Open

Special
Overview & Scrutiny Committee

Agenda

To be held remotely
6pm
Thursday, 25th June 2020

Overview & Scrutiny Committee

Members of Committee:

Chairman: Councillor M J Hart
Vice-Chairman: Councillor S J Chambers

Councillor N J Desmond	**Councillor C Edginton-White**
Councillor S Griffiths	**Councillor S Miah**
Councillor T L Onslow	**Councillor M Rayner**
Councillor S E N Rook	**Councillor D R Sheppard**

Would Members please note that, to ensure continuity in scrutiny, substitutes should only be appointed for the Scrutiny Committee in exceptional circumstances.

Information for Members of the Public:

Part I of the Agenda includes items for discussion in public. You have the right to inspect copies of Minutes and reports on this Agenda as well as the background documents used in the preparation of these reports.

Part II of the Agenda (if applicable) deals with items of "Exempt Information" for which it is anticipated that the public may be excluded from the meeting and neither reports nor background papers are open to public inspection.

1. The Overview & Scrutiny Committee meeting is open to the public except for any exempt/confidential items. These items are normally discussed at the end of the meeting. Where a meeting is held remotely, "open" means available for live or subsequent viewing.

2. Members of the public will be able to hear and see the meetings by a live stream on the Council's website:

   https://www.wyreforestdc.gov.uk/streaming.aspx

3. This meeting is being held remotely online and will be recorded for play back. You should be aware that the Council is a Data Controller under the Data Protection Act 2018. All streamed footage is the copyright of Wyre Forest District Council.

Declaration of Interests by Members – interests of members in contracts and other matters

Declarations of Interest are a standard item on every Council and Committee agenda and each Member must provide a full record of their interests in the Public Register.

In addition, alongside the Register of Interest, the Members Code of Conduct ("the Code") requires the Declaration of Interests at meetings. Members have to decide first whether or not they have a disclosable interest in the matter under discussion.

Please see the Members' Code of Conduct as set out in Section 14 of the Council's constitution for full details.

Disclosable Pecuniary Interest (DPI) / Other Disclosable Interest (ODI)

DPI's and ODI's are interests defined in the Code of Conduct that has been adopted by the District.

If you have a DPI (as defined in the Code) in a matter being considered at a meeting of the Council (as defined in the Code), the Council's Standing Orders require you to leave the room where the meeting is held, for the duration of any discussion or voting on that matter.

If you have an ODI (as defined in the Code) you will need to consider whether you need to leave the room during the consideration of the matter.

Co-opted Members

Scrutiny Committees may wish to appoint Co-Opted Members to sit on their committee in order to add value to the scrutiny process. To appoint a Co-Opted Member, a Committee must first agree to appoint either a specific

person or to approach a relevant organisation to request that they put forward a suitable representative (e.g. the local Police Authority). Co-Optees are non voting by default but Committees can decide to appoint voting rights to a Co-Optee. The Co-Option of the Member will last no longer than the remainder of the municipal year.

Scrutiny Committees can at any meeting agree to terminate the Co-Option of a Co-Opted Member with immediate effect. Where an organisation is appointed to put forward a Co-Opted Member, they are able to send a substitute in exceptional circumstances, provided that they notify Democratic Services in advance. Co-Opted Members must sign up to the Members Code of Conduct before attending their first meeting, failure to sign will mean that they are unable to participate. This also applies to substitute Co-Opted Members, who will need to allow sufficient time before a meeting in order to sign the Code of Conduct.

The following will apply:

i) The total number of voting co-opted members on any Scrutiny Committee will not exceed 25% at any one time.
ii) The total number of voting Co-opted Members on any Review Panel will not be limited.
iii) Those Co-opted Members with voting rights will exercise their rights in accordance with the principles of decision making set out in the constitution.

For Further information:

If you have any queries about this Agenda or require any details of background papers, further documents or information, you should contact Louisa Bright, Principal Committee and Member Services Officer, Wyre Forest House, Finepoint Way, Kidderminster, DY11 7WF. Telephone: 01562 732763 or email louisa.bright@wyreforestdc.gov.uk

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Wyre Forest District Council

Special Overview & Scrutiny Committee

Thursday, 25th June 2020

To be held remotely

Part 1

Open to the press and public

Agenda item	Subject	Page Number
1.	**Apologies for Absence**	
2.	**Appointment of Substitute Members** To receive the name of any Councillor who is to act as a substitute, together with the name of the Councillor for whom he/she is acting.	
3.	**Declarations of Interests by Members** In accordance with the Code of Conduct, to invite Members to declare the existence and nature of any Disclosable Pecuniary Interests (DPI's) and / or Other Disclosable Interests (ODI's) in the following agenda items and indicate the action that they will be taking when the item is considered. Please see the Members' Code of Conduct as set out in Section 14 of the Council's Constitution for full details.	
4.	**Consideration of the flooding motion from Council – Evidence Gathering from the Environment Agency** To receive a report from Dave Throup, Area Manager Herefordshire and Worcestershire and Charles Chandler, West Midlands Strategic Flood Recovery Manager.	5

Wyre Forest District Council Scrutiny Committee Report - Flooding February 2020

Date: June 2020

Report version: FINAL 1.2

We are the Environment Agency. We protect and improve the environment.

We help people and wildlife adapt to climate change and reduce its impacts, including flooding, drought, sea level rise and coastal erosion.

We improve the quality of our water, land and air by tackling pollution. We work with businesses to help them comply with environmental regulations. A healthy and diverse environment enhances people's lives and contributes to economic growth.

We can't do this alone. We work as part of the Defra group (Department for Environment, Food & Rural Affairs), with the rest of government, local councils, businesses, civil society groups and local communities to create a better place for people and wildlife.

Published by:

Environment Agency
Horizon House, Deanery Road,
Bristol BS1 5AH

www.gov.uk/environment-agency

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Email: enquiries@environment-agency.gov.uk

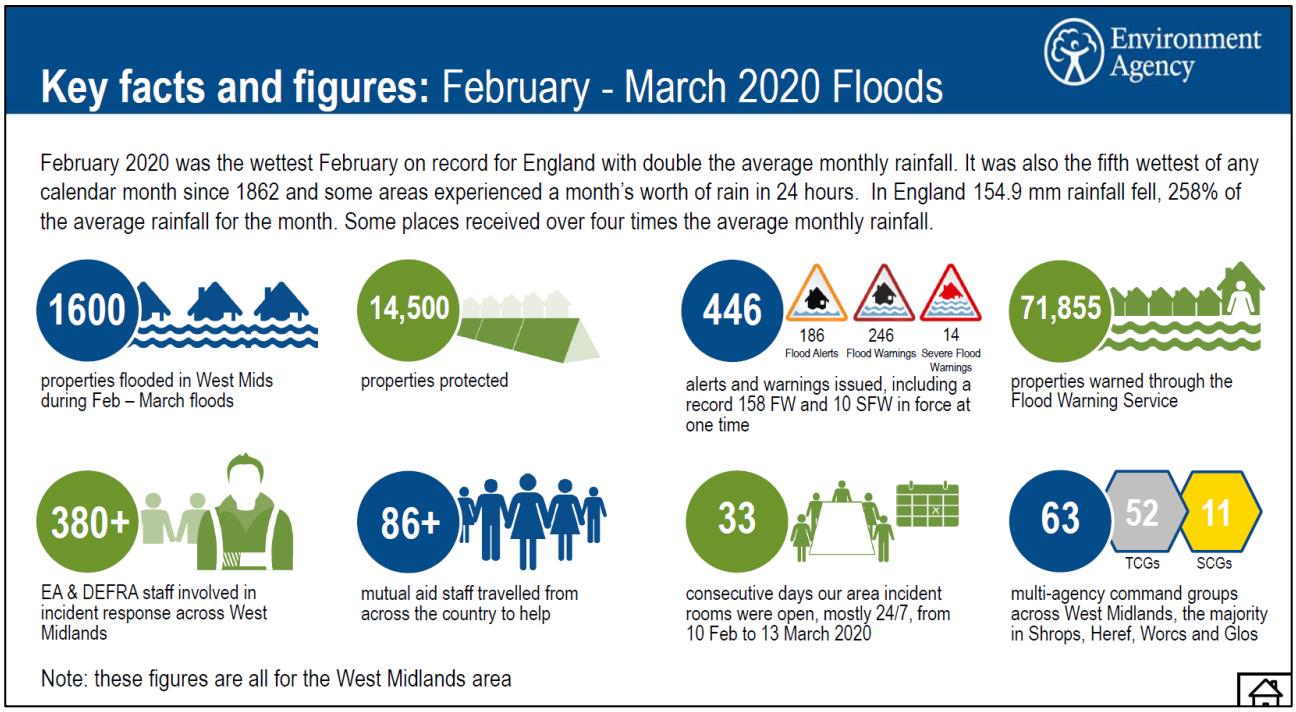
Contents

1. Introduction

Over the winter of 2019/20 the River Severn catchment saw some of the highest river levels ever recorded. Significant flood events were experienced October, November, February and March. Major Incidents were called in Shropshire, Worcestershire and Herefordshire, with the Local Resilience Forums (LRFs) responding to widespread issues.

Over 70,000 properties across the West Midlands were warned of potential flooding allowing residents to take action. Unfortunately, initial indications are that approximately 1,600 properties were flooded. However Environment Agency flood risk management assets prevented over 14,500 properties from flooding across the West Midlands.

It is expected that climate change will have a significant effect on the River Severn. Over the next 30 years it is predicted that flood peaks upstream of Worcester will be 0.6-0.8m higher than those experienced today. Such changes would result in normal winter flooding levels currently experienced in most years being close to those seen in February. More extreme events (like February) would exceed highest recorded levels.



Statistics from the February and March 2020 floods for the West Midlands

This report has been produced in response to the request made in the Flood Briefing Paper (Agenda Item 6) in the Agenda for the Wyre Forest District Council Overview & Scrutiny Committee meeting held on 11th June 2020. This set out the following issues to be explored with the Environment Agency:

- Arrangements for predicting river levels;

- Why the barriers were not deployed along the whole length of Severnside on 12 February;

- The number of properties that had property level protection installed at Beales Corner and why it did not operate successfully;

- What Government or Environment Agency funding is available to provide better protection for communities in Wyre Forest in future;

- Whether permanent flood defences at Beales Corner are technically feasible; how much they might cost and how long would they take to construct if Government or Environment Agency funding were to be available; what implications they might have for the listed bridge and movement of traffic when deployed.

