

Executive Summary for Filey Report

1.1 Background

Parts of Filey have suffered from extensive and repeated flooding during severe summer storms affecting over 200 residential properties. Appendix 1 presents photographs together with a map of the affected areas to illustrate the severity of the events.

This Report details work undertaken by Atkins on behalf of Scarborough Borough Council as part of the Filey Flooding Working Group. This body was convened to investigate the problems and potential solutions to the repeated flooding. The Filey Flooding Working Group comprises the main client - Scarborough Borough Council (SBC) and also includes Yorkshire Water, North Yorkshire County Council, the Environment Agency, Filey Town Council, and some residents of Filey. Atkins was appointed to investigate the problems in an impartial manner and to recommend potential solutions to the various aspects of the flooding problems.

Damages following floods are disruptive, protracted and expensive. In certain cases repair costs have exceeded house values, while some residents have been forced out of their homes for up to a year whilst such repairs are undertaken. A number of residents are also experiencing difficulties in obtaining appropriate insurance for their homes.

The flooding comes from various sources which interact in a complex manner, making it difficult to find the specific causes. Technical solutions, whilst possible, are difficult to attribute due to the various organisations that may carry responsibility for the work.

1.2 Study Methods

The first part of the study was to gather the available information about the extent and nature of the flooding:

- What areas are affected?
- How often does it occur?
- Where does the floodwater come from?
- How long does it take for the floods to drain down?

A questionnaire distributed in 2002 and 2003 formed the basis of much of the above information, and a plan of the areas flooded in August 2002 was also produced by SBC and provided to Atkins.

Next, a computer model of the drainage network was constructed, including all the watercourses sewers, drains, and flood routes, using the latest software available – a programme named InfoWorks, produced by Wallingford Software Ltd. The programme simulates rainstorms, and follows the rainwater as it finds its way into the drains and sewers. It then tracks the performance of each manhole node and pipe in the system until the water from the storm has completely drained away. This computer model was adjusted until

Technical note - Model Quality

This is described as a **calibrated** model. A further check can be made, in which a real rainstorm and the flows generated by it are measured and then compared to the flows predicted by the model for the same real rainstorm. This is known as Model Verification. The calibrated Filey model is believed to be sufficiently accurate for this phase of the project, but should not be used for detailed design until it has been **verified**. Thus, it should be noted that any proposed solutions may change after verification.

it showed the same pattern of flooding as had been experienced by the town. **(See box)**

By using the results from the model it is now possible to confirm that the flooding was a result of certain sections of the drainage system being overwhelmed during the heavy rain. Once this had been established, further investigations uncovered the different types of problems affecting different areas. These were land drainage issues and sewer incapacity and or a mixture of both. Once the problems had been identified it was possible to suggest ways to solve the problems and to test those suggestions against the computer model. Considering the model quality issues described previously, it is recommended that additional topographical and flow survey data be obtained in addition to a review of the accuracy of the sewer data utilised, to support any proposed solutions. (Flow surveys were not undertaken as part of the data gathering exercise.)

1.3 General Results

There are a number of interacting problems. Some relate to the watercourse and rainwater falling beyond the urban area of the town overwhelming the drainage system and others relate to the sewer system being under-capacity. These findings are summarised in the table below and presented in the Appendix.

