FLOODING INVESTIGATION REPORT

BADGER HILL / HULL ROAD, YORK

Incident Date: 10 June, 2012

Hull Road Flooding – 12 July 2012

March 2013

Revision Schedule

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March 2013
BADGER HILL - HULL ROAD S19 REPORT V4final.docx

Rev	Date	Details	Author	Checked and Approved By
1	Oct. 2012	Draft report for stakeholder consultation	Jim Cavanagh (Flood Risk Engineer)	Mike Tavener
2	November 2012	YWS initial consultation response	Brian Smith - YWS	
3	February 2013	YWS revised consultation response	Gary Collins - YWS	
4	March 2013	Final Report	Jim Cavanagh (Flood Risk Engineer)	Mike Tavener
5				
6				
7				

Table of Contents

Appendix 1:

Executive Summary

This flood investigation report has been written by City of York Council (CYC), under its duty as Lead Local Flood Authority (LLFA) for the York Area. CYC has a responsibility under Section 19 of the Flood and Water Management Act 2010 (FWMA) to investigate significant flood incidents in its area and determine which risk management authorities have relevant flood management functions and whether those functions have been exercised. The Council must also publish the results of its investigation and notify any relevant risk management authorities.

Flooding to Hull Road, opposite its junction with Canham Grove, had been noted by CYC in June 2007. However, as no properties were reported to have flooded at the time, further investigations were deemed to be low priority

Intense rainfall on 10th June 2012 resulted in the flood incident at Hull Road / Badger Hill estate, 3km miles east of York, with the following reported problems:-

- **Internal flooding** (under/over floorboards) to **19** properties
- **external flooding** (garden/drive/road) to an additional **40** properties
- **closure of Hull Road** (A1079) both in-bound/out-bound for **5 hours**

This is therefore regarded by the Council as a significant flood event, meriting an investigation under Section 19 of the Act. Initial investigations also indicated that similar flooding has been experienced in the past.

Figure 3 shows that there were ten areas affected by significant flooding (2 or more properties)

Investigations by CYC and YWS established that a number of factors combined together to cause the flooding experienced at Badger Hill / Hull Road.

Lack of knowledge of critical drainage infrastructure, combined with subsequent lack of maintenance by several parties, caused a build up of problems over the years.

The intense storm of 10th June, and the subsequent flooding that ensued, highlighted deficiencies in several areas of the Badger Hill Estate and on Hull Road that were long-standing and had not been addressed by those responsible for their maintenance. Neither CYC nor YWS had received flooding complaints in the past.

There has been concerted action and co-operation by the relevant responsible bodies to ensure that the immediate flood risk was minimised, with remedial works as detailed in Table 1 in Appendix 1 and shown on Figure 3.

An in-depth study of the drainage network by CYC and YWS is required to ensure that other factors are not causing wider scale under-capacity problems.

Asset records have been up-dated to unsure that infrastructure is logged and maintenance regimes established by the relevant bodies.

Residents should be informed of the change to planning law regarding additional front garden paving, and asked to ensure that debris is not dumped into road gullies.

Performance of the drainage system should be monitored and residents should be encouraged to report any future flooding problems to CYC's Flood Risk Management Team on 01904 553466 or FRM@York.gov.uk

1. Introduction

1.1 LLFA Investigation

City of York Council (CYC), as the Lead Local Flood Authority (LLFA), has a responsibility under Section 19 of the Flood and Water Management Act 2010 (FWMA) to investigate significant flood incidents in its area.

Section 19 states:

(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.

The Council, as LLFA, has provisionally defined its criteria for the instigation of investigations under Section 19, pending the publication of its Local Flood Risk Management Strategy, as follows:–

1. The internal flooding of one or more residential or business properties.

2. A risk to life as a result of the depth and/or velocity of floodwater.

3. Critical infrastructure (e.g. emergency services buildings, utility company infrastructure, schools, day centres, hospitals and main transport routes) suffering flooding or obstruction, or were in imminent danger of flooding.