Following this introductory chapter, each chapter provides information relating to each of the subject areas.

Roles and responsibilities

The Environment Agency is an executive non-departmental public body, sponsored by, but independent from, the United Kingdom Government's Department for Environment, Food and Rural Affairs ("Defra"). The Environment Agency was established in 1996 to protect and improve the environment. As part of its functions in relation to water, the Environment Agency manages the risk of flooding from rivers designated as "main rivers", reservoirs, estuaries, and the sea, and has a general supervisory role for all types of flooding and coastal erosion. There are a number of designated main rivers in the Wyre Forest District area, including the River Severn and the River Stour.

The Environment Agency has legal powers to undertake certain flood risk management works for the public good, but these are permissive powers rather than statutory duties. Works are carried out across the country, at public expense, to reduce flood risk because of the wider economic and social case for reducing the effects of flooding. There is no general right to be protected from flooding and no right to be protected to any particular standard where risk management action is taken. In common law, the owners of land are responsible for safeguarding their own land and property.

The Environment Agency also has a role in responding to flood incidents, primarily operating Environment Agency flood risk management assets, the issuing of flood warnings where possible, and supporting LRFs. The free flood warning service issues warnings by text email and phone to the public and professional partners across England to warn of flooding from river and the sea. There is no legal right to be warned about floods. Flood warning is a flood risk management tool which enables those acting upon the warning to reduce the potential impact of flooding, including any potential damage.

Flood risk information, including action that home owners can take along with the latest flood warning information and Environment Agency river level data, can all be freely viewed on the .GOV website:

Flood risk data:

https://www.gov.uk/check-flood-risk

Flood Warnings:

https://flood-warning-information.service.gov.uk/warnings

River level data:

https://flood-warning-information.service.gov.uk/river-and-sea-levels

Flood risk management in the Wyre Forest District

The main risk to properties from fluvial flooding in the Wyre Forest District is from the River Severn and the River Stour. Areas which are affected include the towns of Bewdley, Stourport and Kidderminster. Properties and roads can also be affected by flooding from the Blakedown and Hoo Brooks.

To reduce the risk of flooding to properties in Kidderminster, the Environment Agency constructed a flood alleviation scheme just upstream of the town centre in 2004, with a significant developer contribution. This storage area is a large raised reservoir, as defined by the Reservoirs Act 1975, and consists of several embankments, a control structure, a trash screen and multiple outfalls. The storage area operates to attenuate flood flows from the River Stour which would otherwise pass through the town. This scheme also offers a reduced benefit to properties in Stourport.

Kidderminster Flood Alleviation Scheme storing water - winter 2019/20

At Bewdley, a combination of demountable barriers and temporary barriers are used to reduce flood risk from the River Severn. There is also a storage area on the Riddings Brook (Wribbenhall), further reducing flood risk within the town.

The Environment Agency routinely inspects the River Stour and the brook channels, and removes debris and obstructions where they are considered to present a flood risk. We manage vegetation on Riddings Brook and also sensitively clear vegetation on the Blakedown and Hoo brooks. The amount of maintenance work the Environment Agency is able to carry out depends on the amount of public funding allocated to the Environment Agency. Maintenance is prioritised based on the benefit-to-cost ratio of the works, the urgency of works and the Environment Agency's legal liabilities.

The Wyre Forest District is covered by 4 Flood Alerts and 13 Flood Warnings.

Clearance works on the River Stour at Stourport

River Stour debris and rubbish clearance working with Canal and Rivers Trust

River Stour debris and rubbish clearance working with Canal and Rivers Trust

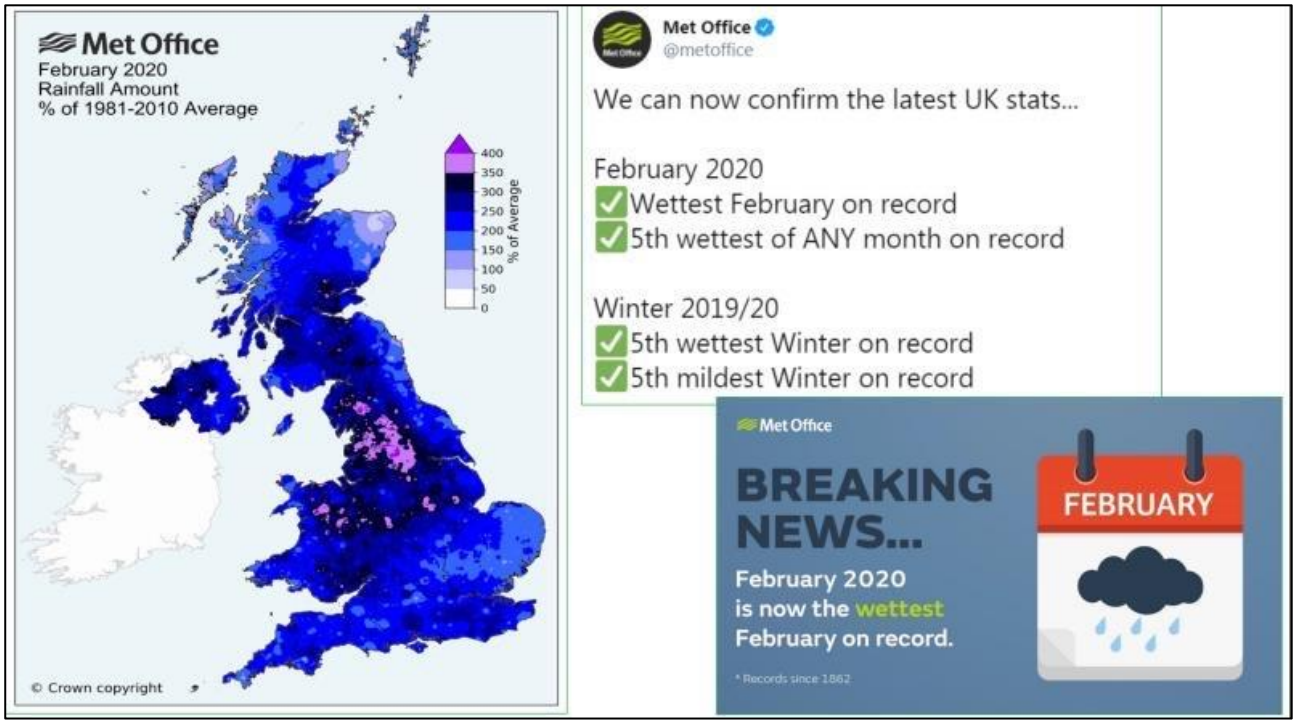
The flood story of February 2020

February 2020 was the wettest February on record for England with double the average monthly rainfall. Storms Ciara (8th-9th February), Dennis (15th-16th February), 'no name' (22nd-23rd Feb) and Jorge (28th Feb – 1st March) crossed the country in quick succession. It was also the fifth wettest of any calendar month since 1862 and some areas experienced a month's worth of rain in 24 hours. In England 154.9 mm rainfall fell, 258% of the average rainfall for the month.

In just a 9 day period between 8th-16th February, 150% of the monthly average rainfall fell across the West Midlands; over 200% of the monthly average rainfall fell in parts of Herefordshire and Worcestershire. With ground already sodden from last autumn's heavy rains and floods, the West Midlands quickly became flooded. The main rivers Severn, Wye and Trent, along with others including the Teme and Lugg, reached some of the highest levels ever seen or reached levels not seen since 2000 and 2014. Around 20% of the river gauges in the Environment Agency West Midlands Area recorded their highest ever levels. In many places river levels remained high and for a prolonged period.

Our incident response in the Wyre Forest District included:

- Deployment of Severn Side demountable barrier and Beales Corner temporary barrier, including logistics, maintenance and security;
- Inspection, monitoring and clearing of obstructions from control structure and screens prior to and during operation of Kidderminster and Wribbenhall flood storage areas, as well as reactive removal of debris and obstruction from structures and trash screens and Riddings Brook channel.



Our Community Information Officers (CIOs) visited Bewdley on a number of occasions during the flooding on 16th February, 19th February, 25th February, 26th February, 28th February, 3rd March and 9th March. The CIOs aim to provide support to communities during incidents and gather information to improve situational awareness for us and our partners.

Storm Ciara – 8th-9th February 2020

Storm Ciara on February 8th and 9th brought very strong winds across the West Midlands. Persistent heavy rain fell over areas of the Environment Agency West Midlands Area, including over the higher ground in Wales which led to high levels down the River Severn. We issued widespread flood alerts, as well as flood warnings in some areas.

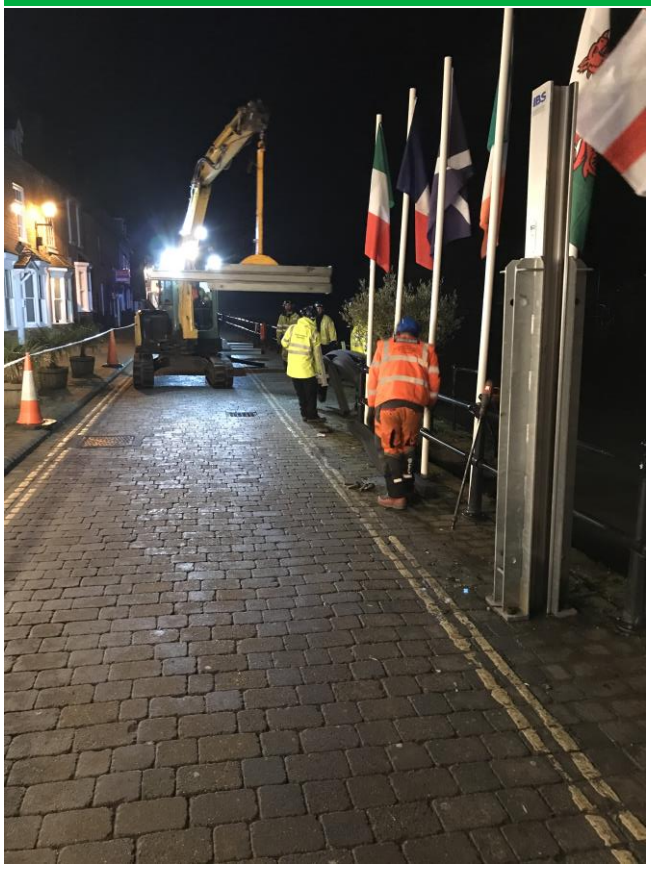
Storm Dennis – 15th-16th February 2020

Rivers did not have time to recover from Storm Ciara before Storm Dennis arrived on the 15th and 16th of February. Storm Dennis brought very heavy rainfall across the West Midlands, including in the lower ground, leading to very high levels in the Rivers Severn and Wye as well as in the tributaries. The river level at the Puxton gauge on the River Stour was the second highest in the gauge record (since 2004).

