR data does not accurately reflect threshold level at each property, but rather the surrounding ground level. The decision was taken by the project board that a new threshold levelling survey was not necessary. However given the age of the available threshold data, and the critical importance associated with defining risk levels and eligibility in light of the reduced grant in Phase 1, it is suggested that an opportunity to undertake an updated and comprehensive topographic threshold survey was missed. JBA Consulting has since recommended an updated threshold survey be undertaken, and this was completed by the EA during May 2013.

The desk study recognised that although the principal source of flooding was from Main River, it also included a review of flooding from surface and groundwater sources. The conclusion was made that 50% of the study area was at medium risk of surface water flooding, and 50% at high risk. As regards groundwater flooding, 38% were determined as being at medium risk, with 62% at low risk. This information was captured from that in the B&NES Strategic Flood Risk Assessment (SFRA) 2009.

Having established the relative importance of these flood sources, this information did not then cascade sufficiently to inform the property surveys. Groundwater flood risk was not captured or summarised on the Phase 1 survey sheets, and only noted on the Phase 2 sheets. Furthermore, a distinction was not made between the potential for groundwater flooding in areas underlain by permeable rocks and the potential for the local floodplain soils (comprising clays with impeded drainage) to become waterlogged following rainfall and during flood conditions. Although it is recognised that there is a lesser risk of flooding from water rising up through the ground in Chew Magna compared to fluvial flood risks, this important element was not sufficiently addressed or mitigated. The impact of this on the property surveys and recommendations is considered further in section 4.3.3.

4.3.2 Eligibility criteria

A complex weighting system was used to prioritise the different flood risk sources to inform which properties would qualify for PLP within the initial Defra allocation. Although it is unclear whether the eligibility criteria for inclusion into Phase 1 were clearly understood by residents, the prioritisation report aimed to be transparent and fair and it was made publicly available on the Parish Council website for inspection and comment.

Whilst it can be assumed from the desk study that the scheme targeted those most at-risk properties, the distinction between those included and not included is founded on the number of high-risk properties which could be covered by the available grant (rather than, for example,

targeting all properties defined as being at risk by a given return period flood event). This approach did guarantee that the available grant was well targeted and every effort was made to keep the prioritisation process as transparent and fair as reasonably practical. The additional £175,000 funding allowed Phase 2 to proceed, helping to extend the number of properties included in the scheme.

4.3.3 Property survey

4.3.3.1 Survey approach

The property-level flood risk surveys are an opportunity to engage residents, encourage support and buy-in at an early stage, and to begin to manage homeowner expectations about the level of protection provided and the nature of PLP schemes. The evidence suggests the management of expectations was a recurrently missed factor throughout the scheme. Many residents had not understood or realised that whilst such PLP measures can help reduce the impacts and damage caused by flooding, they cannot and will not prevent flooding completely. Numerous residents reported feeling uncertain about what the products would offer and what the limitations of PLP are. This will be evaluated further in section 4.5.2.

4.3.3.2 Survey proforma and sources of flooding

The surveyors used a survey proforma and annotated map to capture details of all possible ingress routes (e.g. sizes, locations). The survey proforma adopted for Phase 1 only identified fluvial and surface water sources, omitting groundwater completely. Groundwater flood risk was only added as a potential source to the phase 2 proforma. It is interesting to note that the risk of foul sewer flooding was also identified a lesser risk in the desk study appraisal, but that provisions to manage this risk were made through the supply and installation of foul chamber non-return valves. Whilst there was no change in the classification of groundwater risks, the desk study and property surveys did not identify the characteristics of the underlying soils to become waterlogged or for the potential for water to rise from saturated soils through the sub-floor cavity of the properties.

The provision to consider the use of pumps was made in the original guidance accompanying the Defra Pilot Scheme. Many properties were reported as flooding via the floors (see Table 4-1). Although survey proformas recorded the construction material of the property floor, the risks of water rising through floors was discounted at the time. The rapid response of the catchment was noted during the survey and hence the duration of flooding was considered as short, limiting the time for water ingress. Consequently recommendations for pumps to control, or attempt to limit, the damage were not made; they were also considered by the project board to not be affordable under the limited scheme funds available. At the bequest of the homeowners, two properties were provided with sump pumps, one with a cellar and the neighbouring property built on the old course of the Winford Brook. Although the cellar pump failed to operate correctly in the September event due to inundation of the electrical supply, this was rectified by the November floods and the property was successfully protected.

As the PLP industry has evolved the use of sump pumps to regulate sub-floor water levels is now seen as critical. Capita Symonds has since confirmed that it is now standard practice to recommend sump pumps for all suspended timber floor properties, regardless of the findings of the desk study. In fact in Chew Magna some properties with concrete floors experienced flooding via the floor, believed to be rising under pressure up through cracks and weak points, and also through seepage under the foundations.

4.3.3.3 Independence of survey

The Defra pilot PLP scheme guidance ("Government grants to local authorities for household-level flood mitigation" - October 2009) stated:

"The surveys...should not suggest particular manufacturers or installers".

The intention was for a property survey fully independent of any manufacturer or installer, so that impartial recommendations could be made which suited the needs, ability and preferences of the homeowners. This independence between the surveyors and the product suppliers and installers existed during Phase 1. However, a 'joint' survey approach was adopted for Phase 2 given the time constraints of the scheme. It was agreed via the Project Board that joint Capita Symonds and UK Flood Barriers surveys were carried out to provide

cost efficiencies, minimise inconvenience for homeowners and to reduce the time taken to agree product specification at each property. A number of residents commented on this issue, wondering who was providing reassurances about the appropriateness of the recommended measures. This endorses wider experiences and feedback since this scheme that residents place importance of independence between the survey and installation stages.

Although the requirement for independence was stressed in the Defra guidance, this has since been reinforced through one of the key recommendations of the Evaluation Report of the Defra Property-Level Flood Protection Grant Scheme:

The initial Appraisal Survey and the Suppliers’ Survey have different purposes and require different skill sets. There is evidence that residents favour independence between the surveyor and supplier, to be confident that the appropriate choice of measures is installed in their property.

4.3.3.4 Missed ingress points

This investigation did not extend to resurveying and auditing of properties, however a limited number were checked as part of the current investigation. From this small sample, evidence was found of potential ingress routes that had been missed at a number of properties selected for review. This included missed air vents, unprotected drainage pipes and unprotected windows with the same sill levels as adjacent protected windows. Residents subsequently reported ingress of water adjacent to and possibly through these drainage routes.



Figure 4-2 Examples of missed ingress routes

A cross-checking system was in place to record and address any discrepancies between the survey and the installation phase. However despite this, it appears from this small (and therefore unrepresentative) sample of sites in this early Defra Pilot Scheme that not all potential ingress routes or flood sources had been addressed. The experience and competence of property flood risk surveying companies has since increased and the industry has matured significantly; this was one of the objectives of the original Defra Pilot Scheme.

