UNIVERSITY OF LEEDS

MATH3001: Project in Mathematics

Flood Analysis: Assessing and communicating mitigation of river floods to policy makers and the general public

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Contents

1 To do list

- write report by monday

- send to mum for spell check

- do comprehensive figure captions

- check marys graphs, should i talk about flood mitigation here?

- do graphs for leeds flood mitigation

- chase up antonia, make sure she knows new ht

- do flood mitigation for avon - this is the main work yet to be done

- write automated code for aire graph

- sort out references

- make sure git hub is up to scratch, inlcude automated code once done

- talk about supercritical and sub critical flows, github

- include flood risk maps for Avon

- rerun graphs at a smaller size so theyre not as squashed, may have to enlarge text on graph

- **how many codes should I inlcude in appendix?**

- **rainfall scenario, can i include essentially what is in supervisors report as want to inlcude hypothetical dam so will have same areas to deal with**

- **should i include supervisors graphs as a comparison**

2 Introduction

3 Definition of flood-excess volume

3.1 Available flood-storage volume

4 The Boxing Day 2015 floods in the county of West Yorkshire

4.1 The River Aire

Figure 1: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.
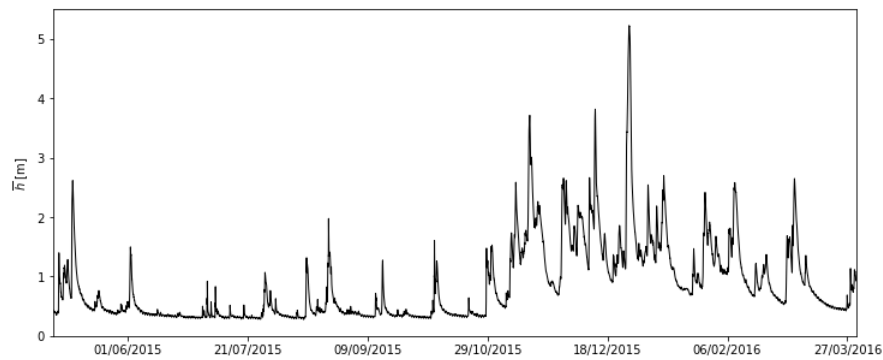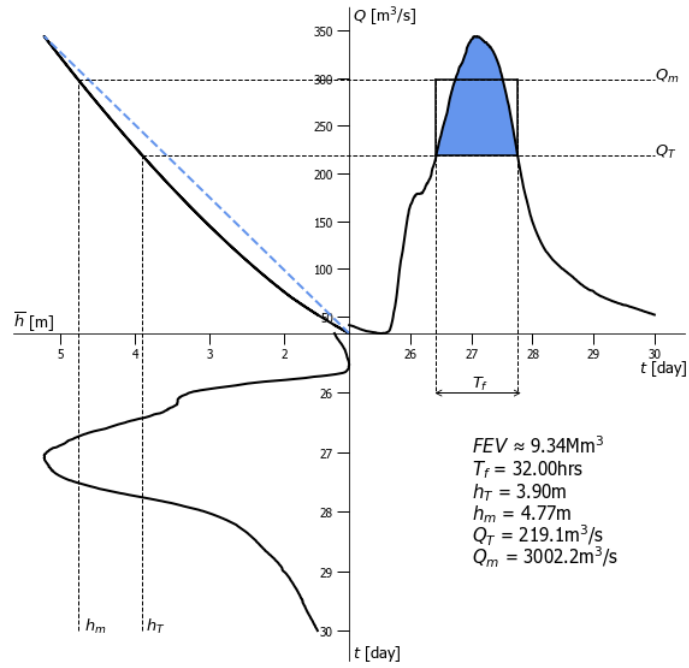
Figure 2: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.

Lower Stage Limit [m]	Upper Stage Limit [m]	c	b	a
0.2	0.685	30.69	1.115	0.156
0.685	1.917	27.884	1.462	0.028
1.917	4.17	30.127	1.502	0.153