Between 5pm on 15th February and 9pm on 16th February we issued 144 flood warnings across the Environment Agency West Midlands Area, including 4 severe flood warnings; 76 of these were between 5pm on 15th February and 7.30am on 16th February. These 144 flood warnings covered 48 different rivers and brooks in the Environment Agency West Midlands Area, including the River Severn and River Stour in the Wyre Forest District. We issued a further 17 flood warnings and 8 severe flood warnings across the Environment Agency West Midlands Area between 17th February and 18th February.

In Bewdley:

- Phase 1 of the Severn Side defences was deployed late night on the 12th February through into the 13th February, as the river level forecast indicated barriers would be required early hours on 13th February.
- Phase 2 of the Severn Side defences was deployed and in place at 10.20 am on 16th February.
- We then, on 16th February, placed barrier around property on Beales Corner and Mill Side Court. We were unable to erect the full length of the temporary barriers at Beales Corner at this time due to water levels and poor light on Stourport Road, obstructing any underwater hazards.
- We also deployed Phase 3 of the Severn Side barriers on 16th February, finishing the deployment, by adding the last slats along Severn Side North, on the night of the 17th.
- Water levels receded overnight on the 16th February. As it was then safer to do so, we deployed the temporary barriers at Beales Corner in its standard deployment (i.e. along the length of Stourport Road).
- We placed a sandbag wall as a best endeavours effort at the top of Pewterers Alley to push the level of protection above that which the temporary barriers would otherwise have provided. The river level peaked at 5.24m ASD on 19th February.
- The barriers along Severn Side and Beales Corner remained in place for the successive river level peaks that followed. Between peaks, we removed the short section of temporary barrier that runs alongside Kidderminster Road to allow for Bewdley Bridge to be reopened. These short sections of temporary barrier were replaced in time for each peak thereafter.



Environment Agency staff supported by Jackson Civil Engineering deployed the Severn Side demountable barrier

Rainfall - 22nd February - 24th February 2020

Rainfall over 3 consecutive days 22nd - 24th February caused rivers and brooks to respond across the Environment Agency West Midlands Area. This included the River Severn, following rainfall in the Severn Uplands and Welsh mountains. In the upper reaches of the River Severn an additional 100mm of rainfall fell on top of the roughly 100mm which had fallen there in Storm Dennis. This additional rainfall led to a further river level rise on the River Severn leading to the highest levels since 2000.

Between 22nd February and 26th February we issued a further 21 flood alerts, 40 flood warnings and 2 severe flood warnings covering 28 different rivers and brooks in the Environment Agency West Midlands Area. The flood warnings included the River Severn in the Wyre Forest District.

The Severn Side demountable barriers and the temporary barriers at Beales Corner were still in place following the earlier period of flooding. As we did for the flood which peaked on 18th February, we placed a sandbag wall at the top of Pewterers Alley to push the level of protection above that which the temporary barriers would otherwise have provided. Floodwater overtopped the Beales Corner barrier and sandbag wall on 25th February. In preparation for overtopping, we placed a number of mobile pumps behind the temporary barrier, to help with giving as much time as we possibly could for residents to move possessions upstairs and evacuate. These were rendered useless after the water reached a certain point, as the equilibrium of water pressure behind and in front of the barrier caused the membrane to lift, further adding to the overtopping.

- The river peaked at 5.48m ASD at the Bewdley gauge on 26th February and levels started to drop on the 27th February. This was the highest river level since the temporary barrier trial was put in place, though was below the highest recorded in 1947.
- Approximately 40 properties flooded, but we managed to prevent flooding to 28 properties by holding back the flood water for longer.
- We inspected the barriers and carried out minor repairs on 28th February in time for Storm Jorge. As soon as it was safe to do so after the barriers overtopped, we entered the flooded area, and reconstructed the temporary barrier on Beales Corner, then pumped out the water from behind the barrier. This gave residents the ability to enter their property 24-48 hours earlier than if we had waited for water levels to recede. The barrier stayed mostly intact during the exceedance, but there were a few elements which had lifted due to water being both side of the barrier and a couple of clips that had failed. The membrane that covers the barrier was torn in places, and we made good by folding it over and weighing it down.

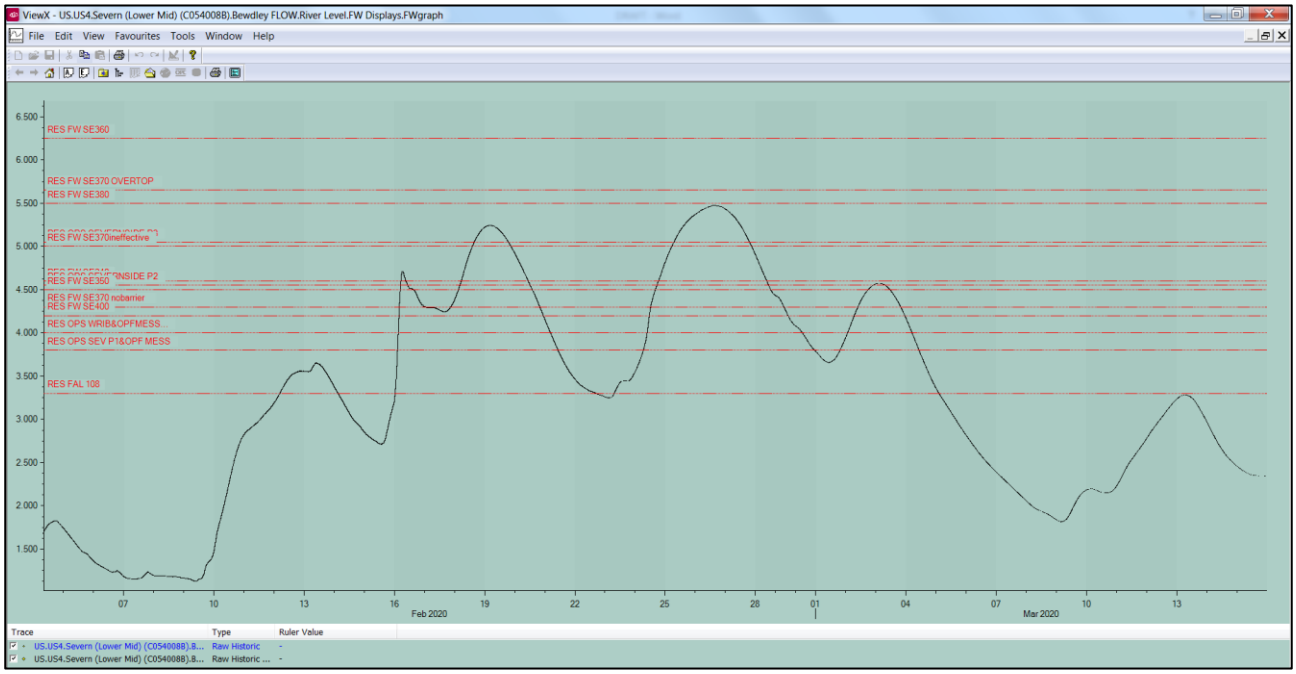
Barrier deployment at Beales Corner, Bewdley

Storm Jorge (28th February - 1st March)

Rain falling in Storm Jorge kept river levels high and elevated for a prolonged period along the River Severn. We issued flood alerts and flood warnings in areas across the Environment Agency West Midlands Area, including two flood warnings in the Wyre Forest District area on 1st and 2nd March. The River Severn level peaked at 4.57m ASD at the Bewdley gauge on 3rd March 2020.

The temporary barrier at Beales Corner had slid in a few locations in the recent flooding. This is normal, as the barrier will “lock” against itself and provide it with additional support. On Sunday 1st March, in-between peaks and following the exceedance of the barrier, we completely deconstructed the barrier and moved it so it was no longer on top of the damaged road surface. This gave assurance over the barriers' stability ready for the next flood event - Storm Jorge, on the 2nd and 3rd March.

Following the successive flood events, the Beales Corner temporary defences were taken down on 13th March and the Severn Side demountable barriers were all removed by the 15th March.



River Severn levels at Bewdley February and March 2020

2. Flood forecasting

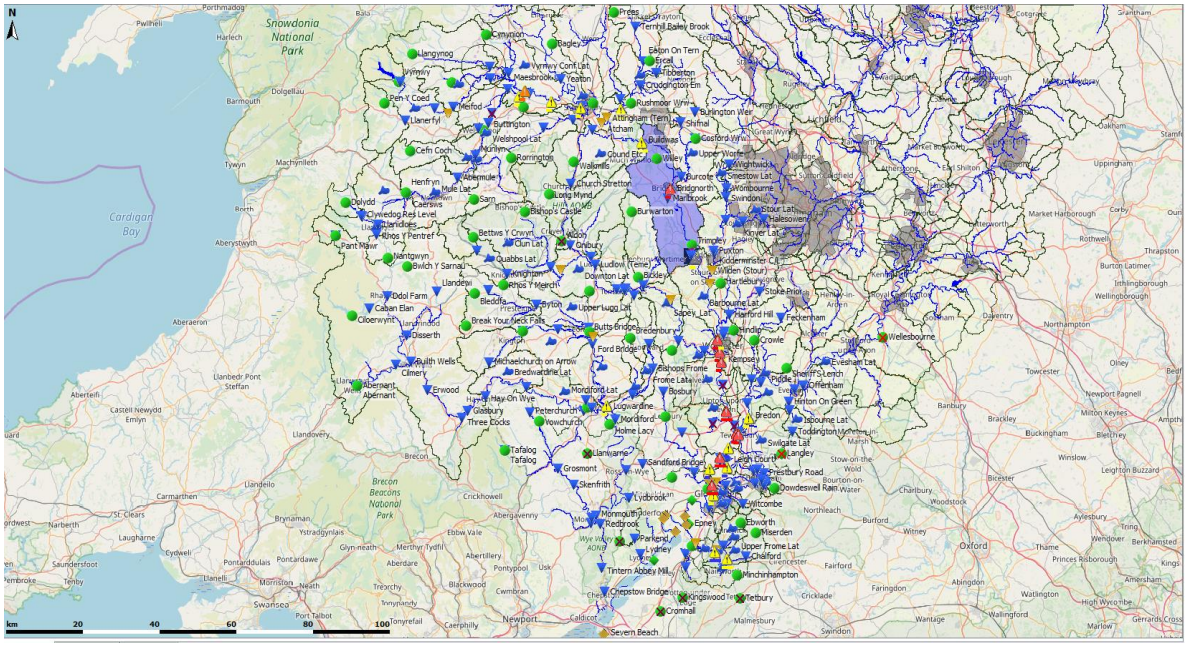
The Met Office and the Environment Agency

The Environment Agency works closely with the Flood Forecasting Centre (FFC) at the Met Office, whereby we receive regular updates or products in emails from them twice a day, and which can be increased depending on the confidence of the forecast. We hold a joint telephone conference with the FFC every morning to discuss the weather conditions, and we have access to radar data so we can visualise the forecast rainfall. We can also call them to check if we have any questions on the weather conditions.