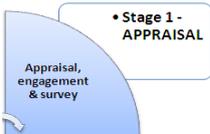
4.3.4 Engagement

Flood Fair events were held to help provide advice, inform and support the residents. Consequently, the scheme became seen by those involved in the PLP industry as best

practice. The Parish Council was used as a vehicle for exchanging information between residents and the project delivery team, while face to face meetings took place at the time of each survey.

Although the partners involved in the management and delivery of the Chew Magna PLP scheme made attempts to engage and inform the residents, key opportunities were missed. In particular, individual homeowner reports presenting the results of the survey and recommended actions and advice were not provided to residents, although a template was provided in the Defra scheme guidance. Targeted homeowner questionnaire were not issued, instead homeowners were interviewed face to face and relevant questions were asked as part of the survey. This was considered at the time to be a superior method to a questionnaire. Both would have been preferable however as questionnaires offer more time for a considered and recorded response to gather a full understanding of residents' experiences of past flooding at their properties before the survey.

Expectation management was not given sufficient emphasis or consideration by B&NES or by their appointed surveyor or product supplier and installer. Neither the survey phase, nor the agreement that B&NES used to register residents for the scheme, explicitly highlighted that the risk that products might leak or could be overtopped. Further discussion concerning the role of engagement in the hand-over process, training and with on-going support is considered in Section 4.5.2.



• Stage 1 - APPRAISAL

Appraisal and engagement - Key Findings

1. **An improved and updated topographic threshold survey was not carried out by B&NES and the surveyor, with over-reliance on old data supplemented by a less accurate LIDAR dataset.**
2. **Targeted homeowner questionnaires and individual property survey reports were not provided to residents. These are of major benefit in gathering flood history and sharing evidence for PLP schemes and should not be overlooked as part of the survey.**
3. **Although properties were prioritised on a risk basis, it is unclear how this was communicated and explained to residents.**
4. **Groundwater flood risk identified in the desk study was omitted from the Phase 1 survey proforma.**
5. **The risks from floodwater rising through the ground floors and the need for sump pumps to help control the risk were not given due consideration as an integral part of the PLP scheme.**
6. **The joint surveys of Phase 2 bought in to question the perception of independence of the property surveyor from the product supplier.**
7. **From a small check survey, the property surveys missed key items (vents, drains, low level windows) and appear inconsistent in approach. In some instances this suggested that the available topographic (or LIDAR) data was not accurate enough or used to inform the property surveys.**

4.4 Stage 2: Selection

4.4.1 Procurement of surveyors and installers

B&NES used their Project Management Framework Agreement to shortlist consultants for the appointment of the survey component. Through a transparent and robust analysis of the project costs, Capita Symonds was identified as the 'best value' option.

From their industry knowledge, Capita Symonds produced a shortlist of 5 companies for B&NES to invite to tender for the supply and installation phase. The tender process was managed through the council's e-procurement portal and maintained a full audit trail of tenders, communications and decisions. It is believed that the key factors which influenced the decision were: BSI Kitemark, product price, weight, warranty arrangements, lead time, and overall scheme delivery costs. UK Flood Barriers were awarded the contract.

4.4.2 Homeowner product choice

A Flood Fair event was organised by B&NES in Bath ahead of the appointment of the supplier, to demonstrate the general types of product available by companies who had been short-listed by Capita Symonds for the supply and install phase. The Project Board agreed that, given the budget and time constraints of the scheme, it would be best to simplify procurement to save time and appoint a single supplier / installer, which resulted in the use of only their products. As a result of the appointment of a single product supplier however, the residents were generally not able to influence the decision over what measures were provided or indicate their own preferred product choice from right across the PLP market. It is understood from discussions and interviews with residents that there was limited or no opportunity for residents to express opinions concerning their specific preferences for products. However, it is understood that a small number of homeowners expressed a preference for less visually intrusive measures and were therefore provided with 'Aqua Sac' products.

It is unclear to what extent the ability of individual residents to deploy PLP measures was considered, especially given that product choice was driven by those products available from UK Flood Barriers, such as the Flood Angel 'Defended Barrier' and 'Water Wall' products. Throughout Chew Magna there are a number of elderly and vulnerable residents who may struggle to carry and deploy such measures in emergency flood situations. However, through the Parish Council's Emergency Flood Plan there were active flood wardens to support those in need of extra help and assistance.

It must be recognised that at the time of the scheme the PLP market was in its infancy, and has matured much since then. The findings and recommendations of the Evaluation Report of the Defra Property-Level Flood Protection Grant Scheme, the continued promotion of PLP schemes since by the EA and local authorities, and the role of the National Flood Forum and the Flood Protection Agency have all contributed to this. One of the recommendations of the Evaluation Report was:

All product suppliers and manufacturers should aim to expand their sales and markets through partnership working and a greater willingness to cooperate.

As such it is noted that there is now a greater emphasis placed on homeowner choice and suitability of products for specific property types and residents needs.

Product selection and procurement

- Stage 2 - SELECTION

Product selection - Key Findings

1. Homeowners were provided with an opportunity to view the range of PLP options at an early flood fair but had limited opportunity to view or express their preferences for products from the chosen supplier.
2. It is unclear to what extent the ability of homeowners to lift, carry and deploy products suitable to their needs was considered.
3. The risks from floodwater rising through the ground floors and the need for sump pumps to help control the risk were not given due consideration as an integral part of the PLP scheme.
4. The procurement and appointment of the surveyor and product supplier/installer followed a transparent process but the joint Phase 2 surveys led to a perception of a loss of independence.

4.5 Stage 3: Installation & Handover

4.5.1 Installation

The following product types or treatments were provided through the scheme:

- Door barriers
- Self-closing airbricks
- Vent covers
- Foul-chamber non-return valves
- W/c bungs
- Waste pipe non-return valves (50mm)
- Sump-pump (2 no.)
- External wall waterproof treatment
- Re-pointing

The evidence gained suggests that the nature of installation and product specifications available at the time resulted in the mixed accounts of product performance during the 2012 floods.

Given the ingress routes missed by the property flood risk surveyors (identified in section 4.3.3), the responsibility of the installer should be reinforced. Product installers should not simply follow a Bill of Quantities provided by the surveyor, but should scrutinise those identified ingress routes during the install phase and question the surveyor for discrepancies where necessary. The respective roles should remain independent, but a greater degree of data exchange and review of recommended products is strongly encouraged. It is noted that such cooperation between surveyor and installer now exists on many PLP schemes.