4. The imminent danger of flooding of five or more properties.

The incident which is the subject of this report meets criteria 1 and 3.

The report will be published on the council's website, copies delivered to those authorities deemed responsible for further action in relation to the flooding and copies delivered to those residents and businesses who suffered flooding.

1.2 Location of Flooding

The Badger Hill / Hull Road (A1079) area is located approximately 3km east of the centre of York, as shown on **Figure 1**. The estate is predominantly residential with a row of local shops on Yarburgh Way. The housing was developed in the early 1960s and during the same period Archbishop Holgate's School, to the west of the estate, was also built. The A1079 Hull Road dual carriageway forms the northern boundary of the estate, with Field Lane forming the eastern and southern boundaries. South of the estate beyond Field Lane is the new Heslington East University of York (UoY) campus.

1.3 Current Drainage Network

Figure 2 shows the recorded extent of the Yorkshire Water Services (YWS) public sewerage network. The Badger Hill estate is served by separate foul and surface water sewers which flow in a generally southerly direction.

The surface water sewers originally discharged to a watercourse, which eventually joined Germany Beck. The recent development of the UoY diverted outfalls from the estate into their attenuation lakes. Ultimately, flows from the attenuation system discharge to Germany Beck.

The foul system also flows generally southward, connecting into Field Lane, which then runs south-westwards to School Lane.

CYC is responsible for the road gullies in the public highway and their piped connections to the public sewerage system on the estate. There is no separate highway drainage system within the estate.

The CYC highway gullies on Hull Road lead to two un-recorded highway drainage networks. The western half connects to the YWS surface water sewer at the junction of Hull Road / Yarburgh Way, just upstream of Tank 'A' (discussed below). The eastern half of Hull Road connects to a culverted watercourse, running north-easterly to the rear of Cavendish Road. This eventually connects to Osbaldwick Beck. These details, along with catchments boundaries, are shown on **Figure 3**.

2. Drainage History

2.1 Previous Flooding Incidents

The Badger Hill estate suffered from flooding during the 1970s. Although no records of the trigger events exist, flooding was extensive enough to require the two-stage flood relief schemes described in 2.2 below.

Flooding to Hull Road, opposite its junction with Canham Grove (Figure 3, Area "J"), had been noted by CYC in June 2007. However, as no properties were reported to have flooded at the time, further investigations were deemed to be low priority.

2.2 Previous Flood Alleviation Works

In the late 1970s York City Council, as agents for Yorkshire Water Authority, carried out modifications to the surface water sewerage system in an attempt to cure the flooding. During Stage 1, two large tanks were built (Tank 'A' and Tank 'B' in Areas "A" & "B") to attenuate the flow and provide additional storage volume, as shown on **Figure 3**.

Tank ‘A’ (near the entrance to Archbishop Holgate’s School on Yarburgh Way), consists of a series of oversized pipes. Outflow from the tank was controlled by a float valve. This restricted flow into the system when high downstream water levels occurred, but was replaced some years ago by a stainless steel orifice plate (75mm diameter hole at invert level restricting the flow) due to seizure of the original mechanism.

Tank ‘B’ (near the old southern entrance to Archbishop Holgate’s School on Bishopsway), consists of a series of oversized pipes, originally controlled by a motorised butterfly valve, which also restricted flow when high downstream water levels occurred. This is known to have been un-operational for a number of years.

The Stage 2 works, built in 1982, entailed the construction of a duplicate surface water sewerage system, serving the western half of the estate, to augment the overloaded original system (see **Figures 4 and 5**).

2.3 Recent Additional Development

There has been some re-development at Archbishop Holgate’s School. However, although the existing car park was replaced by buildings, there was no increase in impermeable areas and run-off from the new building has additional attenuation and storage.

The construction of patios and new driveways to the existing houses has increased the impermeable runoff in the Badger Hill system.

Construction of the large new roundabout at the junction of Hull Road / Field Lane increased the run-off into the head of the Osbaldwick system.