Environment Agency Monitoring and Forecasting Duty Officers

There is a designated duty officer on duty per Environment Agency Area; this duty officer is called a Monitoring and Forecasting Duty Officer (MFDO). The MFDO monitors weather conditions and local flood forecast models, and alerts the local area Flood Warning Duty Officers if there are any concerns or forecast impacts. There is also a 'Lead MFDO' for each region of the Environment Agency. Their role is to have regional oversight, liaise with national teams, and co-ordinate the activities of the Area MFDOs.

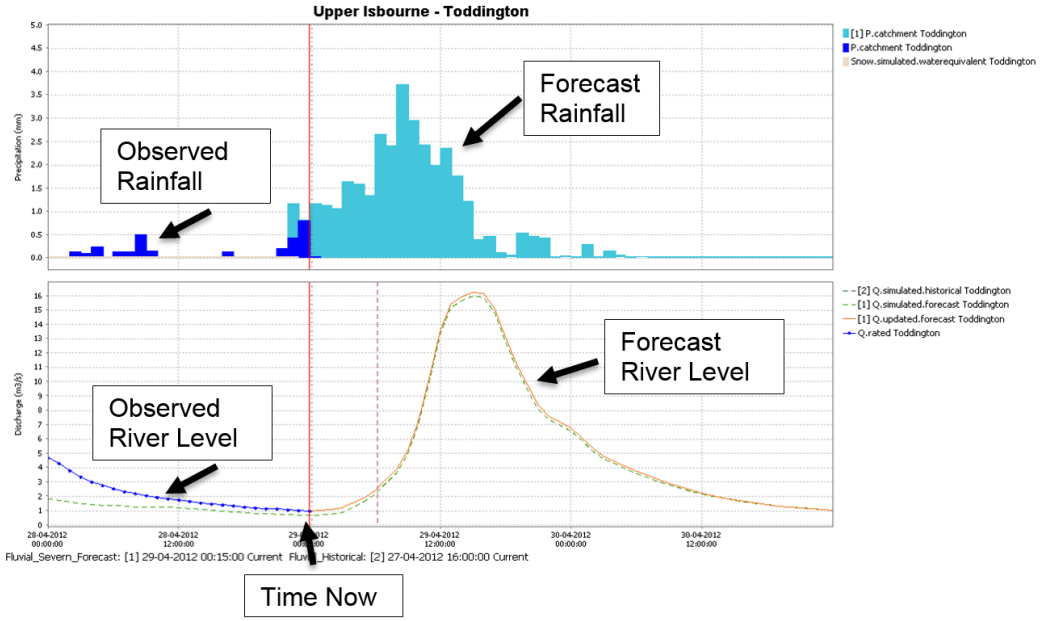
The Bewdley area is monitored by the SHWG (Shropshire, Herefordshire, Worcestershire and Gloucestershire) Area MFDO. They are also monitoring ~150 sites throughout these 4 counties. In addition this MFDO needs to maintain an awareness of activity in Powys Natural Resources Wales (NRW) areas, as the rainfall and water in these areas flows into Midlands England areas.



Shropshire, Herefordshire, Worcestershire, Gloucestershire MFDO Monitoring Sites

The Local Flood Forecasting Models

There are hundreds of local flood forecasting models in each Environment Agency region. The MFDOs monitor these by using alarms and active monitoring of computer systems during flood events. In Midlands we use a mixture of catchment models and reach models.



Example of a catchment flood forecasting model

Bewdley Models

At Bewdley we use reach models, with catchment models feeding in at the sides. All our reach models link together so all the rain that falls at the top of the river flows down. Catchment models collect the rainfall, and work out how much water to feed into the sides of the rivers. The reach models predict how much water there will be in the river at any one point, by adding up all water upstream and all the water going in the sides from the catchments.

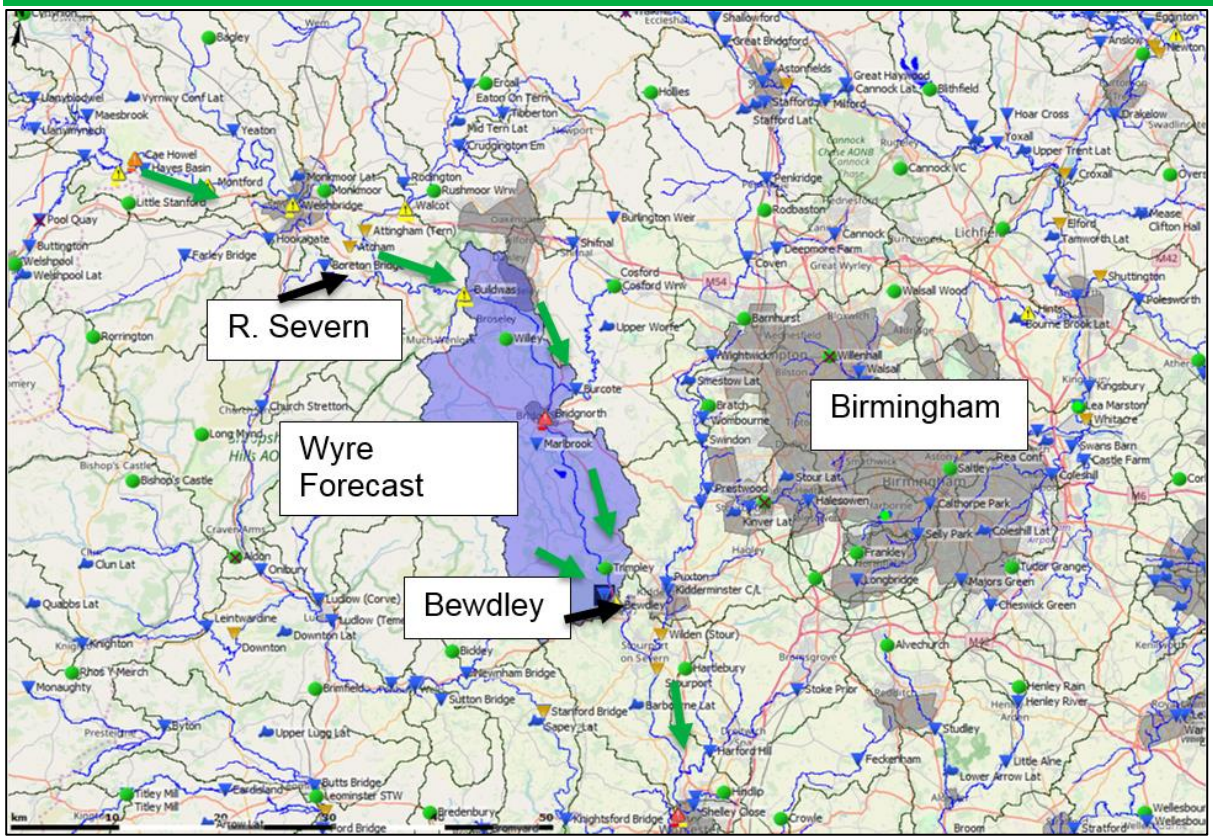
At Bewdley river levels are susceptible to runoff from the Wyre Forest catchment at the side. This catchment is very large (352 Km2), stretching all the way from Ironbridge down to Bewdley.

There is a separate catchment model to estimate rainfall and runoff from Wyre Forest catchment into Bewdley. Without the influence of significant rainfall in side catchments, the Bewdley reach model is normally very reliable.

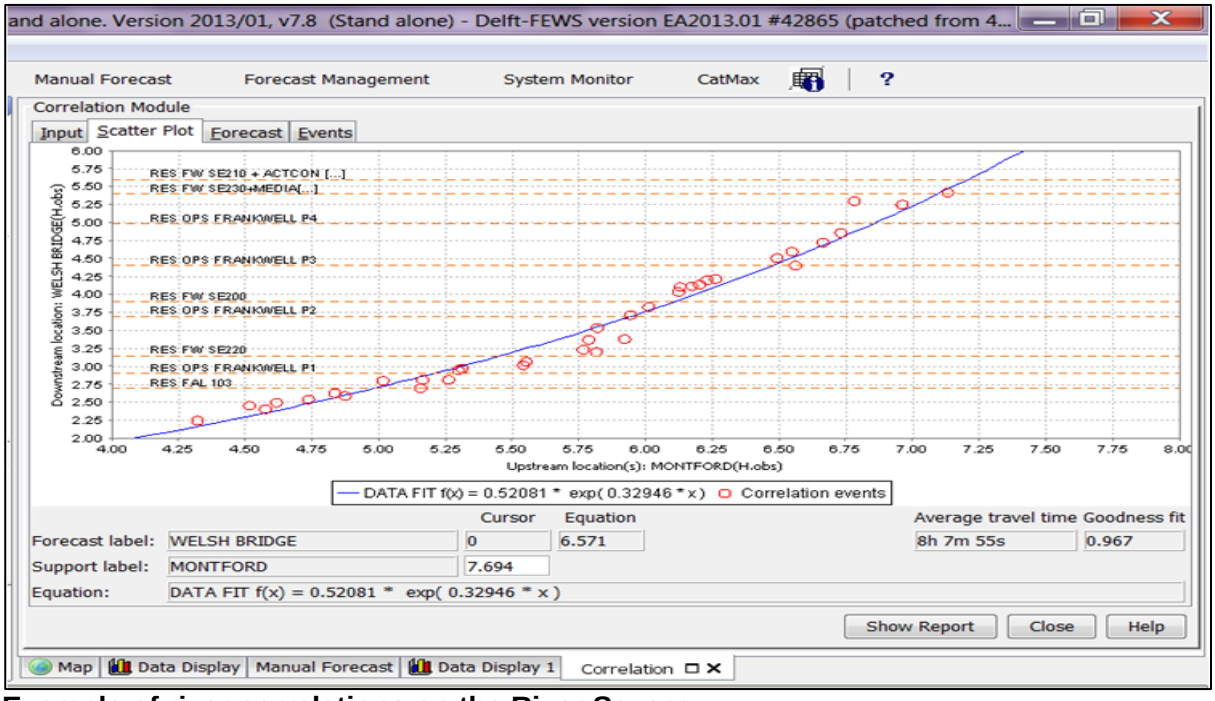
Environment Agency duty officers are taught not to just rely on the computer models, as sometimes they can be unreliable. Duty officers will also use correlations to check models are correct and local catchment information files to give them more information about sites and local geography. They take account of local catchment conditions during their activities.