Table 1: Aire

4.1.1 Past and planned mitigation projects in Leeds

4.2 The River Calder

Figure 3: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.
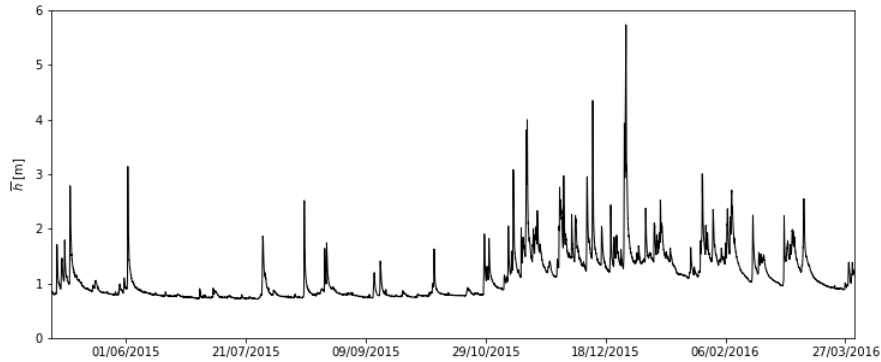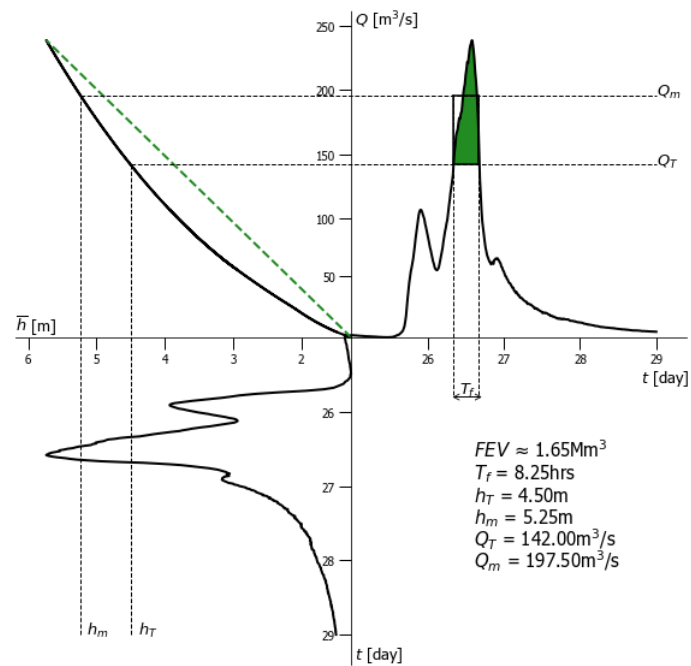

Figure 4: Graph detailing the relationship between the Height and Flow Rate of the River Calder during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Mytholmroyd'.

Lower Stage Limit [m]	Upper Stage Limit [m]	c	b	a
0	2.107	8.459	2.239	0.342
2.107	3.088	21.5	1.37	0.826
3.088	5.8	2.086	2.515	-0.856