The specification of the Flood Angel 'Defender Barrier' at the time had thinner rubber seals at the bottom edge than are provided now. The nature of the product design means that once the receiving screw holes are drilled the ability of the homeowner to deploy the barrier under pressure to ensure a watertight seal at the bottom edge is restricted. It is therefore imperative that the holes are drilled with all such barriers installed under downward pressure, rather than simply resting on the threshold. It is considered likely that combinations of some of these early barriers had either thin barrier seals and/or some barriers were not installed under pressure, resulting in barrier seals leaking. Evidence of poorly stored barriers left outside and resting on the lower seals exacerbated the risk of seal failure, causing both seal delamination and compression of the seals. The storage and maintenance issues and the evolution of the PLP industry and available products are addressed in Section 4.6.

Product design and the experience, ability and competence of product installers have improved over the intervening years since the pilot schemes. Two years have elapsed since the Chew Magna pilot scheme and enhancements and product improvements have been witnessed as the PLP industry has developed. Many suppliers have since invested in updates and improvements to their product lines (2nd generation, including better seals, tolerances, handles, screwing mechanisms, weep vents and improved deployment processes to aid those with disabilities), and introduced new concepts. For example, one element introduced by some suppliers has been the 'wet test' of products once installed. This not only gives reassurance to homeowners that the products are watertight and seals are operating correctly, but also allows for valuable hands-on product deployment training. The types of barrier fixing system used by UK Flood Barriers have also expanded, allowing greater flexibility with non-standard apertures, and greater homeowner choice over aesthetics.

Barrier design and specification has also evolved considerably. The 'Defender Barrier' now has new and improved seals, thicker in dimension and with the option of either push-in or adhesive sealing. Some residents observed the adhesive had dried on their products over time, rendering the seals ineffective. Again, this has since been rectified in the specification of the adhesive, although as has been noted, correct product storage is vital as well.

4.5.2 Handover

4.5.2.1 Property report

The original Defra pilot scheme guidance (“Government grants to local authorities for household-level flood mitigation” - October 2009) recommended that individual homeowner survey reports should be produced and provided an example template to be adopted by surveyors.

It was the intention that such reports would provide a summary of the desk study appraisal and property flood risk survey for each homeowner. They would cover topics such as an assessment of property threshold levels, flood sources and risks, an assessment of local flood warning arrangements, a summary of the building characteristics, the likely points of ingress identified in the survey and the recommendations for mitigation. Such reports are fundamental to informing and raising the awareness of residents about their level of risk; the aims and objectives of the scheme; their responsibilities to maintain, store and deploy the measures; and what level of residual risk may remain. They are also critical for managing homeowner expectations that the products are not designed to prevent flooding, but rather are a means through which the impacts can be mitigated.

In spite of the guidance and these clear benefits, individual property reports were not issued to homeowners in Chew Magna. This is an oversight on behalf of B&NES and the surveyor as it missed the opportunity to inform, educate and continue effective engagement with the residents.

4.5.2.2 Inspection and sign-off

Following the completion of the installation phase and the sign-off of measures by the surveyor, a letter – or certificate of completion as some residents have referred to it - was issued to residents to provide an estimate of the standard of protection provided.

The claim was made (for a large number of the properties) that the PLP products would provide up to a 1 in 1,000 year standard of protection. This misled the residents in the standard of protection provided, without fully recognising all flood sources, the need to ensure correct storage and long-term maintenance, and the levels of residual flood risk. An example of the statement is documented below, and a copy of the full letter is provided in Appendix A. Such statements increased the residents' feelings of misplaced security and ultimately misunderstanding concerning what protection the PLP products would provide.

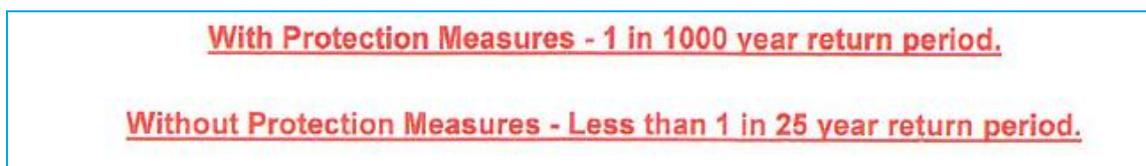


Figure 4-3 Example of standard of protection wording in sign-off letter

It is considered that this letter to residents made unhelpful and inaccurate claims regarding the post-scheme levels of flood risk. It is evident there is uncertainty over the extent that the letter's contents or claims were reviewed by B&NES and the EA. Seemingly no attempts were made to use this sign-off and handover process to raise the awareness of residents that PLP is not intended to prevent flooding, but rather mitigate and lessen the impacts. This was an oversight. Many residents had not understood or realised that whilst such PLP measures can help reduce the impacts and damage caused by flooding, they cannot and will not prevent flooding completely.

A different completion certificate and sign-off form was also provided by UK Flood Barriers, having been signed by a representative of Capita Symonds following the successful inspection of each property. It appears that the missed ingress points highlighted earlier from a small, random selection of survey checks were also missed at this stage of the process, leading to questions of due diligence but perhaps also misunderstanding and confusion over responsibility on behalf of both the surveyor and installer.

At the time there was no standardised format for the sign-off and inspection process, with each surveyor adopting a different proforma. The increased adoption of PLP schemes by the EA and local authorities, and through a need to engage the insurance industry, the EA has

provided a standard template for recording the flood risk of a property after installation of flood resistance and resilience measures. The Flood Risk Report was developed together with Defra, the Association of British Insurers, British Insurance Brokers Association, Royal Institution of Chartered Surveyors, National Flood Forum and the Law Society. The recommendation is that this should now be used as standard in all PLP schemes, providing reassurance regarding scheme quality, product suitability and completeness.

4.5.2.3 Handover

The nature of PLP and individual homeowner responsibility means that ensuring a smooth and comprehensive hand-over process is critical. At the time of the Chew Magna scheme, UK Flood Barriers had developed a very helpful instruction booklet provided to all homeowners covering the correct storage, long-term maintenance and deployment. This was also coupled with a toolkit pack containing additional materials to aid long-term maintenance, such as replacement barrier handles and screws, lubricant etc). This proved a useful addition to products, and has since been extended to a waterproof sticker on the barrier, giving deployment instructions. Helpfully, all barriers were labelled with the aperture for which it is intended. Such good practice should be adopted by all product suppliers, and include labelling of the outside and inside (front and back) of the barrier, to help ensure correct deployment.

Homeowner training in product deployment is also an important part of the handover process. An opportunity for homeowners to attend an event with UK Flood Barriers was arranged, but evidence suggests this was very poorly attended. The reasons for this remain unclear; lack of or poor levels of communication of the need for education regarding deployment and maintenance may have contributed. Unfortunately, further opportunities to ensure all homeowners were trained in how to deploy and store the products were not arranged by B&NES or UK Flood Barriers.

