
Subject: Economic Assessment

Date: 28th August 2009

1. Introduction

The purpose of this assessment was to provide a broad level estimate of flood damages in Bath, and assess the benefits of a number of flood risk management options.

2. Methodology

The assessment follows guidance for Pre-Feasibility Studies from the Flood Hazard Research Centre's Multi-Coloured Manual (2005).

2.1 Residential Property

Damages to residential property were estimated using the weighted annual average damages by Standard of Protection; these can be found in Table 4.4 of the Multi-Coloured Handbook. We have assumed that no flood warning is available.

2.2 Non-residential property

In the absence of the National Property Database which contains floor areas for non-residential property, the Multi-Coloured Manual was used to provide floor areas by bulk class (Table 5.3 of the MCH). Non-residential properties were therefore classified into the four bulk classes, namely:

- Retail;
- Warehouse;
- Factory; and,
- Office / Other.

Each non-residential property was assigned a floor area based on the national mean floor area for these bulk classes. Damages to non-residential properties were then calculated using the weighted annual average damages by Standard of Protection, as shown in Table 5.1 of the Multi-Coloured Handbook.

The weighted annual average damage's for the bulk classes have been derived from the Multi-Coloured Manual rather than the Multi-Coloured Handbook; although these publications should contain the same data, it was noticed that for this data set there were considerable differences between the Multi-Coloured Manual and the Multi-Coloured Handbook. It was considered to be more appropriate to use the values provided in the more detailed Multi-Coloured Manual, than use those in the Multi-Coloured Handbook.

2.3 Assumptions

In undertaking the assessment the following assumptions were made:

- The assessment is based on the numbers of properties within the 100-year plus climate change event floodplain, and does not consider any other return period events. We have only calculated the annual average damage's for the 100-year plus climate change event and not for other return period events;
- A 100-year appraisal period and associated discount factor has been adopted;
- No assets are written off;

- The annual average damage figures provided in the Multi-Coloured Manual, produced in 2005 were updated using the Retail Price Index (CHAW Index) to reflect price changes between December 2005 and July 2009;
- Residential ground floor areas, provided by Colin Turnbull were converted to residential property numbers by dividing by 50m². This was felt to represent the average ground floor area of a property, following discussions with Colin Turnbull and comparison with the Communities and Local Government datasets on residential property;
- In line with guidance from the Multi-Coloured Manual the costs of emergency services following a flood event were included at 10.7% of total direct damages;
- Damages have not been assessed for losses associated with temporary accommodation costs, agricultural losses, recreational losses, transport disruption or environmental losses;
- The current Standard of Protection was derived from the existing ISIS model results. For simplification the study area was split into three reaches: 1) upstream of cross section RC052 with a 50-year Standard of Protection; 2) Between RC052 and RC044 with a 75-year Standard of Protection; 3) Downstream of RC044 with a 100-year Standard of Protection. Each property was assigned to one of these reaches; and,
- Damages have only been calculated in full for the baseline scenario (100-year event plus climate change) with the proposed developments in place. Damages for the flood risk management options have been calculated by reducing damages by a percentage based on the average change in water levels from the baseline for the 100-year plus climate change event.

3. Results

The following tables contain the results from the economic assessment.

Table 3-1: Baseline scenario Annual Average Damage and Present Value damages

| | Outside Development Sites (£) | Development Sites (£) | Total (£) |
|----------------------------------|-------------------------------|-----------------------|-------------|
| Residential Damages | £403,745 | £10,396 | £414,141 |
| Non Residential Property Damages | £289,163 | £213,792 | £502,956 |
| Emergency Costs | £74,141 | £23,988 | £98,129 |
| | | | |
| Total Annual Average Damage | £767,049 | £248,176 | £1,015,226 |
| Total Present Value damage | £22,868,040 | £7,398,881 | £30,266,920 |

The following table shows the average change in peak water levels by flood risk management option, and the percentage reductions in baseline damages applied. It should be noted that for the raised defence option it has been assumed that damages are reduced to zero.

Table 3-2: Average change in water levels by option and % reduction in damages

| Option No. | Option Description | Average Change in Water Level | % Reduction in damages |
|------------|---|-------------------------------|------------------------|
| 1 | Storage upstream of the A4 | -0.012 | 2% |
| 2 | Kensington Meadows storage | -0.095 | 20% |
| 3 | Raised Defences | 0.059 | 100% |
| 4 | Cumulative storage in development areas | -0.099 | 21% |
| 4a | Twerton Sluice adjustments | -0.021 | 4% |

The Present Value damages and benefits for the proposed flood risk management options are displayed in the following table.