Table 2: Calder

4.2.1 Past and planned mitigation projects in Calderdale

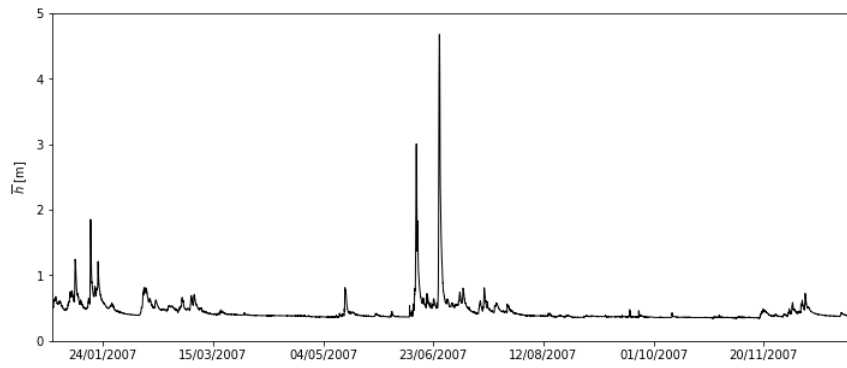# 5 The June 2007 flood of the River Don

Figure 5: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.
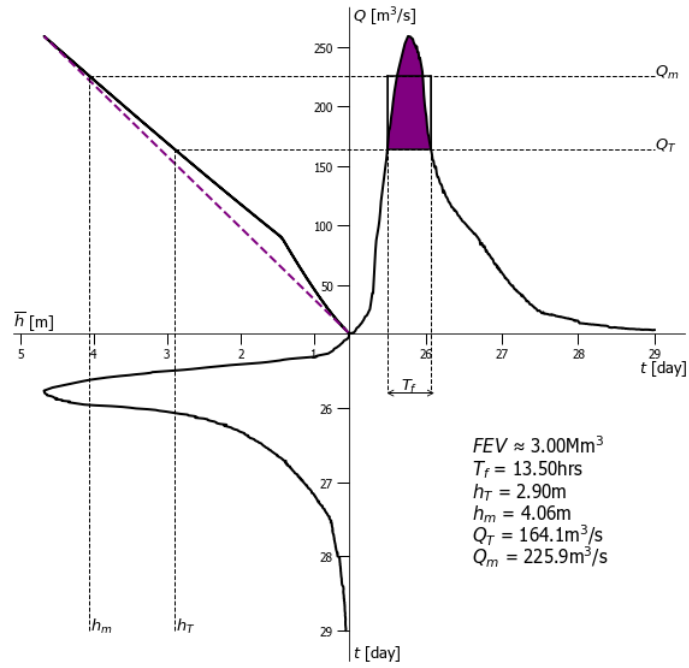
Figure 6: Graph detailing the relationship between the Height and Flow Rate of the River Don during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Sheffield Hadfields'.

Lower Stage Limit [m]	Upper Stage Limit [m]	c	b	a
0	0.52	78.4407	1.7742	0.223
0.52	0.931	77.2829	1.3803	0.3077
0.931	1.436	79.5956	1.2967	0.34
1.436	3.58	41.3367	1.1066	-0.5767

Table 3: Don

5.1 Past and planned mitigation projects in Sheffield

6 The November 2012 flood of the River Avon

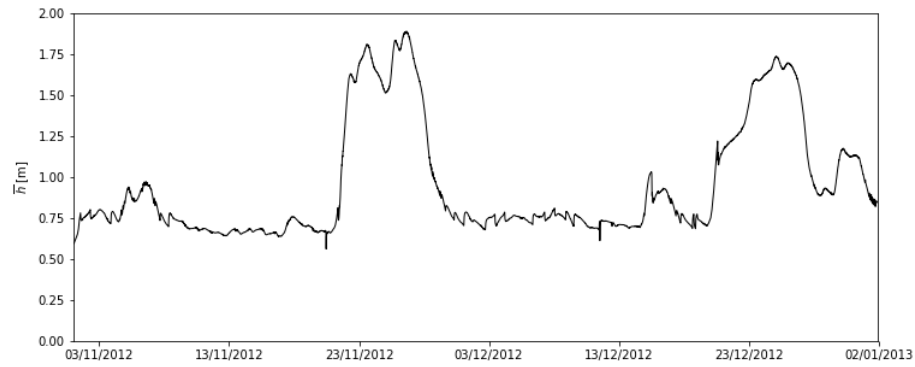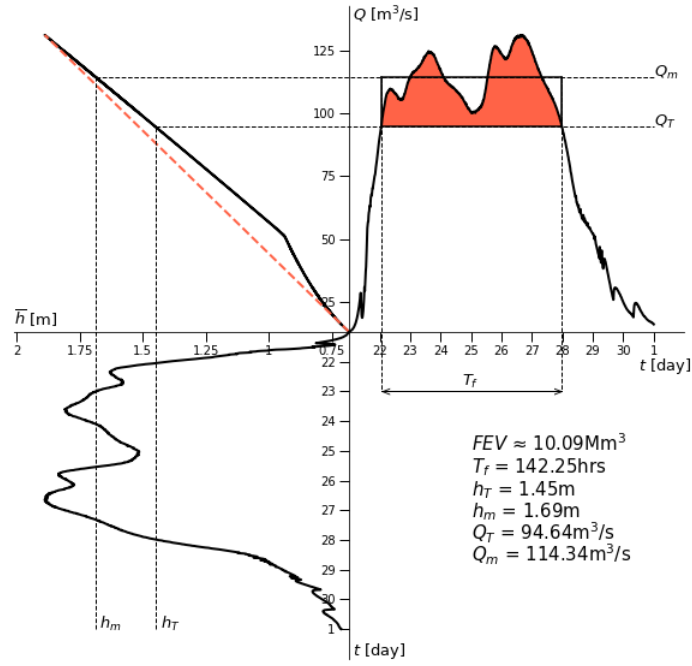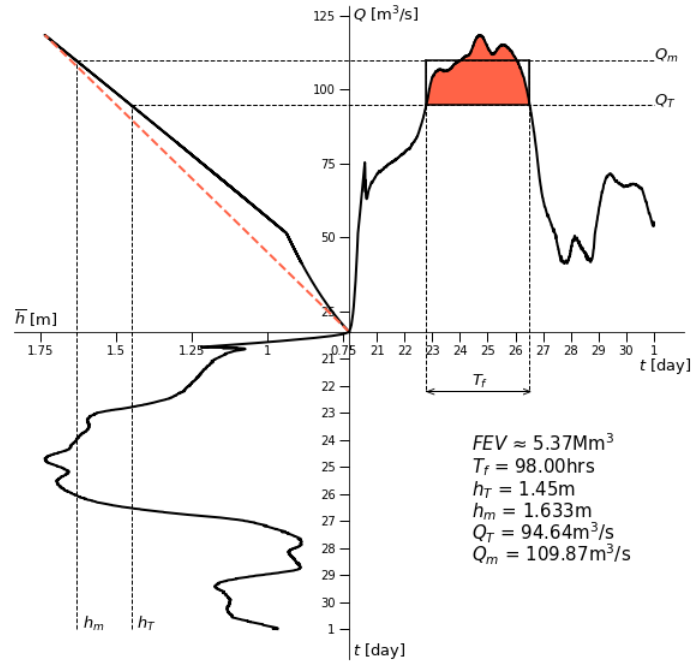## 6.1 The flood in Stratford-upon-Avon