There were clear signs that some residents had not followed the correct, recommended storage requirements, with some products left outside exposed to the elements, some still left in situ or in some cases resting on the barrier seals. UK Flood Barriers also noted that some residents had not installed the barriers correctly, with either bolts or washers missing. There were even reports of barriers alleged to have been deployed back-to-front although further investigation suggests this was not actually possible. Whilst these reports remain unsubstantiated, the evidence suggests that comprehensive training and regular follow-up tests and emergency exercises would have helped ensure all products were deployed correctly.

By the nature of PLP schemes they depend on the active involvement and intervention of the homeowner to deploy and operate the measures. To help homeowners to correctly deploy products, and to ensure that residents are signed-up to Floodline Warnings Direct to receive the issued flood warnings (to prompt deployment), some recent PLP schemes have arranged for hand-over exercises. These involve a dummy flood warning being issued, which prompts the activation of the local emergency plan and deployment of measures by individuals. Representatives from the project team (lead delivery organisation, surveyor and installer) then visit each property to ensure correct and timely deployment, to discuss and rectify any issues arising, and to ensure that vulnerable residents are suitably supported by the community through the emergency flood plan. Such an emergency exercise was not held in Chew Magna but would be worth factoring in as a regular requirement as part of the redrafting required of the emergency plan.



Installation and handover - Key Findings

1. Individual homeowner reports were not provided to residents, as recommended in the Defra guidance. This was a missed opportunity that would have helped with handover and understanding.
2. The risks from floodwater rising up through the ground floors and the need for sump pumps to help control the risk were not given due consideration as an integral part of the PLP scheme.
3. The handover letters provided by the surveyor gave misleading and exaggerated claims over the standards of flood protection.
4. Installers should use the survey report and schedule of requirements as guidance but carefully scrutinise and review this for any specific requirements or queries, to avoid missed items and discrepancies.
5. UK Flood Barriers developed a very helpful instruction booklet and toolkit pack, providing homeowners guidance on the correct storage, long-term maintenance and deployment of their measures.
6. Clearly labelled identification tags were provided on each barrier, avoiding any confusion over their intended location or installation position.
7. Poor homeowner uptake of the training offered in correct deployment techniques would have contributed to uncertainty of residents when in emergency flood situation. An opportunity was missed to emphasise the importance to repeat such an event.
8. Handover flood exercises should be arranged for all PLP schemes as the final part of the hand-over process, and to test the local emergency flood plan.
9. A new Flood Risk Report has since been developed and approved by Defra, EA and ABI for sign-off and handover of all PLP schemes.

4.6 Stage 4: Product performance & after care

4.6.1 Product Performance

4.6.1.1 The successes

It is evident that throughout the September and November floods of 2012 there was a mixed performance of PLP products in Chew Magna and the scheme did not perform as had been hoped. It is important to recognise however that the package of measures did operate effectively and helped to protect some properties from flooding and minimise the damage caused. These included not just door barriers, but self-closing airbricks, vent covers, non-return valves (for foul and waste pipes), and protection and improvement of the external wall fabric. This should be seen as a partial success of the PLP scheme that should be used to develop and wherever possible resolve problems and widen these benefits. For example, one property reported that in the November flood the full package of measures operated as expected, and only a small amount of leakage was experienced around the seals which was effectively soaked up with towels.

Despite the PLP scheme however, around half of the 69 properties provided with individual property protection measures suffered flood inundation and damage, leading to widespread anger and concern. The problems experienced were a combination of interacting factors: particularly severe flooding; a failure to recognise the risk posed by floodwater rising up through the floors; the lack of provision of dewatering pumps to mitigate this risk; leaking

barrier seals reported at some properties; and falsely raised expectations of the standards of protection that might be expected from PLP measures. Although the PLP measures helped protect some properties, many residents have now understandably lost faith in the scheme and are concerned over future flood risk.

4.6.1.2 Overtopping

The investigation has found that barriers were overtopped at a number of properties (see Table 4-1). Whilst the impacts of flooding understandably brought much distress and disruption to the residents of Chew Magna, the fact that the magnitude of flooding exceeded the design standards, cannot be considered as a failure of the PLP scheme. However, this raises concerns over understanding of the level of protection that residents believed they were provided with, and the need to ensure individual flood emergency plans are established and maintained. As discussed, the hand-over letters provided by Capita Symonds were unhelpful in this regard.

It is evident that the target protection height standard used at each property was 900mm. Whilst Kitemarked products were employed wherever possible, this protection height now exceeds the generally recognised industry standard of 600mm that has since been adopted as precautionary best practice. This seeks to ensure additional risks are not created due to any structural stability issues that could be created due to the pressure gradient between the inside and outside of an unsupported property wall. At the time of the scheme there was some ambiguity over the issue of barrier height, with no clear guidance. However no evidence was found of any additional consideration, comment or structural surveys being provided where 900mm barriers have been provided.

4.6.1.3 Leaking seals

Some reports suggest that a number of properties experienced leaking under the lower barrier seals. Thinner seals were used at the time and the adhesive tape holding these in place was seen to have delaminated in some instances. Mention has already been made that poor storage was an issue in some cases, with barriers left outside exposed to the elements and resting on the seals. Instances of missing bolts or washers on barriers were also reported. It is also possible that problems were experienced at some locations due to the barrier fixing sockets not being drilled whilst the barrier itself was placed under downward pressure.

Since the reports of possible seal leaks during this earlier pilot phase, UK Flood Barriers have taken steps to rectify and provide improved seals. As part of the on-going support, following the September flood event UK Flood Barriers visited a number of properties and replaced these rubber seals with the new thicker ones. It is recognised that product specification has improved over time, but the leakage experienced does bring into question the initial installation of the products. The nationwide Defra pilot scheme resulted in considerable time pressures for completion on, what was then, a small industry with a limited number of suppliers. These pressures may have contributed to poor workmanship in the install phase. It is recognised that on some schemes in the Defra pilot, sub-contractors were used who may have been less thorough and their work of lower quality; it is strongly recommended that only experienced and trained product installers be used and the use of subcontractors avoided unless they too are fully trained.

4.6.1.4 Other routes

Reports suggest that flood water was believed to have penetrated the building fabric in some instances, entering the cavity walls and then inundating the sub-floor void and rising up through the floors themselves. The potential for hidden ingress routes will always exist although steps were taken to apply polymer sealant around service entry pipes wherever possible. Given the budgetary constraints of the pilot PLP schemes, only simple resistance measures could be considered, such as the application of waterproof sealant applied to lower external walls. Inevitably there will always be a risk of penetration through the walls, especially if floodwater remains in contact for a lengthy period. Highly expensive and bespoke resilient measures such as tanking would have to be considered to address this risk further but costs can exceed £50,000 per property so were beyond the project scope.