Table 3-3: Baseline and Options Present Value damages and Present Value benefits

| Option No. | Option Description | Present Value damages | Present Value benefits |
|------------|---|-----------------------|------------------------|
| 0 | Baseline Scenario | £30,266,920 | £0 |
| 1 | Storage upstream of the A4 | £29,661,582 | £605,338 |
| 2 | Kensington Meadows storage | £24,213,536 | £6,053,384 |
| 3 | Raised Defences | £0 | £30,266,920 |
| 4 | Cumulative storage in development areas | £23,910,867 | £6,356,053 |
| 4a | Twerton Sluice adjustments | £29,056,244 | £1,210,677 |

4. Conclusion

This assessment has estimated the baseline scenario Present Value damages for Bath City Centre to be £30.3 million, with a fairly even split between residential and non-residential damages.

Subject: North East Somerset Towns Economic Assessment

Date: 12th March 2010

1. Introduction

The purpose of this assessment was to provide a broad level estimate of flood damages in the North East Somerset towns and thereby provide a benchmark against which the economic viability of any proposed flood risk management options can be assessed.

2. Methodology

- 2.1 Economic assessment of the North East Somerset towns was undertaken by site survey, both on the ground and by inspection of aerial and Ordnance Survey mapping. Each property is identified by inspecting its position in relation to the flood outline and boundaries to the flow of floodwater or weaknesses in existing defences can easily be identified. By inference, the small number of properties that makes this approach practical limits the benefits that would be realised were defence works to be undertaken.
- 2.2 Drawing from the data generated from the economic assessment undertaken for the city of Bath, as part of this study, the average value of benefits to be realised by protecting a property against flooding was £13,900 and represents the cumulative total of the value of damage incurred during each flood event that might occur during over a 100 year appraisal period, discounted back to today's figures (i.e. were £13,900 invested today, in 100 years time it would represent several £100,000's). The reference database used to determine the value of flood damages incurred to a building during such a flood was the Flood Hazard Research Centre's Multi-Coloured Manual (2005). This was used to build up the damages for a range of return periods and standard depths. The advantages of using the data derived Bath data was that the damage values would prove consistent as these are influenced by the same economic influences geographically and that it would save duplication in effort.
- 2.3 The typical damages figure per property was multiplied by the total number of properties that lay in the 1%AEP flood zone at each site. To this end, the most up to date flood zone maps were referenced. This identified that only one development site was found to be at risk in Radstock, and that was the Combend (RK9) site which, from inspection, currently has some 10 properties located within its envelope. The only other site affected was in Keynsham, and was the Broadmead Lane Waste (KM11) site, although this would suffer no economic loss during a flood but, being a municipal waste site it would be important to ensure its continued operation.
- 2.4 By comparing the economic value of damages with the cost of constructing the options the financial viability of the defence works was established. A similar exercise was undertaken as part of the viability assessment work, but in terms of revenue that could be realised by developing the site. This is covered in a separate section of the flood risk management study report

3. Assumptions

In undertaking the assessment the above referenced figure was applied on the basis that the following assumptions were also applicable to the North East Somerset towns:

- The assessment is based on the numbers of properties within the 100-year plus climate change event floodplain, and does not consider any other return period events. We have only calculated the annual average damage's for the 100-year plus climate change event and not for other return period events;
- A 100-year appraisal period and associated discount factor has been adopted;
- No assets are written off;
- The annual average damage figures provided in the Multi-Coloured Manual, produced in 2005 were updated using the Retail Price Index (CHAW Index) to reflect price changes between December 2005 and July 2009;
- In line with guidance from the Multi-Coloured Manual the costs of emergency services following a flood event were included at 10.7% of total direct damages;
- Damages have not been assessed for losses associated with temporary accommodation costs, agricultural losses, recreational losses, transport disruption or environmental losses;
- The current Standard of Protection was derived from the flood zone mapping for flood zone 3a. and,
- Damages have only been calculated in full for the baseline scenario (100-year event plus climate change) with the proposed developments in place. Damages for the flood risk management options have been calculated by reducing damages by a percentage based on the average change in water levels from the baseline for the 100-year plus climate change event.

4. Results

The following tables contain the results from the simple economic assessment, assessed by inspection. Due to the small number of properties affected by flooding, they are identified individually on the following table.

Table 4-1: Baseline scenario Annual Average Damage and Present Value damages

| Study Area | Development Site | Number of Properties/Surface Area Affected | £ Damages/property or unit area (m ²) | Total Present Value Damages per Development Site |
|-----------------|------------------|--|---|--|
| Keynsham | KM11 | 0.9hectares | £ 150/hectare | £135 |
| Midsomer Norton | None | - | - | - |
| Radstock | RK9 – Combend | 10 | £13,900/property, £ /m ² | £139,000 |

5. Conclusion

This assessment has estimated the baseline scenario Present Value damages for the North East Somerset towns development sites to be:

- Broadmead Lane Waste site KM11 - £135 for the minor flooding incursion to the boundary, and
- Combend RK9 - £139,000 in total present value damages to the 10 properties.

As has been demonstrated in the main flood risk management strategy report, the construction cost of a properly functioning flood defence storage area of the size required to protect the Combend (Radstock) or Broadmead Lane (Keynsham) waste site from flooding would be some £200,000 or more, making the provision of a strategic flood defence scheme economically unviable. Local works to defence the individual site would be much more cost effective.