Correlations on the River Severn are very good, and there was no known problems with the Bewdley reach model on the day of 15th/16th February 2020.

Reasonable worst case scenarios are carried out before rainfall events occur. During an event our MFDOs routinely give a 'range' of forecast water levels for barrier sites, this will cover a range of forecast impacts.



Location of Bewdley and nearby catchments



Example of river correlations on the River Severn

3. Bewdley Severn Side barrier deployment February 2020

Background to flood risk management in Bewdley

Bewdley has a long history of flooding including in 1947, 1965, 1998, 2000, 2002, 2004, 2008, 2014 and more recently in 2019 and 2020. The highest known river level of 5.82m ASD was recorded at the Bewdley gauge in 1947.

Flooding to property can occur directly and indirectly from the River Severn. Indirect flooding can occur due to rising groundwater with cellars filling with water, and from surface water and sewers when the rise in river level means the sewers cannot discharge to the River Severn. High river levels also lead to the flooding of Kidderminster Road, being the main through road, and Stourport Road at Beales Corner. These roads become impassable and cut off one side of the river from the other. Bewdley is also affected by flooding from the Riddings Brook.

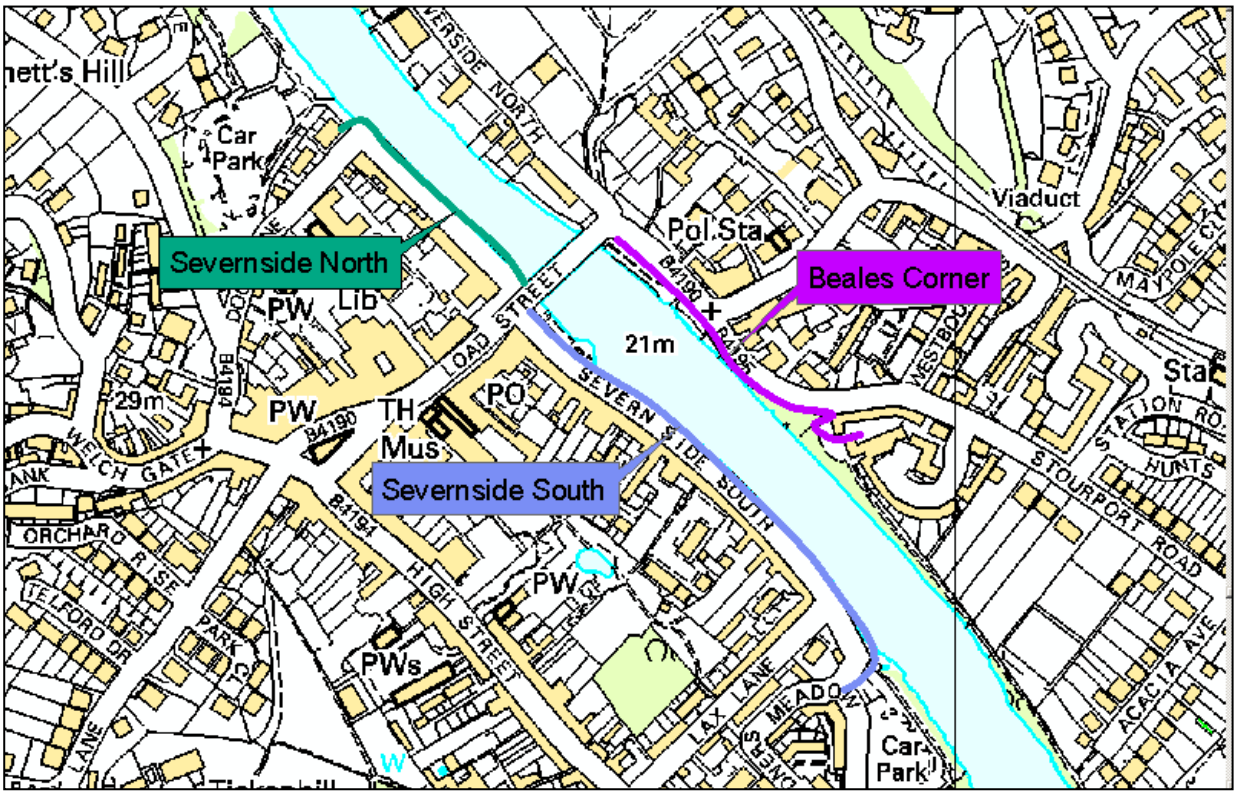
In spring 2003, the Environment Agency was allocated funding from Defra to purchase plant and equipment that would facilitate the trials of temporary flood defences. Several types of temporary flood defence barriers were purchased and joint action plans were established with local authorities and other professional partners such as Severn Trent Water. Three locations along the River Severn were initially identified as suitable for the trials including Beales corner in Bewdley.

The trial at Beales Corner consists of temporary pallet barriers which are 1.2m high. This provides a level of protection up to 5m ASD at the Bewdley gauge for approximately 20 properties. Above the 5m ASD level water flows over Pewterers Alley and down Kidderminster Road, and water makes its way through the ground under Pewterers Alley and through Courtyards on this side of the river. Properties are thus at risk of flooding before the barriers are overtopped. We have engaged in the past with Bewdley Town Council to make them aware of these issues.

Elsewhere in the town, the Environment Agency constructed a scheme to reduce the risk of River Severn flooding along the right bank of the river (along Severn Side North in 2004 and along Severn Side South in 2006). This scheme provides a greater than 1 in 100 year standard of protection (1% annual probability) and consists of 200m of brick wall, around 600m of demountable barriers, and two pumping stations to facilitate seepage and surface water backing up when it cannot freely outfall into the River Severn. The demountable defences are erected in the event of a flood. During the rest of the year when the river is not a threat, there is an uninterrupted view of the river. The Severn Side scheme protects approximately 270 properties to a level of 6.25m ASD at the Bewdley gauge. It had a capital cost £11m, which included a contribution of £0.5m from Advantage West Midlands.

The Severn Side demountable barriers have been deployed 23 times since 2004, and the Beales Corner temporary barriers have been deployed 15 times since 2007. There has been water against the barriers on 12 of the 14 times they have been erected since 2012.

When not in use, the Severn Side and temporary barriers are stored at an Environment Agency depot near Kidderminster. When required, our emergency workforce will bring them out of storage, transport them to site and erect them. The Severn Side and Beales Corner defences are not dependent upon each other.



Location of Bewdley demountable and temporary defences

In 2011, the Environment Agency constructed a flood storage area at Wribbenhall which temporarily retains water in the field above the culvert (underground pipe) running beneath the Queensway Estate. This reduces the flood flows passing down the Riddings Brook. The construction of two debris screens reduces the risk of blockages occurring which would contribute to flooding. The scheme provides a level of protection to approximately 60 properties.

Incident planning approach

The Environment Agency's incident response includes deployment and operation of flood risk management assets across the Environment Agency West Midlands Area. This is planned so that these activities are carried out in a sequence, depending on available resources and when the forecast of river levels indicates they will be needed.

The Environment Agency acts on the most likely forecast river levels for the deployment of assets and the issuing of flood warnings, however at the same time prepares to respond to the reasonable worst case forecast. This allows the response to be proportionate while also being prepared if the reasonable worst case materialises.

Thresholds for barrier deployment have been optimised to ensure that disruption is kept to a minimum, and that the Environment Agency provides a measured response to predicted flood peaks. As it is elsewhere, it is standard practice to phase the deployment of the Bewdley flood barriers. It is common that only the earlier barrier phases are required to manage the impacts of most floods and the normal rate of rise is slow enough to allow later phases to be added as the forecast suggests necessary. This phased approach minimises the disruption to the town and also minimises the cost to the public purse. Minimising the amount of barrier deployed also minimises the risk of vandalism and theft of the barrier sections - currently the Environment Agency has to provide 24/7 security to safeguard the barriers.

Demountable barriers at Severn Side showing some of the disturbance to the local community

Deployment phases of the Severn Side flood barriers

In our planning approach, there are three phases of deployment of the Severn Side demountable barrier in Bewdley. These phases are:

- Phase 1 is deployed at a forecast of 3.85mASD and rising at the Bewdley gauge - involves deployment of flood barrier along the full length of Severn Side North, as well as some flood barrier to the south of the bridge, between the bridge and the band stand. The barriers are made up of 2.8m high columns, which we then put a slat in-between. The area between columns is named a bay. We will fill each bay with six slats, giving this side of the river a 4.55mASD level of protection (at the Bewdley gauge). Phase 1 takes approximately 8 hours to deploy.
- Phase 2 is deployed at a forecast of 4.55mASD and rising at the Bewdley gauge - involves the deployment of 1.8m high columns along the length of Severn Side South. We fill each bay with three slats, but then also add an additional two slats along the full length of barrier deployed in Phase 1. We will also deploy the columns only on Lax Lane flood wall. This gives a 5.0mASD level of protection (at the Bewdley gauge). Phase 2 takes approximately 6 hours to deploy.
- Phase 3 is deployed at a forecast of 5.00mASD and rising at the Bewdley gauge - involves a full height deployment, adding an additional nine slats along the full length of the barrier and bringing the standard of protection to 6.25mASD (at the Bewdley gauge). Backing braces will be installed on the 2.8m high columns to counteract the

high hydraulic forces exerted on the barrier. Phase 3 takes approximately 12 hours to deploy.