The risk of gradual penetration through walls or floodwater rising up through floors highlights the reason why dewatering pumps are invaluable as a further means of controlling or

mitigating the worst of the damaging effects should this occur. Re-pointing, improving and making good of external walls should always be considered, and the need and extent considered at each property individually.

Finally, in some instances the barriers operated effectively, but were bypassed at other ingress routes. There were concerns from some residents that the self-closing airbricks had suddenly 'failed', thereby allowing water to enter sub-flood cavities. The hypothesis provided for this was that a low level of flooding had entered the cavity via cracks and in the walls and sub-floor, which was sufficient to force the flap-valves to open and allow ingress from outside the property. With outside floodwater levels exceeding those inside the property however, the hydraulic pressure would not allow this to occur, and the following photographs illustrate a tank test that demonstrates this point.

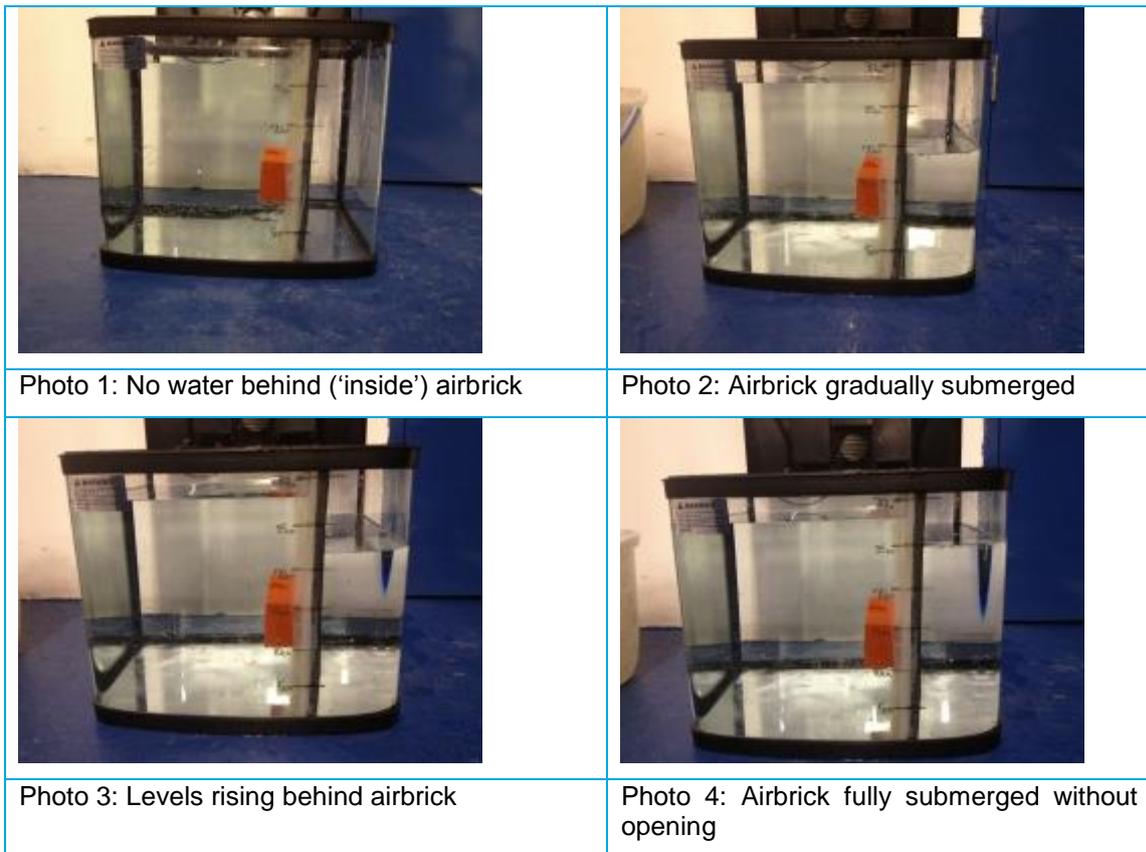


Figure 4-4 Photos of self-closing airbrick operation

Note: As water level on the 'inside' of the airbrick was increased the flap valve remained closed, thereby retaining the water on the 'outside'. This dispels the theory that internal flooding caused the airbrick to open.

It was noted from a small, random selection of more detailed property survey reviews that a number of potential ingress routes were missed in the surveys. This is a matter of some concern but a further programme of site visits to all properties would be required to further investigate this issue.

It should also be noted that a number of residents from North Chew Terrace are exploring the potential to construct a flood defence wall around their properties. This will require flood defence consent, and the EA and B&NES are being consulted.

4.6.2 Emergency Flood Plan

An emergency plan for Chew Magna was developed by the Parish Council following flooding that occurred in the village on 11th January 2008. Experience then had shown that a single warning is insufficient to cater for both the Winford Brook and the River Chew as they react independently during periods of heavy or prolonged rainfall. This fact has been verified once again during the 2012 flood events.

The emergency plan is therefore initiated as follows:

Winford Brook:

- The most vulnerable daytime location is the primary school which will be evacuated upon the issue of a Flood Watch (now replaced by Flood Alert) for the Winford Brook.
- Outside the hours of 09:00-16:30 and at weekends the emergency plan will be activated upon receipt of a Flood Warning for the Winford Brook.

River Chew:

- The emergency plan would be activated upon a Flood Warning being issued for the River Chew.

It was noted that this plan still refers to the local sandbag arrangements and has not yet been updated to reflect the Chew Magna PLP scheme and requirements. The review has confirmed that whilst the implemented products and solutions are mostly suitable, some residents may require support in installing and deploying barriers, and this needs to be factored in to the updated emergency plan arrangements. In addition, the EA flood warning messages advise that 'flood protection equipment (should be) put in place' when a flood warning is issued. This is likely to be too late however and should be reviewed as part of a wider emergency plan update and flood warning review.

4.6.3 Flood warning

Chew Magna falls within, and benefits from, the EA's flood warning service. This service generally aims to issue flood warnings with a two hour lead time, unless the catchment falls under a rapid response catchment, such as Chew Magna. In this case, half an hour is the target time. Under normal circumstances a flood alert is issued to customers during waking hours, ahead of a flood warning. The precise nature of 'waking hours' is determined on a risk basis by the duty officer but the EA will not normally issue a Flood Alert before 6am or after 9pm unless the duty officer decides that this is necessary. This means a Flood Alert is often issued based on a forecast if river levels are expected to exceed the Flood Alert threshold level overnight. The aim of course is to give people the earliest possible advance notice of the chance of flooding, recognising this involves probabilities rather than certainties. However it is possible that a flood warning could be issued ahead of a flood alert. Under certain conditions the River Chew and Winford Brook are known to respond rapidly to heavy rainfall. If property flooding is imminent then the priority is to raise awareness of the risk by issuing a flood warning.