2.4 Flood Incident - 10 June 2012 (refer to Figure 3: Key Plan)

Intense rainfall on 10th June 2012, further discussed in 3.3, resulted in the following reported problems:-

- **internal flooding** (under/over floorboards) to **19** properties, occasioning damage to at least 5 properties (75mm deep flood over floorboards),
- **external flooding** (garden/drive/road) to an additional **40** properties / areas,
- **closure of A1079** (Hull Road) both inbound/outbound for **5 hours.**

The fire brigade assisted several of the worst affected properties with pumping at the northern end of the estate (Area "D") and the Council's workforce attended with a tanker to alleviate the highway flooding on Hull Road (Area "J), but with little success. CYC's Duty Emergency Officer attended during the event, but the flooding was not witnessed by the Flood Risk Management team.

YWS did not receive any customer contacts or communication that flooding was occurring and as a consequence was unaware of a flooding incident at the time.

2.5 Rainfall Analysis

The rainfall on 10th June was preceded by three days of less intense rain, as shown on **Figure 6.** It can be seen that these events were each spread over 4-6 hours, which would have filled the drainage systems, but not caused extensive flooding. The 10th June storm was over a much shorter duration (51minutes), producing intense localised rainfall**, shown on **Figure 7**. Analysis by YWS calculated the return period to range from 1 in 7-years to 1 in 31-years, which they classed as exceptional. However, modern sewerage systems should have capacity for these storms, without causing flooding. This flood risk investigation shows that other factors had considerable influence on the extent of flooding.

** This information was kindly provided by the UoY Electronics Department weather station located at the West Campus (1.5km from the Badger Hill estate).

(http://weather.elec.york.ac.uk/archive.html)

3. Recent Flooding Investigations and Remedial Work

3.1 CYC Investigations

The first attendance at the site by members of CYC's Flood Risk Management team was on 14 June 2012, when high surcharge levels in the highway drainage system were still being experienced. From the initial flooding reports, investigations by CYC were focussed on areas "A" to "D", with results as follows:

Discussions with a resident affected by internal flooding on Yarburgh Way indicated that the road suffered from recurring flooding with heavy rainfall. As neither CYC nor YWS had received any flooding complaints, CYC sent out flooding questionnaires to all the residents on the Badger Hill Estate. This revealed the extent of the problem listed in 2.4, and is discussed further in this report.

Area "A" – Hull Road / Yarburgh Way junction
An initial inspection of the (un-recorded) highway drainage in Hull Road found it to be surcharged throughout the majority of its length. At its connection into the Yarburgh Way public surface water sewer (Area "A"), water levels were standing approximately 1.0m deep within the manhole, with no discernible flow. Checks of the pipework outside 1 Yarburgh Way, later confirmed to be a YWS surface water sewer, showed no surcharge in level. This indicated that a problem existed between the two manholes.

Tank 'A' was found to have high water levels and blocked with silt and debris. The only outflow was through a high level relief in the manhole (150mm diameter). To lessen the chance of a recurrence of flooding, the blockage of the orifice plate was released by CYC. However, a large amount of silt remained in the YWS upstream tanks, significantly reducing its design volume. Details of the flooding and siltation problems were reported to the YWS Help Desk on 15 June (Ref.K086337), stressing the urgent need to address the defects with the storage tank.

Some questionnaire responses from residents indicated that water was running off Hull Road into Yarburgh Way "like a river" during the 10 June storm. A more in-depth investigation by CYC revealed that all the western half of Hull Road's highway drainage (199 to 261) had tree roots and

siltation problems, causing blockages and permanent surcharge in 90% of the system. This contributed to the excess run-off into Yarburgh Way during storms. These have now been cleared and are fully operational.

Area "B" – Bishopsway

Following further investigations by CYC, another YWS storage tank (Tank 'B') was also found to have high water levels, within 200mm of the manhole covers, with evidence of recent flooding to the adjacent property. It was also noted that the controls for the motorised butterfly valve were no longer in operation (no power supply). This was reported to YWS for investigation on 13 July (Ref.K107493).

