Broadmead Lane Industrial Estate: Flooding Incident Winter 2013 / 2014
Flood and Water Management Act, Section 19 Flood Investigation Report

June 2014
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Flood and Water Management Act, Section 19 Flood Investigation Report
Prepared by Bath and North East Somerset Council

June 2014

Useful contact details

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<th>Checked by</th>
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<td>02/06/14</td>
<td>Jim McEwen</td>
<td>Stella Davies Senior Engineer</td>
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<td>Trainee Drainage and Flooding</td>
<td>Jim Collings Lead Local Flood Authority Manager</td>
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Jim Collings Lead Local Flood Authority Manager
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1. Executive summary

This Flood Investigation Report has been completed by Bath and North East Somerset Council (BANES) under its duties as the Lead Local Flood Authority (LLFA) in accordance with Section 19 of the Flood and Water Management Act 2010 (F&WMA).

**Flood and Water Management Act 2010: Section 19**

Local Authorities: Investigations

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 –
   a) which risk management authorities have relevant flood risk management functions, and
   b) 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 –
   a) publish the results of its investigation, and
   b) notify any relevant risk management authorities.

**Flood and Water Management Act (2010), S.19, c.29, London: HMSO**

Bath and North East Somerset Council will carry out a Section 19 flood investigation when, either:

- Five or more properties at an urban location suffer from internal flooding, or
- Two or more properties at a rural location suffer from internal property flooding.
2. Site location

Broadmead Lane Industrial Estate
Broadmead Lane
Keynsham
BS31 1ST

Easting: 366627
Northing: 169186

Broadmead Lane Industrial Estate is situated approximately 1km north of the town of Keynsham and lies immediately adjacent to the river Avon (main river).

Figure 2.1: Broadmead Lane Industrial estate location
The Industrial Estate lies on the southern banks of the River Avon. The surrounding area is agricultural land with one small access road leading to the site from the south.
Figure 2.3: Broadmead Lane Industrial estate within the functional flood plain of the River Avon
Source: Environment Agency Risk of Flooding from Rivers and Sea map

The Industrial Estate is within the functional flood plain of the River Avon and is described by the Environment Agency as being at ‘High risk’, having a greater than 1 in 30 chance of flooding.
3. Evidence gathering

Representatives of Bath and North East Somerset Council’s Drainage and Flooding team visited the industrial estate on 7 May 2014. Around eight of the business units were inspected, five people working in business units and one resident were interviewed. A spreadsheet detailing the responses of those interviewed has been sent to the Environment Agency and can be seen in Appendix B.

Bath and North East Somerset Council’s historic flooding records for the area were reviewed. This investigation did not have the scope to gather detailed rainfall information. The Environment Agency was not consulted for the purposes of this initial investigation.

4. Previous flooding incidents

The Industrial Estate has been affected by fluvial flooding over many years. People living and working on the Estate understand that the area is within the flood plain of the Avon and that it is an area liable to flooding.

Anecdotally there are reports that flooding events have been more frequent in recent years.
5. Flooding incident

Bath and North East Somerset Council deemed it necessary to complete a formal investigation into a flooding incident at the Broadmead Lane Industrial Estate, near Keynsham that began on 24 December 2013.

Approximately 16 industrial estate units and one residential building were affected by internal flooding during this incident, meeting BANES’ threshold criteria for a Section 19 investigation.

Details

Dates

First-hand accounts from people working in the Industrial Estate units set the date of the river reaching bank-full capacity on or around 23/12/13. This water initially flooded the agricultural field to the south of the Industrial Estate before flooding the access road (Broadmead Lane) and the Industrial Estate. Reports state that Industrial Estate Units were flooded on 24/12/13.

Water levels remained high for the period between Christmas and New Year however there was some drop in flood levels as rainfall became less frequent and the tidal action of the River Avon pulled some water away from the site.

However further intense rainfall occurred just before New Year and property flooding was reported to have reoccurred again on 01/01/14.

Properties remained flooded until around 05/01/14.

Depths

First-hand accounts report flooding levels of up to 600mm within the Industrial Estate Units.

Flood water on Broadmead Lane (access Road) was reported as being ‘impassable’. Lorries from one of the units were used to transport people from the Industrial Estate.
Cause of flooding

The flooding that occurred at Broadmead Lane Industrial Estate is a reflection of the intense rainfall that fell onto a saturated catchment over the course of the week leading up to the event, and the continuation of rainfall over the Christmas period.

Total rainfall in the area for the period 11 December 2013 to 10 January 2014 was more than twice the December long term average\(^1\).

The Environment Agency’s river gauge at Saltford (approximately 6km upstream of Broadmead Lane Industrial Estate) recorded its highest river level at this location as 2.31 metres on 24/12/2013. This is 0.9m higher than the top boundary of the typical level range (0.46m-1.41m). This gauge has been open since January 2004.

In the days leading up to the flooding of the industrial estate on 24/12/13, there was intense rainfall. This was followed by a pause in rainfall between Christmas Day and the end of December before further rainfall resulted in more flooding over the New Year.