There appears to be relatively little lead time before the result threshold is reached for the majority of the flood events seen last year. This is likely to be due to the catchments responding rapidly to rainfall, leaving little time to issue warnings. Discussions with local residents indicate that there is some confusion and misunderstanding of the EA flood warning codes. Many residents in Chew Magna seem concerned at receiving so many 'warnings', although it is possible that this is a misconception of flood alerts. There is a risk of complacency by not taking any action as it is assumed, from previous experience, that there is little chance of flooding occurring. Further information for raising awareness of these warnings may be necessary to ensure that appropriate action is taken at the appropriate time. As part of the EA's improvement programme, the current flood warning service is being refined and updated and new flood warning procedures for Chew Magna are being prepared. The new warning procedures have been drafted to make use of the Chew Stoke Stream level gauge more local to the risk area which should help to improve the quality of the warnings issued and provide more lead time.

4.6.4 Aftercare

Following the completion of the scheme this investigation has shown there was confusion between all parties over the ownership of the products, with everyone apparently unclear of whether the products remained the property of the homeowner or were centrally owned by the Parish Council. The Participation Agreement drafted by B&NES (included in Appendix B) however makes clear that the measures will remain the property of Chew Magna Parish Council but will need to be stored by the property owner. Such an approach is unusual as the model most widely adopted by the other Defra schemes had ownership clearly resting with the residents. It is presumed such an agreement was to attempt to overcome the risk of homeowners potentially selling them. It is considered an important part of empowering

homeowners that products are the property of the resident, and remain with the property should it be subsequently sold. Again, an opportunity was missed to ensure clarity and buy-in. This reinforces that on-going effective engagement is critical to overall scheme success, including better levels of information provided at the start to inform on the intentions of PLP.

Following the completion of the installation phase, UK Flood Barriers provided much on-going support to residents to rectify issues concerning screws and threads on barriers. This suggests that there were ongoing problems concerning the barriers at the time. UK Flood Barriers have recognised this, and demonstrated improvements in the specifications since. An innovative maintenance package was offered by UKFB, although it is understood that the uptake for this was very poor, infact possibly with only one household taking up the agreement. This initiative should, alongside appropriate product training, be promoted during the handover phase and to ensure ongoing aftercare. This should be offered by all product suppliers and risk management authorities managing or overseeing such schemes should also consider the provision or encouragement of maintenance packages for all properties.

All parties involved in the PLP scheme responded well to their on-going responsibilities to support communities after the handover process, mobilising effectively and quickly to site following the floods. Particular mention should be made of the commitment and time given by UK Flood Barriers who visited the village and supported residents on many occasions in an attempt to determine the flooding mechanisms and any possible remedial actions. It was evident through the course of the investigation that the flooding had inevitably led to a lot of distress and emotional upset. This not only resulted from the initial actual flood damage but also the stressful process of dealing with insurers and builders as part of the ongoing recovery and renovation process. It was apparent that residents would have welcomed and benefitted from health care and emotional counselling support throughout the long recovery process. Some made clear that the interviews and discussions provided as part of subsequent investigations were the first and only opportunity residents had to talk about their flooding experiences. In the event, this process was found to be therapeutic so there is scope for B&NES to offer more formalised and qualified support in this regard. Furthermore the wider professional responsibilities of those involved in PLP schemes concerning the treatment of distressed homeowners who may have suffered flooding, the use of media and the on-going support should be reiterated.

It is evident from this investigation that the risk management partnership will need to consider a programme of renewed and ongoing engagement with residents (through flood surgeries, newsletters etc) to help raise and maintain flood awareness and understanding on warning, channel maintenance, preparedness, emergency planning, PLP deployment etc. In particular, given these findings, it is also necessary to assess the potential and funding for an enhanced package of PLP measures for those included in the scheme. This should seek to ensure all sources of flooding are captured through a comprehensive survey capturing all ingress routes, and that individual homeowner reports are issued. It will be vital that effective resident engagement is achieved as a key part of this next stage, with emergency plans also reflecting the needs of tenanted properties as well as situations where properties are sold.

4.7 Summary

The stages of appraisal, selection, install and handover were completed within the budget and time constraints of the Defra pilot schemes. This scheme became the largest PLP scheme at that time and was considered then to represent best practice with regards to partnership working. It is now evident with hindsight and the benefit of increased experience in the PLP industry that there were oversights and opportunities missed. In particular more information could have been provided to inform residents of their responsibilities and expectations around the level of flood protection, which were unduly raised beyond what PLP can deliver. Vitality, the risk of floodwater rising through the floors was also discounted and only two of the 69 properties were provided with dewatering pumps.

It should be remembered that the Chew Magna PLP scheme was completed over two years ago, during the Defra pilot phase with the intention to identify learning points to take PLP forward, to provide best practice examples and evaluation of scheme successes. The PLP industry, and those surveyors and product suppliers involved in this scheme, have demonstrated how their processes, products and approaches have evolved in the time since this scheme completed.

• Stage 4 -
AFTERCARE

Aftercare,
operation &
insurance

Aftercare and operation - Key Findings

1. The package of PLP measures operated as expected at some properties, and this should be recognised.
2. The flooding witnessed in 2012 was severe with a low probability of occurrence and it led to overtopping at some flood barriers, exceeding the standard of protection rather than representing a failure of the PLP.
3. The risks from floodwater rising up through the ground floors and the need for sump pumps to help control the risk were not given due consideration as an integral part of the PLP scheme.
4. A target design standard height of 900mm was adopted, greater than the industry guide height of 600mm that has since been adopted. It appears no additional structural survey accompanied the property flood risk surveys or whether homeowners were given the option of a lower standard.
5. Some barriers were reported to have leaked via the bottom seals, due in part to poor storage. The early thin barrier seals of the 'Defender Barrier' have since improved, together with the securing adhesive.
6. A small number of properties were resurveyed as part of this investigation. Additional ingress routes (e.g. air vents, drains etc) were identified that had been missed and hence had no protection measures.
7. Improved product ranges and specifications have been developed since this scheme. The 'wet test' is a good example of how the installation process has evolved.
8. The automatic airbricks and non-return valves operated as expected.
9. Suggestions of sudden airbrick failure due to internal flooding have been disproved, with tank tests illustrating how hydraulic pressure acts to keep the flap valves closed.
10. All parties mobilised quickly to site during the flood events, and UK Flood Barriers responded to many requests for assistance and repairs to products.
11. All PLP products should remain the property of the homeowner, with clear arrangements in place for tenanted properties and should remain with the property should it ever be sold.
12. A maintenance package was offered by UK Flood Barriers, but uptake from residents was very low. Such packages should be considered by the risk management authority to be offered to all properties involved in PLP schemes.
13. The Chew Magna Emergency Flood Plan is outdated and does not reflect the PLP scheme. This should now be updated to reflect the scheme and changes to the flood warning arrangements along with consideration of an enhanced package of PLP measures.
14. The flooding led to a lot of distress and emotional upset. There was no emotional support or professional healthcare counselling throughout the process. B&NES should offer more formalised support in such circumstances.

