Experiences of Groundwater Flooding, South Winterbourne Valley, Dorset

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INTRODUCTION

Heavy rainfall on the 6th and 7th July 2012 resulted in groundwater, fluvial and surface water flooding in three villages in the South Winterbourne valley in south west Dorset, UK. Rainfall records from nearby rainfall gauges showed 112mm of rainfall in the 38 hour period between 1pm on 6th July and 3am on 8th July. The rainfall was assessed using the Flood Estimation Handbook (FEH) methodology to have an annual probability of 1.3% - 2.2% (return period of 40 - 80 years). High flood levels caused the closure of the A35 trunk road through the valley and 42 properties in Winterbourne Steepleton, Winterbourne Abbas and Martinstown suffered internal property flooding. Water levels remained high for over two weeks following 6th July.

The high rainfall followed an extended period of above average rain, with the total rainfall from April – July 2012 close to twice the long-term average for this four month period.

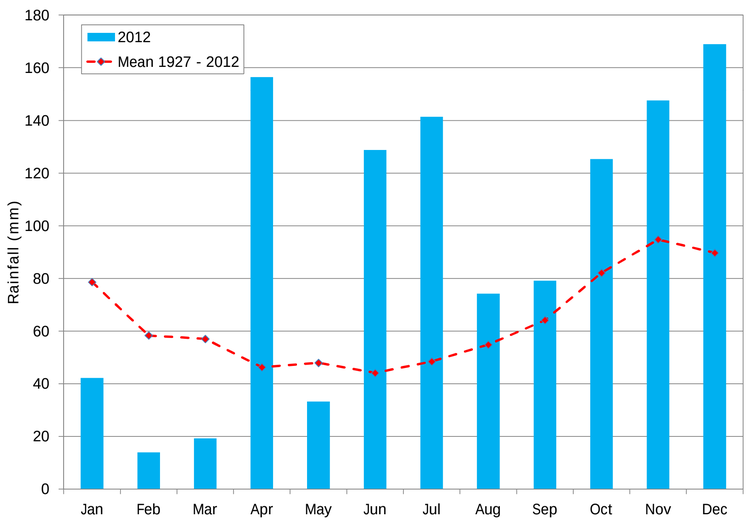

Figure 1. 2012 Dorset rainfall record against Dorset 1927-2012 long-term average.

As the Lead Local Flood Authority for the area, Dorset County Council led an investigation into the flooding. Parsons Brinckerhoff was appointed to assess the flood risk in the catchment and identify measures to improve protection and resilience against future flood events.

The catchment has suffered significant flooding in the past, notably on 19th July 1955, when 280mm of rainfall fell in 24 hours. This was a UK record until 2009[1].

Figure 2. Flooding in Martinstown, July 1955.

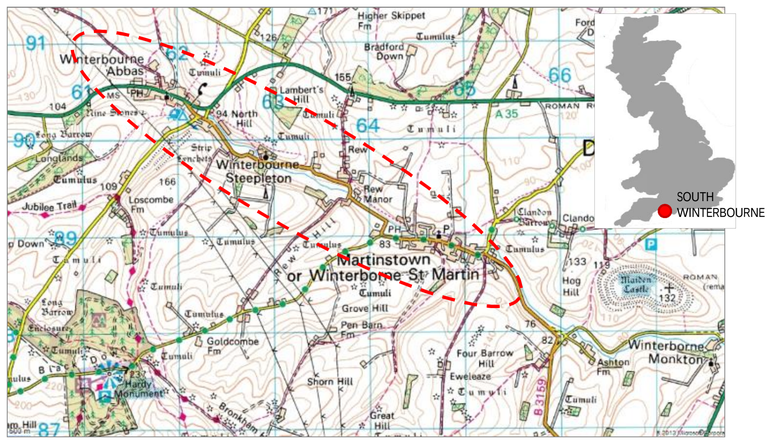

Figure 3. Project location.