Figure 7: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.

(a) Figure 5

(b) Figure 5 plotted using raw flow rate data

Figure 8: Comparison of the Warwick graph, the left using our rating information to find our flow rate values and the right using raw flow rate data.

Lower Stage Limit [m]	Upper Stage Limit [m]	c	b	a
0.136	0.938	158.04	2.85438	0.262919
0.938	1.427	87.0362	0.962129	0.358741

Table 4: Stratford-upon-Avon

(a) Figure 5

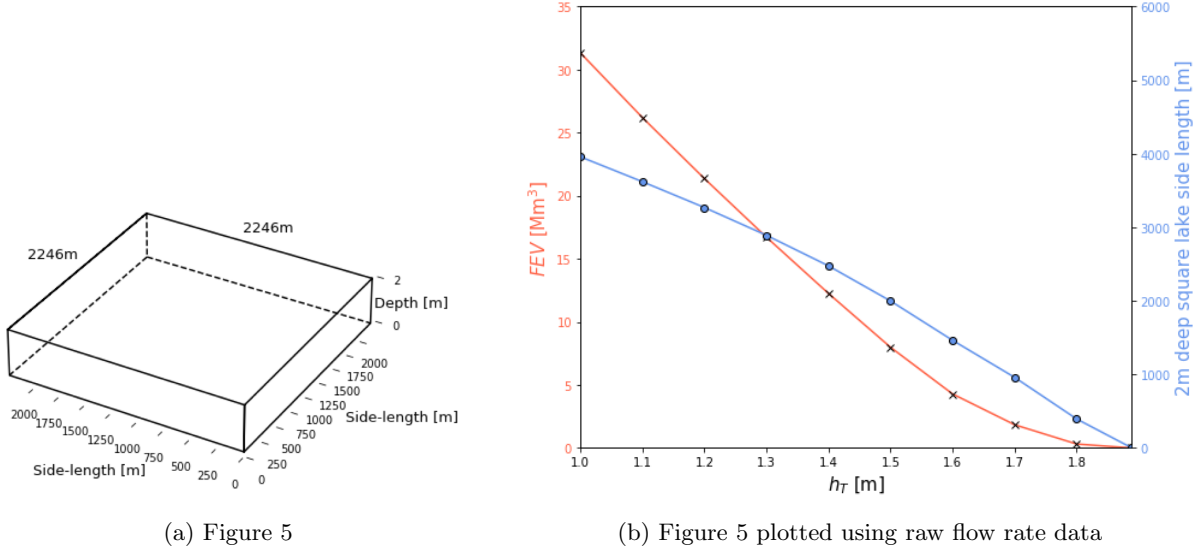(b) Figure 5 plotted using raw flow rate data