5 Conclusions & Recommendations

5.1 Conclusions

This report presents the findings of an independent investigation into the Chew Magna PLP scheme delivery and performance, gathering evidence and feedback from residents and the project partners. It is recognised this was one of the many early pilot schemes investigating this new innovative approach, under tight timescale and budgetary constraints. Since that time the industry has made significant progress, building on many of the findings and outcomes identified by the pilot schemes. This investigation provides additional evidence to help consolidate this progress.

The study has made reference to the data analysis undertaken for the formal Section 19 flood investigation reports, to better understand the flooding mechanisms and relative scale of the flooding experienced in 2012. After analysing the data and evidence collected, the Section 19 flood investigation has shown that during the flood events of 2012, the prime source of flooding was from the Winford Brook and the River Chew. Both catchments respond rapidly to rainfall and this was exacerbated by saturated conditions for much of 2012, leading to an excess of surface water on the roads, insufficient drainage capacity to cope with the heavy rainfall and runoff from the agricultural land. Extremely intense rainfall falling on saturated catchments led to some of the highest river levels on record, causing widespread property flooding. This was exacerbated by flooding from the smaller tributary ordinary watercourses, from surface water runoff following pathways such as roads and from groundwater. There were however no records of widespread foul sewer flooding.

The investigation has shown that the problems experienced were a combination of factors: particularly severe flooding; a failure to recognise the risk posed by floodwater rising through the floors; the lack of provision of dewatering pumps to help mitigate this risk; leaking barrier seals reported at some properties; instances of poor product storage and maintenance; and raised expectations of the standards of protection that might be expected from PLP measures. In particular, the investigation has found:

- The extreme conditions experienced during 2012 led to severe, extensive and repeat flooding. Analysis suggests that the flooding witnessed on the Winford Brook during September 2012 had a 1% chance of happening in any given year, to only be expected on average once in 100 years. This rarity of flooding resulted in 13% of the flooded properties experiencing floodwater levels above the top of the barriers and hence exceeded the standards of protection offered.
- Although the flooding was severe, the PLP measures did not provide the degree of protection that had been expected, with 31 properties flooded and damaged.
- The principle inundation route at these properties was floodwater rising up through the floors (at 45% of the flooded properties) and floodwater leaking past the lower door barrier seal (at 30% of the flooded properties).
- Groundwater flood risk and the potential for floodwater to rise up through the floors was not fully recognised, assessed or mitigated. Pumps were discounted at the time on the basis of affordability and on the view that the rapid response catchment results in only short duration floods. Only two properties, on the advice and insistence of the owners, were provided with a dewatering pump to help control and manage this risk. Other properties experienced inundation up through the suspended timber floors, but without pumps had no means to reduce the water depth or damage. At some, a sudden inrush of floodwater was witnessed, this is considered likely to have resulted from the sudden failure of the timber floors and an equalisation of the hydrostatic pressure.
- Evidence in some instances of poor storage of barriers, left outside resting on the seals, will have led to increased risks of leakage. Likewise, some barriers had been installed with incomplete or missing bolts or washers, highlighting the importance of ensuring resident awareness of responsibility for correct storage, maintenance and deployment.
- Barriers at some locations were reported to have bolt fixings that didn't adequately exert downward compression of the lower barrier seals. Renewed and thicker seals have subsequently helped with improved fixings.
- The automatic airbricks and the non-return valves were considered to have functioned correctly, providing protection and helping to mitigate flood damage.

In addition to the findings related to the actual measures, there is evidence that the expectations and understanding of residents had been raised inappropriately, with many believing that the PLP measures would provide standards of flood protection beyond what could reasonably be expected. As a result, some people had stopped their practices of moving valuable items upon receipt of a flood warning, in the belief that the risk of flooding had been removed. Individual responsibility for the maintenance, storage and deployment of the measures was eroded by the decision for the PLP measures to remain the property of Chew Magna Parish Council, rather than becoming the responsibility and ownership of the property owner.

Opportunities were missed to more clearly explain to residents the scope and limitations of PLP measures, through initial questionnaires, follow-up flood fairs, or letters. Significantly, residents were not provided with an individual PLP report: this would have described and emphasised the scheme objectives and limitations as well as presenting a record of the survey findings and recommendations. It would have also helped underline the individual resident's own responsibilities relating to the correct storage, maintenance and deployment of the measures; and the benefits of incorporating these issues in updated community and individual emergency response plans. UK Flood Barriers did provide explanation about product use to homeowners during initial installation as well as a user guide and spares box but it is evident that ongoing community engagement and regular checks and tests of emergency plans are needed to retain awareness and preparedness. A maintenance package was also offered by UK Flood Barriers, but uptake from residents was very low. As mentioned, retaining ownership of the measures with the Parish Council did not help in this respect.

An inappropriate sense of security from flooding was evident, exacerbated by a letter, or certificate of completion, issued to each resident, quoting standards of protection of up to a 1 in 1000 year return period in some instances. There were no cautionary remarks or advice that flooding could, and should, still be expected and planned for and no advice given about the importance of preparing an individual flood emergency plan. The completion certificate also only addresses fluvial flood risk, omitting risks from surface water and groundwater.

Despite the PLP scheme in Chew Magna, around half of the 69 properties provided with individual property protection measures suffered flood inundation and damage, leading to anger and concern. Although the PLP measures helped protect some properties, many residents have now lost faith in the scheme and are concerned over future flood risk.

5.2 Action Plan

Suggestions and recommendations are made in Table 5-1 relating to PLP schemes in general and for taking the Chew Magna PLP scheme forward specifically, based on the evidence and lessons learnt from this investigation. These are presented in a prioritised order with urgent action recommended for updating the Chew Magna emergency plan and flood warning arrangements.