This intense period of rainfall led to flooding of the river Avon at this location.

Appendix A includes a series of indicative maps showing the extent and movement of flood water as described by people on the Industrial Estate. First-hand accounts suggest that the Industrial Estate was not flooded directly as a result of the river Avon overtopping banks, but indirectly from flood water that was ponding in the agricultural field to the south of the site.

The flooding could be described to have occurred in three phases:

**Phase 1**
The southern bank of the Avon was breached approximately 100m upstream of the industrial estate. Flood water then began to spill over into the adjacent agricultural field.

**Phase 2 (+1 day approx.)**
Flood waters began to pond in this field before reaching the level of the access road and the southern edge of the industrial estate.

**Phase 3 (+1 day approx.)**
Flood waters flowed across the road and into the field to the south west of the industrial estate. Some of the flood water is believed to have ultimately discharged downstream of the industrial estate.

In effect, the Industrial estate became an island surrounded by the main channel of the river Avon to the north and flood waters to the south. Fortunately the banks of the river Avon immediately adjoining the industrial estate were not breached, but are reported to have been very close to doing so.

Other theories and factors

Interviews with people working on the industrial estate cited the management of sluice gates up and downstream of the site as potentially having an effect on the speed at which flooding occurred and the duration that flood waters remained in the area.

One theory suggested was that the closing of the sluice gates at Twerton (upstream of the site) caused some kind of flood surge at the site.

There was also a question raised as to whether there was a delay in the opening of downstream flood gates (in the Bristol area), which consequently limited the draining of water during outgoing tides.

6. Main findings and recommendations

Main findings

- Flooding of the industrial estate occurred as a consequence of the river Avon (a main river) reaching bank-full capacity. The Environment Agency is the responsible Flood Risk Management Authority for the river Avon.
- The industrial estate became inundated by flood plain water ponding in the flood plain as opposed to direct bank breach of the river.
- The single access road to the site became impassable for most vehicles, effectively cutting off the industrial estate. This resulted in a high level of risk to people and properties in the industrial estate.
- Fortunately the river did not burst its banks in the immediate vicinity of the estate. Had it done so, this could have been a life-threatening situation for those on the estate, with tidal currents becoming an influence.
- Flood warnings were issued to the industrial estate units however the Christmas holidays meant that few people were around to respond.

Some recommendations

- **More flood analysis required.** Further investigation would be useful to try and establish more precise inundation areas, flood levels and points where the river banks were breached (and where flood waters eventually drained to).
- **Investigation into the effectiveness of flood warnings during holidays.** Is there a way to relay flood warnings to business unit owners/ workers at home, as opposed to flood warnings going directly to the business units only?
- **Investigation into emergency access and egress.** The single access road puts people on the estate at risk of being cut-off during flooding events. Could the road be raised? Should flood warning signs be introduced? Should the road be formally closed at times? How can people be safely evacuated?
- **Land use investigation.** The low lying fields to the south of the Industrial Estate would appear to flood first and pose the direct flood risk to the industrial estate. How is this land currently used and could it be utilised to mitigate flood risk?

7. Next steps

This report will be passed to the Environment Agency as the Flood Risk Management Authority responsible for main river flooding.
Appendix A: Indicative maps showing the extent and movement of flood water
Appendix B: Summary of witness accounts
<table>
<thead>
<tr>
<th>Date</th>
<th>Time (12 hour format)</th>
<th>Event &amp; Impact Comments</th>
<th>Location Problems Further Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/12/2013</td>
<td>12:00</td>
<td>Building has come close to flooding for the past three years (2013, 2012, 2011). Very close to property flooding in 2012</td>
<td>High tides appeared to coincide with flooding of industrial estate</td>
</tr>
<tr>
<td>24/12/2014</td>
<td>12:00</td>
<td>Flood water in premises observed to be '3 feet in places' but is believed to have been higher when people were not present (Christmas holidays). The access road was unpassable for a time. Only lorries were able to drive to/from the site.</td>
<td>Building has come close to flooding for the past three years (2013, 2012, 2011). Very close to property flooding in 2012</td>
</tr>
<tr>
<td>24/12/2015</td>
<td>12:00</td>
<td>Flood water came from the south - running underneath the Robbin Engineering Unit opposite. Filling the Robbin Engineering basement and then overflowing across the access road between the buildings and directly entering into the unit.</td>
<td>River did not breach it's banks immediately to the north and east of the units, instead they were flooded from accumulation of water in the agricultural field to the south of the site. Reported that sink holes have begun to form near the bank of the river following the flooding.</td>
</tr>
<tr>
<td>24/12/2016</td>
<td>12:00</td>
<td>Flood water pressure was increased due to downstream activity on a large river. The Robbin Engineering basement has not been subject to flooding in the past.</td>
<td>Building has come close to flooding for the past three years (2013, 2012, 2011). Very close to property flooding in 2012</td>
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