Location	Summary of problem	Solution
North Filey (Filey Beck) <i>(Watercourse problem)</i>	<p>Tributaries of Filey Beck are unable to cope with rapid runoff and fill and flood north Filey.</p> <p>The surface water from outside the urban area of the town overwhelms the existing town's drainage system.</p> <p>The tributaries directly flood the town and water also fills and floods the local sewer system.</p>	<p>Surface water needs to be directed away from the town or stored and its flow controlled.</p> <p>Sewer and surface water drainage systems could be upgraded. (It should be noted that while the existing sewer system receives land drainage flow there is no obligation on a water company to accommodate for such flows in new sewers)</p>
Long Plantation Watercourse <i>(Watercourse problem)</i>	<p>The watercourse overflows into the Wharfedale Estate.</p> <p>This is a surface water problem. Water overwhelms the watercourse and it floods into the rear of the properties and onto the streets. It goes on to exacerbate other flooding in the Wharfedale Estate and Muston Road.</p>	<p>This is being undertaken as a separate study so is not considered in detail in this report.</p>
Wharfedale Estate <i>(Sewer Problem)</i>	<p>The existing sewer system does not possess sufficient capacity to deal with the rain falling in the immediate area for a 1 in 30 year return period event.</p> <p>(Yorkshire Water have indicated that the current systems were probably designed for a 1 in 10 year standard.)</p> <p>Additional flows entering the estate from Muston road and the Long Plantation Watercourse exacerbate conditions.</p>	<p>Sewer systems need to be upgraded. A more in-depth study is required to ascertain and refine detailed solutions.</p> <p>(This is a sewerage problem in its own right, but requires solutions at the Long Plantation Watercourse and the sewerage problems at Muston Road.)</p>
Muston Road <i>(Sewer Problem)</i>	<p>The existing sewer system does not possess sufficient capacity to deal with the rain falling in the immediate area for a 1 in 30 year return period.</p> <p>(Yorkshire Water have indicated that the current systems were probably designed for a 1 in 10 year standard.)</p>	<p>Sewer system needs to be upgraded. A more in-depth study is required to ascertain and refine detailed solutions.</p>

In some areas, the flooding risk will continue until all of the interacting problems are resolved. Other discrete problems may be resolved by the responsible organisations without impacting upon other areas.

It is envisaged at this stage that the Watercourse improvements are a matter for the Environment Agency and/or Scarborough Borough Council, while the sewerage works will fall within the jurisdiction of Yorkshire Water.

Where residents and their representatives on the working group had put forward their own diagnoses of the problems, they were found to be broadly correct. There were two exceptions: flooding at Wharfedale is not a symptom of water backing from Dams Goit, and the flap valve on the sea wall is unrelated to the flooding of the housing estates.

1.4 Other Findings

Historically, Filey Beck used to run from the Dams area, under the railway line, cut across the northern part of the existing town, into the Ravine and to the sea. Most of this watercourse now flows through underground pipes (i.e the watercourse has been culverted). Thus it appears that Filey Beck used to collect the surface water draining from the fields to the north of the town via its tributaries. Now that it is culverted, this water has no easy route to the sea. This problem appears to be primarily a consequence of urbanisation encroaching on open land, rather than the flows from the agricultural areas in themselves.

The result is that runoff from the fields to the north of Filey overwhelms the existing tributary watercourses, and the small riparian culverts under houses are unable to drain them quickly enough. Therefore, floods arise and pass through the houses and several streets before eventually being drained by the surface water sewers and then into the culverted Filey Beck. This then outfalls into the main culvert in the Ravine.

In practice it is unlikely that residents will be easily able to improve the riparian pipes under their houses, and so any solution will most likely require intervention by Scarborough Borough Council or the Environment Agency. Even if the riparian pipes could be enlarged, the culverted watercourse/surface water sewers to which they connect would be inadequate for this land drainage flow as they were not designed for such an input.

Minor independent problems such as flooding near Filey Senior School are isolated incidents of flooding that affect the highway only.

It is believed that the soil type in the Filey area is a type of clay that under certain conditions forms an almost impermeable surface. Combined with the sloping land this results in very rapid runoff, almost as if it were paved.

The existing InfoWorks model may provide the local authority with a basic tool to assist in the assessment of future development proposals. The model may also provide the starting point for the development of detailed solutions in the next phases of the project.

1.5 Summary of Solutions and costs

The table below outlines the various solutions that are possible with associated costs. The preferred options are underlined:

Location	Solution	Appx. £
Filey Beck	Upsizing of existing culverted watercourse and relevant surface water sewers and riparian pipes.	£1,206k
	<u>Local storage of floodwater.</u>	£164k
	Diversion via tunnelled pipeline skirting the northern boundary of the urban area to Ravine Road watercourse, or via a new sea outfall.	£2,319k
Long Plantation Watercourse	For this study assume watercourse and ditch improvements with a new flood bank to stop overflows into the estate.	-
Wharfedale Estate Sewers	<u>General upsizing of sewers.</u>	-
	General reinforcement.	-
Muston Road Sewer	Upsize sewer as far as Ravine Road.	-
	<u>Offline Tank near level crossing (With a non-return valve north of the railway, or All flows pumped across the railway).</u>	-
	Diversion to Pastures Crescent. Offline tank at Pastures Crescent.	-