In between Phase 1 and Phase 2 deployments of the Severn Side flood barriers, the Beales Corner temporary barriers are deployed by 4.0mASD (at the Bewdley gauge); the barriers though do not get wet until 4.3mASD. The reason for the lower threshold is that flooding occurs on the Stourport road at 4.0mASD, resulting in us otherwise deploying flood barriers in the wet. As mentioned above, these barriers provide a standard of protection of 5.0mASD (at the Bewdley gauge) before the local topography and geology render them ineffective. Beales Corner takes approximately 4 to 6 hours to deploy.

Demountable barriers at Severn Side

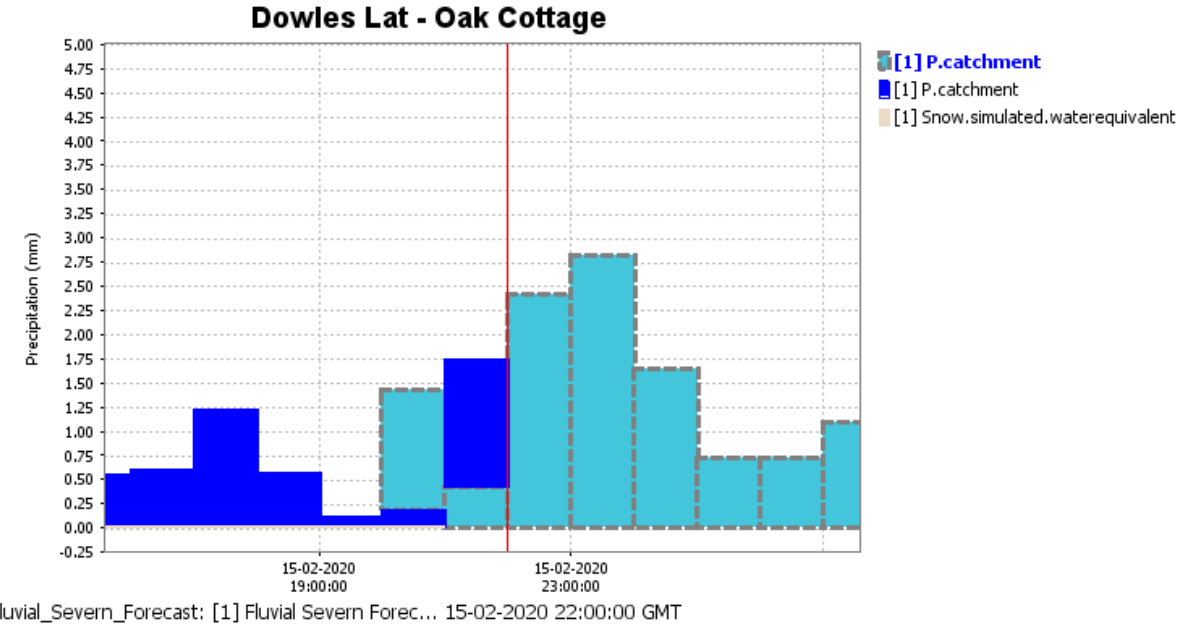
Barrier deployment 12th February 2020

On Saturday 15th February, demountable barriers had been deployed at Shrewsbury (Frankwell Phase 1) and Severn Side, Bewdley (Phase 1 - deployed late on 12th February through to 13th February), in addition to other flood risk management assets being deployed or operated at Hereford, Kempsey and Upton upon Severn. In consideration of when the river level peak was forecast to occur at locations down the River Severn, further deployment of barriers was planned for Sunday morning 16th February at Shrewsbury (Frankwell Phase 2 and Coleham Head) and for Monday 17th February at Shrewsbury (Frankwell Phase 3), Ironbridge and Beales Corner, Bewdley. The deployment of Phase 2 of the Severn Side barriers was to follow on from the Beales Corner deployment later on the Monday/Tuesday. At this planning stage the forecast river level peak for Bewdley was between 4.1-4.6mASD on Tuesday night 18th February at the earliest.

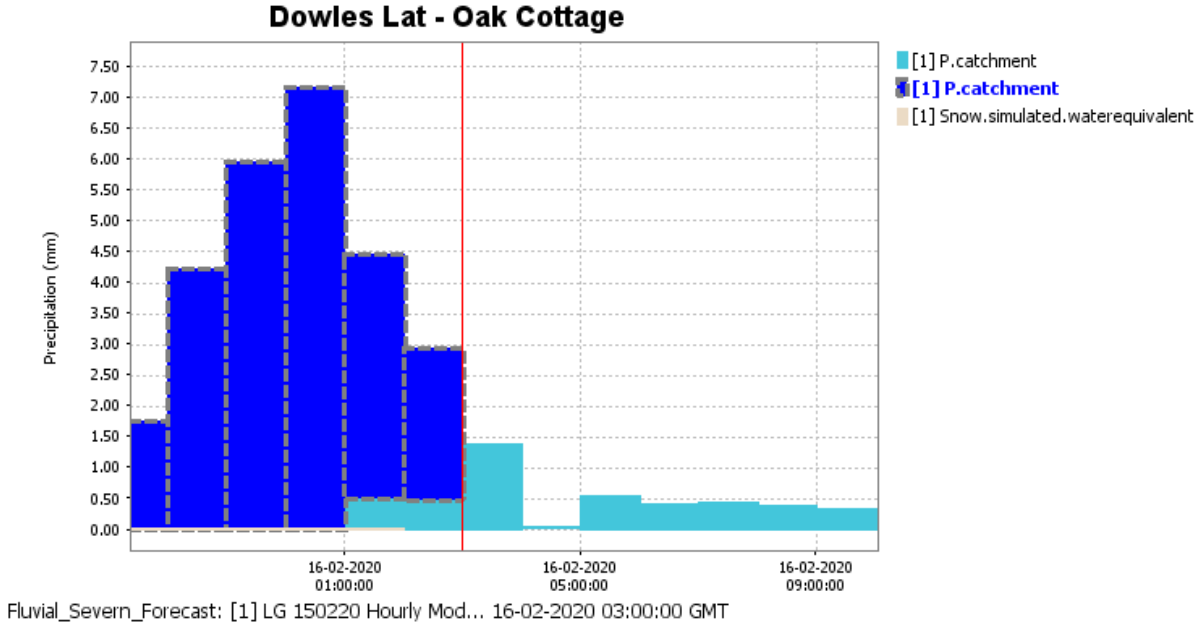
The peak was still forecast to be within this range at 9.43pm on Saturday 15th February. This was based on the reasonable worst case scenario of 11mm of local rainfall across the Wyre Forest Catchment over the Saturday night into Sunday morning.

The heaviest of the forecast rain was forecast at this point to fall further west and north. However it actually fell further south and east of the line convection during the storm, with the result that at 3.00am on Sunday 16th February, rainfall totals of 27mm had been recorded over the Wyre Forest Catchment. The Wyre Forest Catchment is a tributary of the River Severn and runs into the river at Bewdley. The sudden increase in run off from this catchment into an already saturated area and with already high levels in the River Severn caused abnormally fast rises on the main River Severn at Bewdley on the night of 15th/16th February. This resulted in two peaks in the River Severn level at Bewdley, rather than the one from water coming down the river which was expected at the earliest on the night of Tuesday 18th February; the first peak occurring at 6.30am on the 16th February (4.71mASD at the Bewdley gauge) as a result of this localised rainfall from the Wyre Forest Catchment. This effect was above and beyond that expected in any of the reasonable worst-case scenarios forecasted. (The second and expected peak on the River Severn occurred on Wednesday 19th February at 5.24mASD at the Bewdley gauge).

This heavy rainfall occurred between 1.00am and 3.00am on 16th February and was not visible in the forecasting system until the 3.00am model run on 16th February, by which time it was too late to put up all the barriers.



Wyre Forest catchment – 10 pm forecast - 11mm event totals forecast



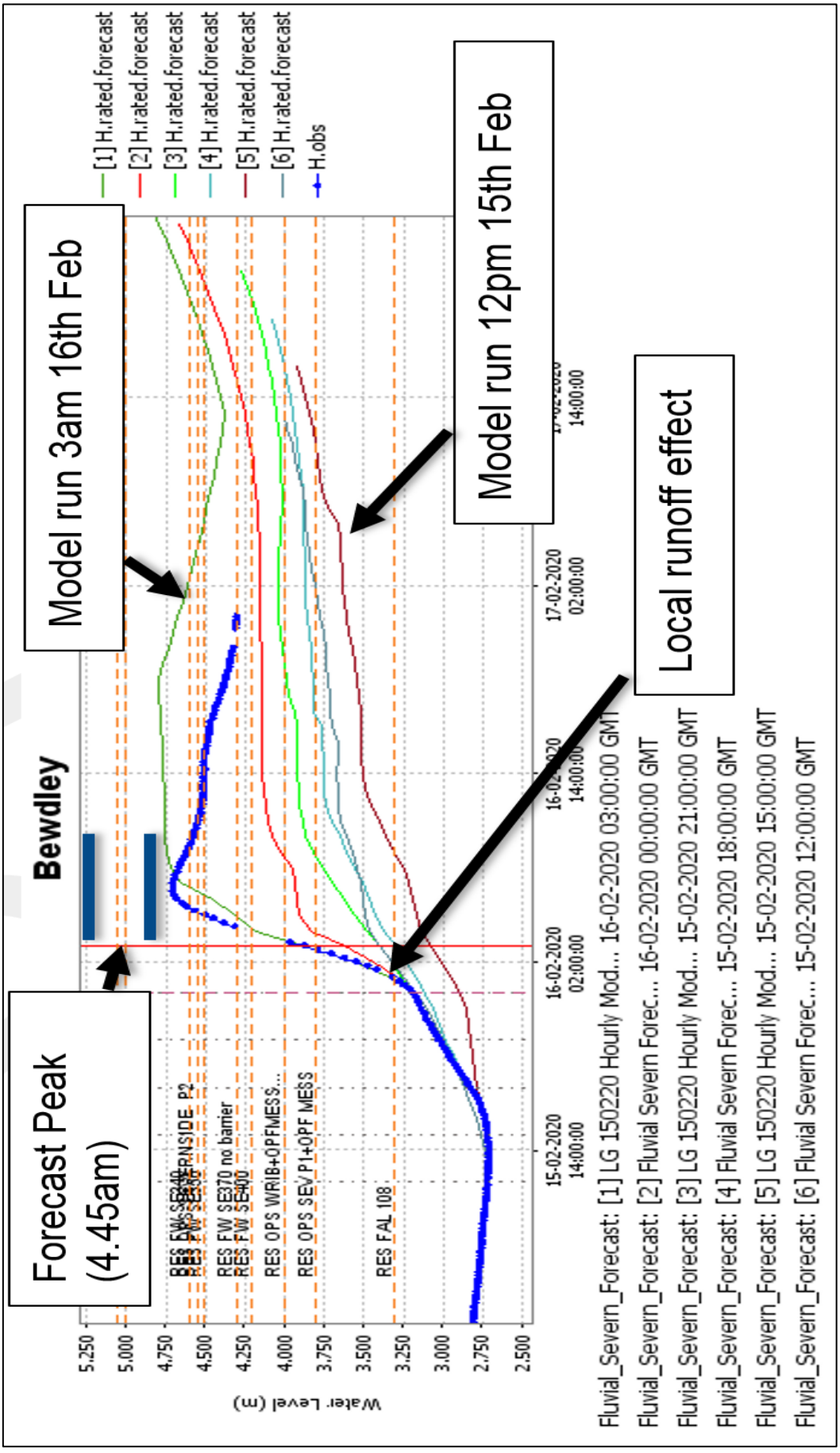
Wyre Forest catchment – 3.00 am (after event) forecast - 27mm catchment totals fell