Residents allege that a ditch was filled in to the rear of Bishopsway in the grounds of Badger Hill Primary School, contributing to the flooding of gardens. This will be investigated by CYC in the spring of 2013, once the area dries sufficiently to allow excavations to take place.

Area "C" - Crossways

Defective gullies were replaced, but it was noted that high surcharge levels had been present in the YWS surface water sewer. Discussions with a neighbour indicated that flooding in both foul and surface water public sewers was a problem. This was also reported to YWS for investigation on 13 July (Ref.K107493).

Area "D" – Yarburgh Way / Crossways junction

The road gullies immediately adjacent to the flooding on Yarburgh Way / Crossways (Area "D") were checked by CYC shortly after the flood on 10 June and all were found to be operational, albeit with some debris in the bottom of the pots.

High water levels following a later heavy rainfall event were noted by CYC in YWS's Yarburgh Way surface water sewer (Area "D"). This was found to be as a result of partial blockage due to silt / cement debris in the pipework. CYC partially removed the blockage on behalf of YWS, which was seen to immediately relieve the surcharged sewer. This was reported to YWS for further investigation.

Areas "E - Deramore Drive / Area "F" – Amenity Area
Resident's questionnaire responses complained of internal foul sewage flooding during heavy rainfall, which also appears to contribute to the pollution and large area of flooding reported in the Amenity Area. This was passed onto YWS for investigation.

Area "G" – Kimberlows Wood Hill
The CYC highway drainage was found to be affected by tree roots. This was removed and a replacement gully installed.

Area "H" – Hesketh Bank
CYC highway gullies were checked and it appears that the original builder never installed a connection to the surface water sewer. The gully was re-connected, but further gullies are to be checked by CYC for missing connections.

Area "J" and "K" - Eastern half of Hull Road (285 to 335)
Siltation, causing complete blockages and permanent surcharge in all highway drains was found, with all road gullies inoperative. Buried manholes have been located, and 75% of the system cleared. The outfall for the highway drainage connects to a defective private culvert, running between Cavendish Road and Brandsdale Crescent. Despite numerous attempts to clear this length by CYC, the culvert remains severely restricted and requires more investigation in the near future by the Council. Its location, size and condition are un-known, but several large trees and hedge lines are adjacent to the old beck line. Few residents will be aware of the culvert, or their riparian obligation to maintain it under the Land Drainage Act.