INVESTIGATION

The factors contributing to the flood risk in South Winterbourne were assessed using eyewitness accounts, photographs and hydrological data, including rainfall records, flow data for the South Winterbourne stream and groundwater monitoring boreholes.

The views of the local water supply and sewerage undertaker, Wessex Water and the UK Environment Agency were also obtained.

CAUSES OF FLOODING

The primary factor contributing to the flooding risk was assessed to be high groundwater levels, due to the underlying geology of the area. The South Winterbourne takes its name from the ephemeral chalk stream or 'winterbourne' that flows through the valley. A high proportion of flows in winterbourne streams – and sometimes all – is of groundwater that emerges from the chalk bedrock in the lowest parts of the valleys. Steeply sided winterbourne valleys are particularly susceptible to groundwater flooding. The fractured nature of the chalk allows rapid infiltration to the water table, resulting in rising groundwater levels, greater groundwater emergence and higher fluvial flows.

Figure 4. Illustration of fractures within chalk geology (supplied by EA).

Analysis of groundwater records in the catchment over the period of the most recent flooding indicated a sharp rise in groundwater level directly following the 112mm of rain that fell on 6th - 8th July 2012. Recorded groundwater levels rose 8.78m between 7th and 8th July.

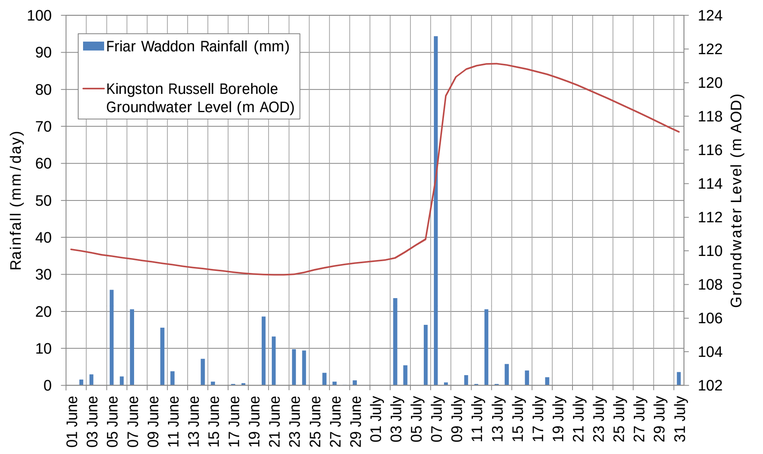

Figure 5. Groundwater (red line) response to rainfall (blue) June – July 2012.

Other contributing factors to flooding include restrictions in the capacity of the South Winterbourne stream as it flows through the affected villages. The intense rainfall on saturated ground also led to high volumes of surface water runoff from agricultural land.

Figure 6. Example of restriction in capacity of South Winterbourne within the study area.

OPTIONS FOR ALLEVIATION

A range of measures were considered to alleviate the flooding in the affected villages:

- × Catchment wide approaches such as flood relief culverts or diversion schemes not feasible for the relatively small number of properties at risk of flooding;
- × Large-scale groundwater pumping technically impracticable.
- ✓ Household flood protection approaches in coordination with improved management and maintenance of surface water infrastructure and improved awareness of groundwater flood risk identified as the best approach for the management of future flood risk in the catchment.

The formation of a Community Flood Action Group was recommended to support this approach, creating a representative voice for flood concerns for the community. The Group would help to coordinate local flood risk reduction and resilience measures, such as maintenance of the watercourse and the preparation of community flood plans to be implemented in the event of forecasted periods of high flood risk.

Specific recommendations to help alleviate localised flood issues in each of the three villages were also made. These included removing obstructions to flow in the watercourse, such as low access bridges and the restoration of disused bifurcation channels.

References

1. Shaw et al, (2011). Hydrology in Practice. 3rd Edition. Oxford: Spon Press