Figure 9: Comparison of the Warwick graph, the left using our rating information to find our flow rate values and the right using raw flow rate data.
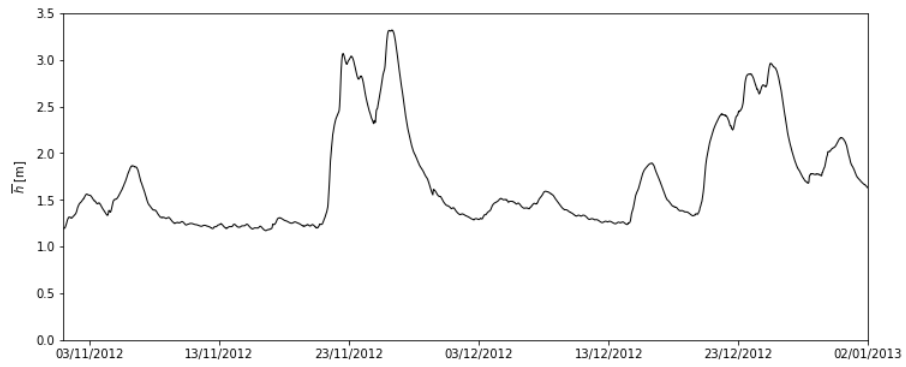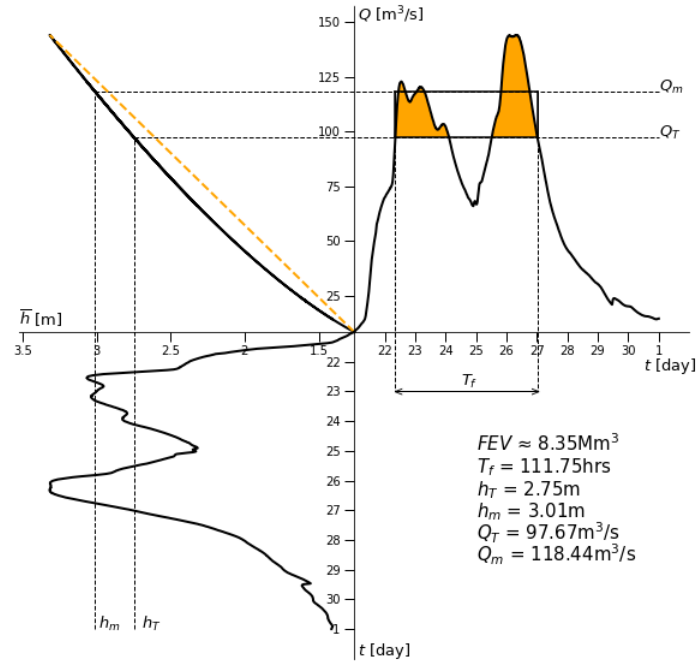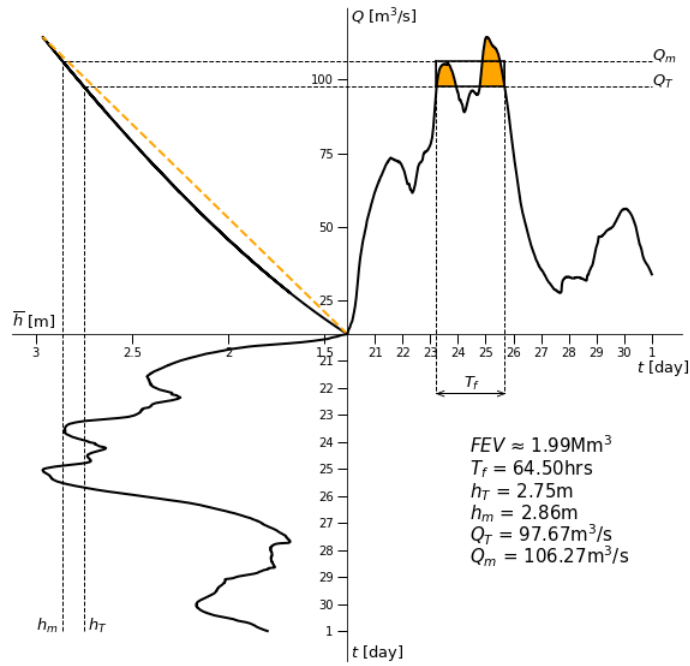
6.2 The flood in Warwick

Figure 10: Graph detailing the relationship between the height and flow rate of the River Aire during the 2015 Boxing Day floods using data provided by the Environment Agency from the monitoring station 'Armley'.
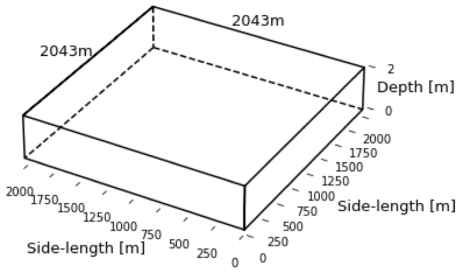
(a) Figure 5