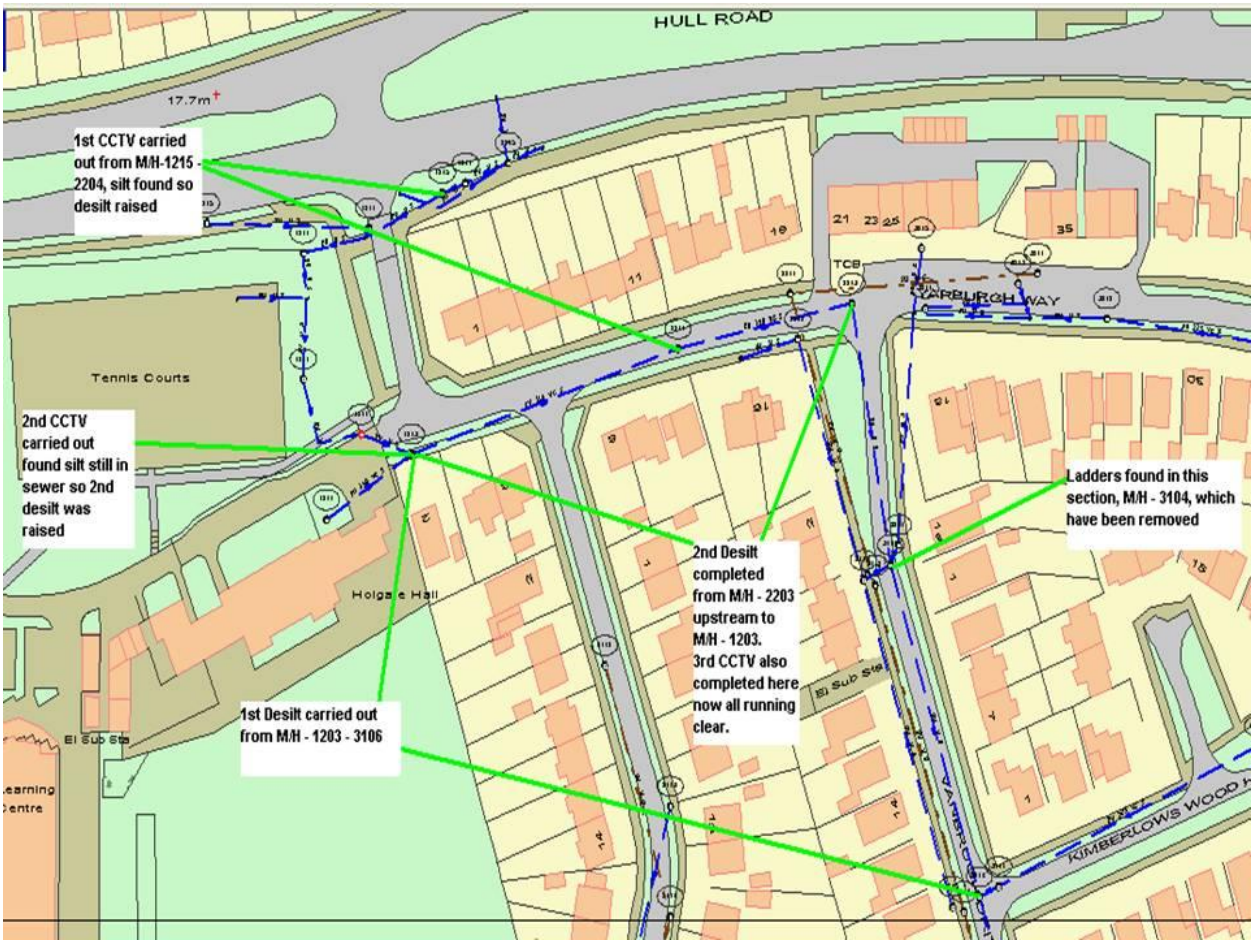
3.2 YWS Investigations

TANK 'A'
Following the report of siltation of Storage Tank 'A' to YWS by CYC on 15 June (Ref.K086337), their contractor cleared the control chamber manhole of silt, but failed to clear the main tanks.

Subsequent CCTV investigations carried out by Yorkshire Water and their contract partners, Lumsden & Carroll, identified the presence of large

quantities of sediment, silt and cement grout in the public surface water sewers. Remedial works were undertaken to cleanse the sewers. The survey also identified the presence of debris and a ladder in a public sewer manhole on Vanbrugh Drive resulting in a restriction on flows. This was removed by a man-entry team.

Although the tanks were cleared, constant high water level was still being experienced. YWS and CYC flood engineers met on site on 11 October, when YWS agreed to carry out further investigatory works. Additional de-silting works were carried out on the public surface water sewer on Hull Road, between the head of the public sewer system and the storage tanks in the grounds of Archbishop Holgate School.



TANK ‘B’

The problems with this tank were reported to YWS on 13 July, (Ref.K107493). It was alleged that YWS inspected the site and reported to

the adjacent resident that there was no problem with the “pumps” and that they were operating correctly. There are no pumps at this location and there is no power supply to the butterfly valve to enable it to operate as designed. The tank was subsequently desilted. An inspection was carried out on 3 October to confirm that the tank was clean.

Future maintenance plans have been initiated to carry out monthly inspections of the detention tank, with cleaning to be raised as and when required.

Further investigatory works will be undertaken to check the operational state and condition of the butterfly valve. Appropriate measures will be implemented to reinstate valve and/or controls as necessary, in accordance with business processes.

Plans for management and mitigation will be implemented on completion of investigations.