Table 5-1: Recommended actions for the Chew Magna PLP scheme

Action Owner	Action	Timescale
EA	1. Complete an updated topographic threshold survey of all properties at risk in Chew Magna.	May 2013 - completed
EA, B&NES and Bristol Water	2. Establish a strategic flood risk management partnership	August 2013
EA and B&NES	3. To communicate the findings of this investigation and agree on recommended actions.	August 2013
B&NES	4. The Emergency Planning team to adopt a partnership approach with the EA to support the Chew Magna Parish Council in the re-drafting and updating of the Chew Magna Emergency Flood Plan.	August 2013
B&NES	5. Working in close partnership with the EA assess the potential and funding for an enhanced package of PLP measures for those included in the previous scheme. This should seek to ensure all sources of flooding are captured through a comprehensive independent survey capturing all ingress routes, and that individual homeowner reports are issued. Ensure that effective resident engagement is a key part of this (surgeries, meetings, newsletter updates, etc).	August 2013
EA and B&NES	6. The full RMA partnership to develop a Communications Plan and programme of renewed and ongoing engagement with residents (through flood surgeries, newsletters etc) to help raise and maintain flood awareness and understanding on warning, channel maintenance, preparedness, emergency planning, PLP deployment etc.	August 2013
EA and B&NES	7. Hold a public surgery to update on proposed actions and progress with regards the programme for an enhanced package of PLP measures.	September 2013
B&NES	8. Working in close partnership with the EA, ensure the ownership of PLP measures is transferred from Chew Magna Parish Council to the homeowner.	December 2013
EA and B&NES	9. To adopt the EA Flood Risk Report template for the sign-off procedure for any future PLP installations, providing clarity over the standard of protection provided	Ongoing
EA and B&NES	10. Arrange annual flood exercises and at the handover of any future PLP schemes, to ensure residents can deploy measures successfully, receive flood warnings as planned, and that emergency flood plans can be tested and updated.	Ongoing

Appendices

A Example of sign-off letter

CAPITA SYMONDS

30th March 2011

Our ref CS/043483

Dear Resident,

RE: Parish of Chew Magna - Property Flood Protection Measures

Property flood protection measures above and below ground have reduced the flood risk to this property. The information supplied in this letter provides an estimated potential standard of protection against fluvial (river) flooding based on data supplied by the Environment Agency in April 2010. The measures installed by UK Flood Barriers have been specified and inspected by a Capita Symonds RICS building surveyor.

Environment Agency modelled fluvial flood depths adjacent to the property are shown in the table below¹. The property flood barriers supplied are able to reduce *internal flooding for flood depths up to 900mm* at potential points of entry identified in the household level flood survey. The estimated standard of protection for properties with protection measures assumes that the measures are deployed correctly to provide the full 900mm of protection.

Chew Magna Property Address				Estimated fluvial flood depth adjacent to property (m)				
House Name	Number	Street	Postcode	Provided by Environment Agency April 2010 – (see notes ^{1,2} below)				
				Return Period Flood Event ²				
				25 Year	50 Year	75 Year	100 Year	1000 Year
				0.34	0.43	0.43	0.43	0.46

With Protection Measures - 1 in 1000 year return period.

Without Protection Measures - Less than 1 in 25 year return period.

Please pay attention to the notes^{1,2, and 3)} provided in the box at the bottom of the letter, I hope the information can be of use to you. It is suggested that this letter is retained with the information supplied by UK Flood Barriers.

Yours sincerely,

Michael Lake – On behalf of Capita Symonds Ltd

¹The depths are based on a coarse modelling approach that is used to derive Environment Agency flood zones. Caution must be exercised in interpreting J Flow derived flood depths due to the large number of assumptions incorporated into the model.

² A return period is an estimate of the average interval of time between flood events of a particular magnitude. It is a statistical measurement denoting the average recurrence interval over an extended period of time. It does not imply that if an event occurs it will not happen again for another formulated number of years. The return period depths are based on the J Flow modelled data provided April 2010.

³Capita Symonds has used information from available sources to make a reasoned judgement on the estimated standard of protection provided by the measures against fluvial flooding. Capita Symonds does not accept any responsibility or liability for the accuracy of the information provided.

B Participation Agreement

Bath & North East Somerset Council

PROPERTY LEVEL FLOOD PROTECTION SCHEME PARTICIPATION AGREEMENT

Bath & North East Somerset Council agrees to do the following:

To provide, at no cost to the Property Owner, demountable flood protection boards and air-brick covers. These will remain the property of Chew Magna Parish Council, but will need to be stored by the Property Owner at the Property, or at some other location, near to the Property, as the Local Council shall indicate.

To arrange for the installation of permanent fittings to the Property to enable the Owner or the tenant to deploy the flood protection in the event of a severe rainfall forecast or a flood warning.

To ensure that the company installing any fittings to the Property carry adequate insurance to recompense the Property Owner or the tenant in the event of any damage or accident during the installation phase of the work.

To provide the Property Owner or the tenant with training in the use and deployment of the flood protection boards and air brick covers.

The Property Owner agrees to do the following

To store the flood protection boards and air-brick covers securely and protect them from damage.

To participate in any community wide implementation plan for the deployment of the flood boards, so far as they are reasonably able to do so.

To carry out any ancillary work, which the Council identifies as a necessary component of the flood protection installation, such as fitting non-return valves etc.

To be included on the Environment Agency's Flood Warning Scheme and Chew Magna Flood Warden Scheme.

To deploy the flood protection boards and air-brick covers, in accordance with the manufacturer's instructions.

To notify Chew Magna Parish Council in writing if they dispose of the property and to surrender the flood protection boards and air-brick covers back to Local Council for possible transfer to the new owner.

To allow access to the property at all reasonable times for the purposes of installation and inspection of the permanent fittings and any subsequent remedial work, if required.

If the Property is currently rented, or becomes rented, to encourage the tenant to undertake actions 1 to 7 above and be aware of the limitations of the Council's liabilities as stated below.

What is not covered by the agreement?

The Council shall not be held liable to the Property Owner or tenant for any actions, claims demands, costs and/or expenses incurred in respect of any loss or damage, including negligence, breach of contract, consequential and indirect loss, or personal injury (including death) which arises out of or in connection with the scheme, or use of the flood protection.

The Council shall not be responsible for providing flood warnings or for ensuring that any other party does so.

The Council shall not be responsible for removing any fixtures associated with the flood protection products, if or when the home-owner no longer requires them.

The Council shall not repair or replace damaged or lost flood protection boards or air brick covers.

The flood protection boards and air brick covers will be covered by a 12 months warranty against inherent defects. However, the Council can not accept responsibility for the normal wear and tear of the flood protection measures, or for their use in any specific manner whether or not this is made known to the Council. Property Owners are encouraged to consider entering into a maintenance agreement with the flood protection product supplier.

The Council shall not undertake any remedial or aesthetic works such as redecorating or re-plastering.

Installation refers to the fixing of any permanent brackets, fittings, etc to the house itself, including any necessary building work.

Deployment means the repeated task of fitting and removing the flood boards and air brick covers before and after a flood.

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