These model outputs illustrate how in the hours running up to the event there was no significant rainfall totals forecast over the Wyre Forest catchments (please note that these are at different scales). It was not until the 3.00am run that large rainfall totals appeared to have fallen in the Wyre Forest catchments.

The graph below shows several forecasts for the Bewdley gauge on top of each other, from midday Saturday15th February until 3am Sunday 16th February. This shows how the forecast increased significantly in the period midnight Saturday to 3am Sunday. The 4.55m ASD level by which we aim to have erected Phase 2 of the Severn Side barrier was not forecast to be exceeded any earlier than the evening of Monday 17th February until the 3am model run.

Our Field Operations Teams were mobilised at 3.20am and started to arrive on site from 3.40am. Temporary barriers for Beales Corner had already been loaded in the Environment Agency's depot in Kidderminster in preparation for their being transported to site to be deployed on Monday 17th February. They arrived on site at 4.15am, with a team of 10 operatives ready to deploy. By this point the conditions were no longer safe to deploy these barriers, due to both the depth and velocity of the water.

The barriers for Phase 2 had not yet been loaded. In following our planned approach, we had intended to do this in time to be able to deploy on Monday 17th February, the river level not having been forecast to come anywhere near the deployment threshold for at least another 48-72 hours. Nevertheless we were able to get the barriers loaded onto third party transport and mobilised to site in less than 4 hours. The barriers arrived on site at approximately 7.15am, 30 minutes after water had started to over top the promenade that runs along Severn Side South. After conducting a through risk assessment, barrier deployment started as soon as they arrived on site, with the barriers in place by 10.20am. Pumps were placed behind the barriers, with water removed from households by 10.50am.



Forecast river levels at Bewdley on the 15th and 16th February 2020

Community Support

During the February 2020 flooding, our field operatives provided the community with additional support, over and above the operation of flood barriers. While not the role or responsibility of the Environment Agency, and not possible in most situations, once we had evacuated water from properties on Severn Side South we hired skips, dehumidifiers and wet/dry vac cleaners to help residents clean their houses as quickly as possible. We supported them by moving furniture and cleaning floors. We also supported with the deployment of property flood resilience measures, and where residents reported pumps had failed, we sourced and installed mobile pumps for them. We also sourced sandbags for residents, and helped with deploying them against their property.

4. Property flood resilience measures at Beales Corner

Property Flood Resilience measures

Property level protection is commonly referred to now as Property Flood Resilience (PFR).

PFR are measures installed or incorporated into a property to reduce the impact of flooding. PFR measures are not designed to stop all water from entering the property but are designed to minimise the entry of water, offer residents additional time to move furniture and other valuables and to minimise the impacts when water does enter the property, for example by minimising sewage and silt entering the property.

PFR measures can be broad ranging, but often include products such as flood doors, non-return valves, small pumps and flood resilient wall and floor surfaces. To achieve the maximum benefits from any PFR products it is important that the property owner maintains the products and installs the product in accordance with the manufacturer's recommendations.

Due to the structural limitations of a normal residential property, PFR products can only offer a maximum level of risk reduction of up to 600mm above the properties threshold level. It is common for water to be able to seep in through the floor even where PLR products have been installed; this can only be prevented by fully sealing the floor cavity which is not normally practical.

The Beales Corner PFR Project

The Beales Corner PFR project has offered PLR measures to 45 properties at Beales Corner and the surrounding area. One property opted out of the scheme and one we haven’t been able to access yet, therefore 43 of these properties have PFR (Property Flood Resilience) measures installed. The Environment Agency has covered the up-front installation costs of the PFR measures, with residents responsible for the future upkeep and maintenance of the products.

Each property has had property specific products selected by a specialist company to help minimise flood risk. Due to the differing property thresholds, each property therefore has a different level of flood risk.

All of these properties are identified in the Multi Agency Response Plan under West Mercia LRF Beales Corner MA Operational Response Arrangements, Appendix B.

By the February 2020 floods most of the key elements had been installed. However some products were still to be installed and the final quality assurance checks were still to be completed.

Timeline of PFR Works

November 2015	Property Flood Resilience (PFR) Surgeries. The surgeries provided the opportunity for residents to talk in more detail about the plans for PFR measures proposed for their properties

November and early December 2015	Individual property survey reports sent to residents highlighting indicative PFR measures suitable for their properties
December 2015 to March 2016	Completion of detailed surveys and designs of specific PFR measures
January 2016 to January 2018	Installation of PFR measures to NON-LISTED properties in accordance with detailed professional surveys
October 2018	NON-LISTED properties Receive surveyors' formal approval for completed PFR measures
January 2018 to December 2020	Installation of PFR measures to LISTED properties in accordance with detailed professional surveys
October 2020	Target date for the installation of the final PFR products
January 2021	LISTED properties Receive surveyors' formal approval for completed PFR measures

Delivering PFR to properties in Bewdley has been made more challenging due to the historic nature of the town and buildings being listed. The installation of PFR measures has had to be phased over several years due to the challenges, sometimes with new products having to be developed. Due to the long lead time for listed building compliant flood doors, individual flood barriers have been provided to those properties.

Homeowner Agreements

We have provided clear and regular communications to homeowners and partners since the scheme began in 2015. Whilst our contractor, Watertight, has been leading on direct communications with homeowners, our work with the community has included scheme updates, annual newsletter briefings, resident drop in sessions and numerous meetings with Bewdley Town Council and local flood group.

We set out very early on the benefits but also the limitations of PFR measures. This extract is from the original JBA surveys that went to each homeowner prior to the measures being installed:

'It should be noted that it is not possible to completely prevent flooding. Flood resilience and resistance measures are designed to mitigate flood risk and reduce damage and adverse consequences. They will help you to recover more quickly following a flood event.'

There is an agreement for each property between the Environment Agency and the property owner that sets out that while the Environment Agency will fund the upfront work, the resident is responsible for the operation and future maintenance of the PFR products:

'The products installed are covered by our contractor, Watertight, for a 12 month period (from the date of installation) from all defects in the products arising from faulty product, material or workmanship. After which period Watertight nor the Agency will hold any responsibility for future maintenance, replacement, or repair any damage, wear or tear or defects to the goods and that such responsibility will be the householders.'

PFR performance winter 2019/20

Following the recent flood events, work is underway to investigate the effectiveness of the installed measures and to ensure they performed as they should so that any issues can be resolved within the warranty period. This has been made more challenging by the impacts of Covid-19 however the Environment Agency has been trying to progress works while working to the government and Public Health England guidance.

The feedback received to date on the effectiveness of the PFR measures is mixed and largely dependent on the depth of water against the properties. Due to the scale of the February 2020 flood event, the majority of the measures in the Beales Corner area were overwhelmed as their design level was exceeded.

PFR measures in use at Beales Corner February 2020

5. Flood risk government funding mechanism

Funding of flood risk management activities

The Environment Agency acknowledges the high public expectation of better flood protection. The government aims for the best outcomes for society as a whole and allocates funding to provide the greatest overall benefit to society. Decisions have to be taken on where flood risk management activities can be carried out with public funding, both nationally and locally, balancing the needs of communities, the economy and the environment. A risk-based management approach is taken to prioritise where public funding is spent.

Funding for the Environment Agency and other risk management authorities to manage flood risk is mainly provided by Defra as Flood and Coastal Erosion Risk Management Grant in Aid (FCERM GiA). There are strict rules governing how government funding is invested.

The UK Government promotes a nationally consistent approach for the assessment and funding of flood risk management works. Projects need to be developed in accordance with the Defra Policy Statement on Appraisal and follow the approach to appraisal provided in Flood and Coastal Erosion Risk Management Appraisal Guidance (FCERM-AG). Whether the Environment Agency (or any other risk management authority) can exercise its statutory permissive powers to carry out works using government funding depends on these works being technically feasible and adaptable to change, socially and environmentally acceptable and the economic benefits to the country outweighing the costs.

The FCERM-AG outlines the principles for assessing benefits. Risk management authorities (including the Environment Agency) use additional industry standards such as the Multi-Coloured Handbook and Manual (MCM)[1], written and published by the Flood Hazard Research Centre at Middlesex University, which provides specific methods for the benefit assessment.

The costs of a scheme that need to be included in the economic assessment are the 'whole life' costs. These include appraisal, design, construction and maintenance (including refurbishment) costs over the lifetime of the scheme. Whole life costing helps to identify future costs and optimise the selection of the preferred option.