4. Cause of Flooding and Remaining Problems

CYC has carried out an assessment of site investigations, flooding questionnaire responses and historic records, and reports that the probable causes of flooding on June 10th 2012, and the responsible bodies, are as follows. These problems have built up over an extended period of time and jointly contributed to the flooding problems.

4.1 CYC Assets

4.1.1 Hull Road Highway Drainage Network (Area "A" - west)

Virtually no public surface water sewers exist in this section of Hull Road, with the CYC highway gullies connecting to an un-recorded highway drainage network. The highway drainage was un-maintained and almost all was blocked by tree roots / siltation, causing loss of storage volume. This will have resulted in overland flow during heavy rainfall, significantly adding to the flooding at Hull Road and Yarburgh Way, reported by residents in the flooding questionnaires.

Remaining problems - none.

4.1.2 Hull Road Highway Drainage Network (Areas "J & K" - east)

No public surface water sewers exist in this area. All highway drainage connects an un-recorded, un-maintained highway drainage network. This then connects to a defective private culvert, which severely restricts the available outflow, resulting in continued flooding problems.

Remaining problems – outfall capacity needs restoring as a matter of urgency, in co-operation with riparian owners of the downstream culvert.

4.1.3 Yarburgh Way / Crossways

The CYC highway gullies in both streets connect to the YWS public SW sewers. All gullies were checked and were found to be operational, with no restriction to flow. Some builder's debris (mainly cement) was removed from the bottom of the pots and may have entered the public sewers.

Remaining problems - none.

4.1.4 Other isolated location within Badger Hill

Questionnaire responses indicated that a number of other highway locations were reported to flood regularly within the estate. These have all been checked and four defective gullies were replaced and tree root ingress has been cleared.

Remaining problems - none.

4.1.4 Badger Hill Primary School

Questionnaire responses suggest that a drainage ditch between the primary school and houses on Bishopsway used to exist, but this was filled in at some time in the past. The line of the old ditch flooded on 10 June, affecting the rear gardens of the properties.

Remaining problem unresolved - investigation of this problem is to be carried out by CYC in the near future.

4.2 Archbishop Holgate's School Assets

4.2.1 School Access Road

The school access road has only one gully serving over 500m² of impermeable area. This was blocked at the time of the flooding incident, allowing rainwater run-off to by-pass the detention tank and flow directly onto Yarburgh Way.

Remaining problems – there are insufficient number of gullies to deal with contributing area. The school has been requested to install additional gullies during 2013 summer holidays.

4.2.2 New Disabled Footpath

A new 3m wide path was constructed in 2008 to allow disabled access to the school and adjacent tennis courts. No gullies were installed to collect the run-off, again allowing rainwater run-off to by-pass the detention tank and flow directly onto Yarburgh Way.

Remaining problems – unresolved. The school has been requested to install interception and storage of overland flow, in the 2013 summer holidays.

4.2.3 School Extension

The run-off from the new school extension has attenuation, and should not have increased flood risk. However, it is suspected that the building work has resulted in cement grout being washed downstream into the control manhole for Tank ‘A’ and the immediate downstream SW sewer. This would have added significantly increased the siltation and blockage problems in the YWS assets, which has now been cleared.

Remaining problems - none.

4.3 YWS Assets

4.3.1 Yarburgh Way Storage Tank ‘A’ and Yarburgh Way SW Sewer

Although a SW sewer was shown adjacent to the tennis courts on YWS records, no mention was made that it was a storage tank requiring regular maintenance, especially the control manhole containing the 75mm dia. orifice plate. The blockage of the orifice by cement grout / silt caused the storage tank to silt up (80% full). This siltation and high water levels extended back into the highway drainage system on Hull Road, reducing it’s storage volume. The combination of the blockage in the tank, with the blockages within the CYC highway drainage, caused water to flow overland from Hull Road and flood Yarburgh Way / Crossways.