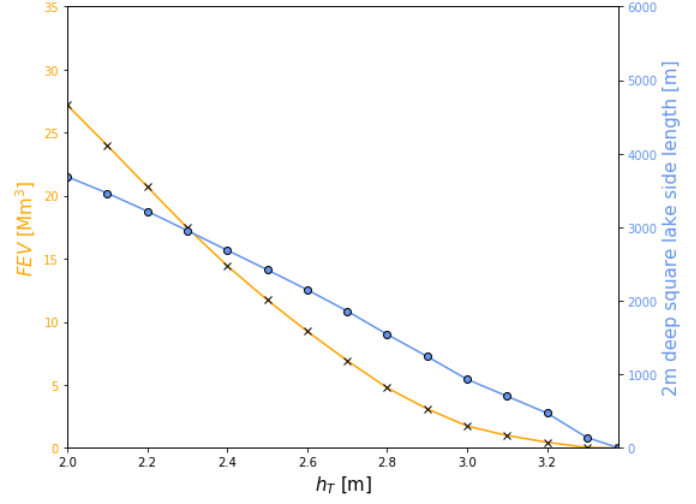(b) Figure 5 plotted using raw flow rate data

Figure 11: Comparison of the Warwick graph, the left using our rating information to find our flow rate values and the right using raw flow rate data.

Lower Stage Limit [m]	Upper Stage Limit [m]	c	b	a
0.960	3.000	40.6178	1.44854	0.917837

Table 5: Warwick

(a) Figure 5

(b) Figure 5 plotted using raw flow rate data

Figure 12: Comparison of the Warwick graph, the left using our rating information to find our flow rate values and the right using raw flow rate data.

7 Flood-mitigation assessment using FEV

7.1 Past and planned mitigation projects upstream of Stratford-upon-Avon
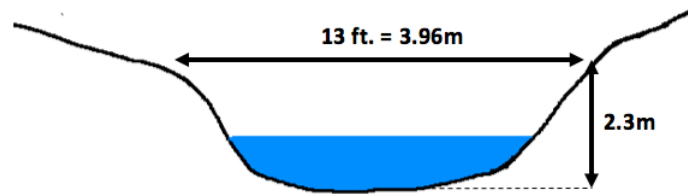
7.2 Natural flood management

7.2.1 Flow-attenuation features
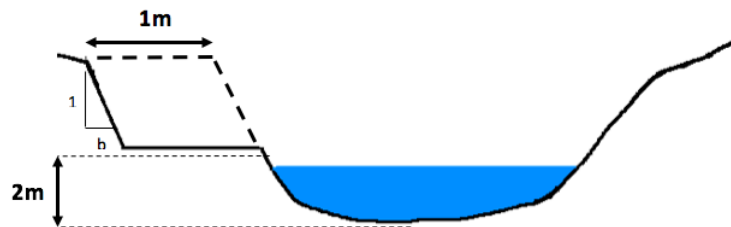
7.2.2 Tree planting

7.3 Storage of flood water in reservoirs

7.4 Giving room to the River

(a) Figure 5

(b) Figure 5 plotted using raw flow rate data

Figure 13: Comparison of the Warwick graph, the left using our rating information to find our flow rate values and the right using raw flow rate data.

8 Precipitation scenarios

9 Futher Reading

10 Summary and discussion

10.1 Acknowledgements

11 References

References

[1] The Flood and Coastal Defence project of the Foresight programme2004: Foresight, Future Flooding. Archived at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/300332/04-947-flooding-summary.pdf

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[3] Peters, H. 1990: Tattooed Faces and Stilt Houses: Who Were the Ancient Yue? Archived at http://sino-platonic.org/complete/spp017_yue.pdf

[4] Warwickshire County Council 2016: Surface Water Management Plan Methodology Report. Archived at https://apps.warwickshire.gov.uk/api/documents/WCCC-1039-45

[5] Warwickshire County Council 2016: Local Flood Risk Management Strategy. Archived at https://apps.warwickshire.gov.uk/api/documents/WCCC-1039-29

[6] Stratford. https://www.gaugemap.co.uk/#!Detail/47

[7] Warwick. https://www.gaugemap.co.uk/#!Detail/45

A   Appendix