Flood risk management works have to compete with other areas of public expenditure, and even where there is an economic case for a project this does not guarantee its being funded with taxpayers' money. The availability of public funds for delivering flood risk management works is dependent on national priorities for investment, and individual projects need to compete for funding with other possible flood and coastal erosion risk management interventions around England. The Defra Flood and Coastal Resilience Partnership Funding arrangement sets out how much FCERM GiA may be contributed towards a project. Where government funding would not fully cover the costs of a project,

[1] The Flood and Coastal Erosion Risk Management: A Manual for Economic Appraisal (Multi-Coloured Manual – latest version 2013) and its Handbook (latest version 2018).

the costs would either need to be reduced or the remainder of the funding would need to be provided through local contributions.

Each project is given a partnership funding score based on the outcomes delivered, costs, benefits and local contributions. This score is used to prioritise and allocate FCERM GiA funding. Those schemes indicatively allocated FCERM GiA funding are then entered onto the government's national six year programme of investment for flood and coastal erosion risk management.

A business case is required to set out the justification for the investment. This would need to be approved, by the Environment Agency where within limits defined by Defra under the Financial Scheme of Delegation (FSoD). All funding, including local contributions need to be secured before works can be designed in detail and all relevant permissions and approvals secured before works can start on the ground.

Others can also carry out works to manage flood risk, including from main rivers, partly or wholly with other sources of funding. This is subject to the impacts being assessed and such works being in accordance with any relevant statutory requirements. These include communities, individuals, voluntary groups, and private and other public sector organisations. The Environment Agency supports them where it can to do this.

Planned future work in the Wyre Forest District

Flood recovery work is a priority for the Environment Agency. A £7.5m flood recovery programme is now underway for the repair of assets in the Environment Agency West Midlands Area which were damaged in the February floods. The programme includes the Severn Side Capital Maintenance Scheme in Bewdley, Worcestershire.

The £300k investment includes the resetting of the block pavers that sit under the flood barriers to reduce seepage during a flood, following damage caused during the October and February floods. It also includes the resealing of the elements of the barrier that remain in place and the recladding of the floodwall at Gardners Meadow.

In addition to the above recovery work the Environment Agency is planning the following investments:

- We are working with Worcestershire County Council to develop a bid for natural flood management measures for Wolverley.
- The Environment Agency intends to continue its inspection and maintenance activities on flood risk management assets. This equates to approximately £400k a year in the Wyre Forest District.
- The Environment Agency intends to continue to provide a flood warning service for areas in the District. In the Wyre Forest District, investment was approximately £100k for 2019/20. Future spend over the next 5 years is estimated to be £300k. This includes river gauge maintenance, gauge upgrades, maintaining, operating and improving the flood warning service, and a contribution to support the LRF.
- The Environment Agency also seeks to continue to reduce flood risk in the District through its role in permitting certain activities in the floodplain and as a statutory consultee, since 2006, in the town and country planning process.
- Looking further to the future, the Environment Agency has set up a new partnership group, the River Severn Partnership, to look holistically at flood risk along the River Severn from mid Wales to Gloucestershire. As well as the Environment Agency, the

Partnership includes Local Authorities, Local Enterprise Partnerships, Natural Resources Wales, Severn Trent Water and Water Resources West. This approach has the political backing of all MPs within the Severn catchment. The ambition of the River Severn Partnership is: ‘To make the Severn Catchment Britain’s most vibrant and resilient river network; where an exceptional quality of life, prosperous local economies and an outstanding natural environment is driven by a programme of innovation to reduce flood risk, secure future water resources and improve and deliver shared natural assets’.

Post flood repairs at Severn Side, Bewdley

6. Options for a permanent scheme for Beales Corner

Permanent options have previously been assessed and reviewed for Beales Corner. As set out in section 5 of this report, any scheme delivered by the Environment Agency has to meet government rules on public funding. To date no study has shown a viable option, with the 2012 Halcrow report concluding that any permanent scheme would have a benefit cost ratio of less than 1 and would therefore preclude public funding. Previous studies have estimated the costs of a permanent scheme to be in the region of £3m to £4m.

Following recent changes to the way flood risk benefits are calculated and a change in the partnership funding calculator, the Environment Agency is once again reviewing possible options and associated costs. This review forms part of the Environment Agency's accelerated programme. Following the winter flooding the Environment Agency has prioritised 13 projects to review flood hit communities. For any scheme to be viable for delivery a partnership approach is going to be required from all local partners and community support. The Environment Agency is aiming to complete the initial review by the end of the summer. We hope then to meet with all partners to discuss possible delivery opportunities and to allow partners to help shape any scheme. Following this work a public update will be given.

The ambition is that any permanent scheme will allow the historic bridge crossing to remain open to traffic during any future flood event, thereby allowing the town to remain connected. However it is worth noting that all options will have to be considered in the search for a viable scheme and that the cost to achieve this, along with any restrictions on what can be done to the bridge, may prevent this ambition. The opportunities to keep the bridge open will be explored by the partners as part of the work in the autumn and if any scheme progresses.

At this point in time it is not possible to provide any delivery timescales due to the great uncertainty as to whether a viable scheme is possible or not. However, if a scheme is found to be viable any scheme will require a business case to be produced and approved in accordance with HM Treasury rules, any site investigations to be undertaken, a planning application to be approved along with any specialist permissions from organisations such as Historic England, landowner permissions secured and the detailed design to be produced prior to any construction commencing. The construction period for a scheme of this scale is likely to be in the region of six months.

It is worth noting that the installation of PFR for properties at Beales Corner does not prevent the funding of any future permanent scheme if a viable option can be identified.

7. Lessons learnt

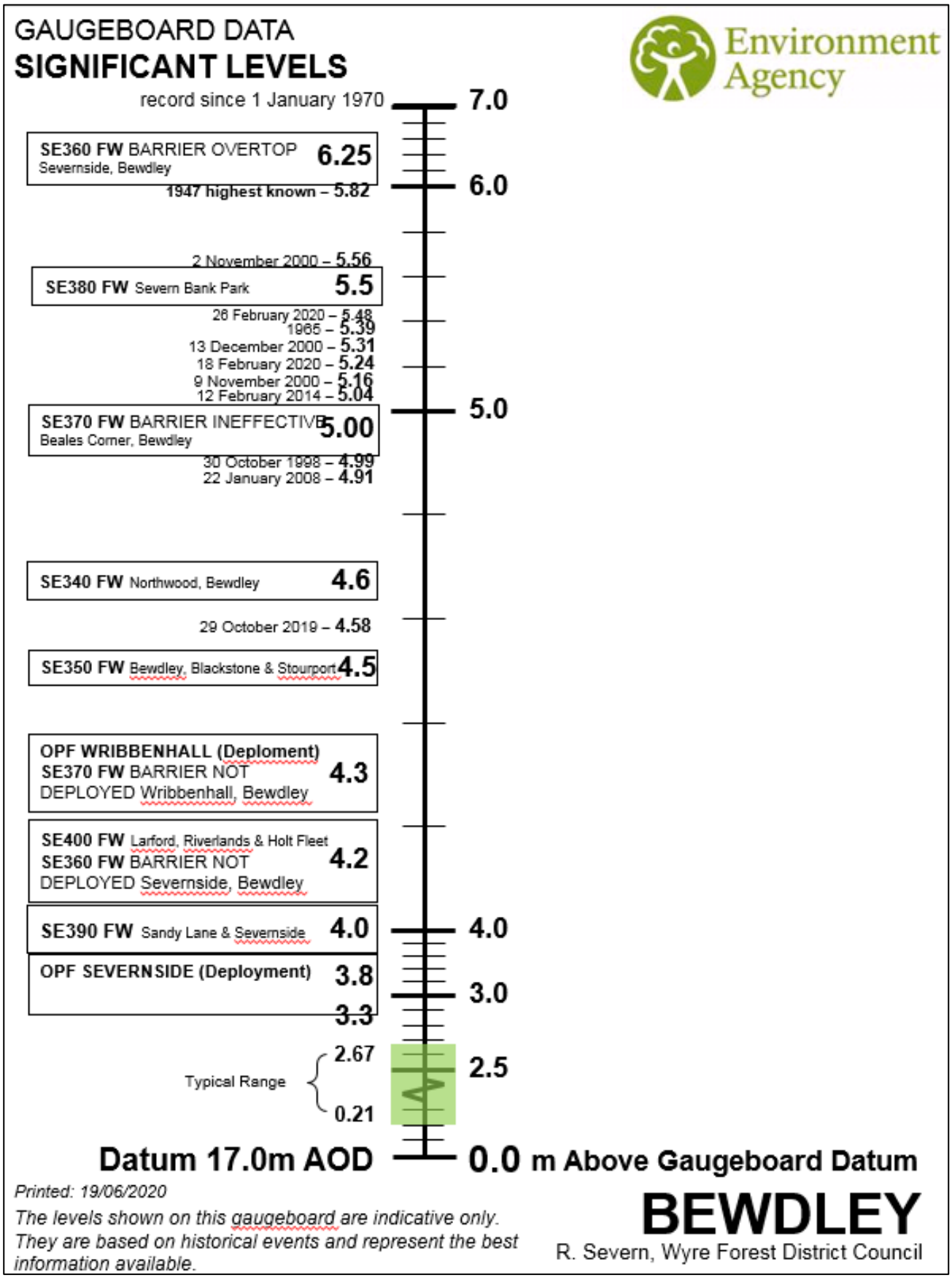
Following any significant flood event the Environment Agency reviews the event to identify any lessons that may reduce future flood risk. The events of February and March 2020 are being reviewed by the Environment Agency West Midlands Area. The Environment Agency is organising Bronze level debriefs for each of the operational sites along the Severn, which will include Bewdley, where all LRF members will be invited to share their experiences and will allow any learning to be implemented.

A number of improvement items have so far been identified by the Environment Agency to reduce flood risk for the future. The key changes are:

- Barriers for Bewdley to be loaded for the next deployment phase, regardless of forecast and to be located on site within the compound on Dog Lane Carpark. This would reduce mobilisation times by up to two hours but will impact space in the Dog Lane car park.
- An additional forecasting officer to be placed on duty for large or significant weather events.

While the Environment Agency and partners will always endeavour to identify new approaches to reduce flood risk, there will always remain a residual risk. We therefore ask communities to be prepared and to consider what they too can do to ensure that their home and their community is climate resilient.

Appendix A: Bewdley historic peak levels



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