1.6 Economic Appraisal of Filey Beck Solution

A broad estimate has been made of the cost of the construction works required by each option. The costs for the preferred Filey Beck proposals have been weighed against the benefits of the option. The estimated cost at £164,000 compares well against the present value of damages (if nothing is done) of £2.3m. (A similar cost benefit analysis will be carried out for the Long Plantation Watercourse as part of that separate study.). Using the Multi-coloured Manual procedures, this produces a cost-benefit ratio of 6.9. This assumes a £1k annual maintenance budget, a 50 year design life and 100 year standard of protection.

The results of the economic appraisal for Filey Beck have been used to calculate a Defra priority score. The Defra priority score is calculated using the number of properties currently at risk of flooding, the estimated cost of the scheme and the benefit cost ratio. For Filey Beck the Defra priority score is 22.8, which is highly favourable.

Cost benefit analyses have not been carried out for the other projects as those being based on sewerage problems will be appraised under different criteria by the relevant organisations concerned. The outcome of this appraisal has been developed into a prioritised schedule of preferred options.

1.7 Recommendations

The recommendations below have been based on the Economic Appraisal, but take account of the confidence levels of the various elements. In some cases the option which appears to be the lowest priced carries high risks of a change of scope that would increase the cost dramatically, or greater risks of conflicts with gas mains or water mains, or environmental risks.

Field Work Recommended

- ◆ A flow survey should be carried out to verify the model and a further stage of modelling should be carried out to test the proposals against the verified model. This will enable options to be designed more precisely and will contribute to more reliable cost estimates.
- ◆ Surveys of the sewer network to confirm the quality of data used in the model.
- ◆ In conjunction with the flow survey, a general ground investigation should be carried out to confirm the nature of the soil and its permeability. This will entail trial pits at various locations to establish its surface characteristics, and deeper boreholes to assist in appraising the behaviour of groundwater. Although this investigation would be primarily to establish the accuracy of the model, it would be beneficial to ensure that sufficient information is derived from this ground investigation to assist in the selection of appropriate construction methods, so that the costs of the various options can be estimated more accurately.

Further Investigations Recommended

- ◆ The separate study of the Long Plantation Watercourse should be completed as a matter of urgency, and its conclusions should be implemented at the earliest opportunity. This will prevent flooding of houses in the southern part of the Wharfedale estate, and will reduce the risks to those in the northern part of the Wharfedale estate and on Muston Road.
- ◆ The Filey Flooding investigation should proceed to the next stage as a matter of priority.

Specific Solutions Recommended

- ◆ In the Filey Beck area, flood banks should be constructed to collect and store runoff from the fields, and to release it slowly through the existing pipes under the houses. Manor Farm is too close to the cliffs and the ravine for this method, and should be relieved by increasing the size of the drains in Church Cliff Drive.
- ◆ To prevent flooding at Muston Road, a deep tank sewer made of large pipes should be laid in the highway to collect foul storm water and store it until it can be pumped back into the sewer once flows subside. A non-return valve should be installed on the far side of the railway to prevent backflow into the tank.
- ◆ The Wharfedale Estate requires general re-sewerage by online replacement with Responsibility for these various works should be determined in conjunction with the agencies concerned.
- ◆ Independent proposals should be carried out to prioritise the work according to organisational and financial parameters which is beyond the scope of this report.

1.8 Prioritisation of Proposals

The table below summarises the priority of the proposals that could be adopted, subject to the specific procedures of the various responsible bodies. The right column also expresses the relative proportion of Filey at risk as separated via the

identified schemes. This is expressed as a percentage of the numbers of properties affected.

Priority	Schemes	Proportion of Problems in Filey, expressed as numbers of properties
High Priority	1. Filey Beck	55%
	2. Long Plantation Watercourse (not estimated in this study)	9% (Seriously affects a further 34%)
	3. Muston Road	12%
	4. Wharfedale Estate	22%
Medium Priority	Filey Senior School	1%
Low Priority	Scarborough Road	2%