Yarburgh Way’s SW sewer was affected by silt and cement grout, as a consequence of sewer network abuse and inappropriate disposal to sewer. This significantly affected its capacity during storms. Frequent highway flooding had occurred previously, as a result of the gullies not being able to drain into the surcharged SW sewer. Neither CYC nor YWS have any records of reported flooding. The intense rainfall on June 10 totally overloaded the system and caused the flooding to houses at the junction of Yarburgh Way / Crossways.

Remaining problems - none.

4.3.2 Bishopsway Storage Tank ‘B’

The original storage tank design used sensors in the downstream sewer in Crossways to operate the motorised butterfly valve. Water levels less than 50% pipe full allowed the flow from the school to freely discharge. Once the 50% level was exceeded, the valve was actuated, stopping off the flow and

diverting in into the storage tank. Although recorded on the YWS network as a storage tank with attendant control devices, vandalism to the electricity supply led to the facility falling into disuse. This was never repaired and the electricity meter and motor controls were stripped out by YWS, with (presumably) the valve being left partially opened.

During rainstorms, the tank would have filled prematurely, resulting in overland flow and flooding to properties in Bishopsway. This problem was reported to YWS by a local resident, who was allegedly told that the device was working as designed. YWS have no record of this conversation. The tanks have since been desilted.

Remaining problems - this is still currently under investigation and being put through a capital process for repair work. There is also a new maintenance regime being implemented for both these tanks.

4.3.3 Crossways

Interviews with residents shortly after the 10th June storm, and subsequent questionnaire responses, indicated high levels of surcharge in the YWS SW sewer downstream of the Bishopsway Tank. This was also witnessed by CYC Flood Risk Engineers and indicates that a problem of either under-capacity in the system or that a physical downstream constriction exists e.g. collapse / tree roots. The longitudinal sections, shown on Figure 3, show parts of Crossways to have relatively shallow manholes and corresponds to the location that flooding was experienced. Site inspection revealed that several extra road gullies had been installed to deal with the flooding.

Remaining problems - this is still currently under investigation by YWS to establish if under-capacity is a problem or other factors further downstream may be having an influence.

4.3.4 Deramore Drive / Playing Fields

Surface water and internal foul sewage flooding has occurred several times previously at this location. Residents complained of “sewage flooding internally in the kitchen...road in front of properties kerb deep in water containing raw sewage...playing field several inches under water including raw sewage”. The longitudinal sections, shown on Figure 3, also show this

area to have relatively shallow manholes and corresponds to the location that flooding was experienced.

Remaining problems - this is still currently under investigation by YWS to establish if under-capacity is a problem or other factors further downstream may be having an influence.

Part of the UoY surface water diversion work in 2009 (YWS Ref.B2947) was to remove an emergency overflow from the foul pumping station serving Field Lane and replace the existing pumps. A connection runs from the foul sewer serving the flooded houses on Deramore Drive to this pumping station, giving an indication that an under-capacity problem existed (or still exists) and that this was probably laid as an emergency relief sewer.

The Field Lane Pumping Station and the sewer from Deramore Drive connect together near the junction of Field Lane and Badger Wood Walk.

Remaining problems - YWS was informed of the problem and has undertaken to investigate it further.

4.4 Householders Work

4.4.1 Building Works Tipping

It was noted during the cleaning of gullies in Badger Hill that a significant number had deposits of cement / plaster in them, presumably emptied in during building renovation works on nearby households. Although Badger Hill is not unique in this problem, this practice reduces the capacity of gully pot and can cause premature blockage and possible flooding.

Remaining problems – none, but letter to be sent to householders to warn of increasing flood risk posed by building debris.

4.1.2 Paving Over of Front Gardens

The growing trend of turning front gardens into parking areas, especially with some student lets, leads to a significant increase in impermeable area and surface water runoff into the drainage network. This is a nation-wide problem and has led to the need for legislation to control this. **Any new**

impermeable greater than 5m² (less than half an average parking bay), **is now required to have Planning Permission,** unless it connects to soakaway.

Remaining problems – letter to be sent to householders to warn of increasing flood risk by un-regulated development.

5. Risk Management Authorities Consulted

The following authorities are considered to have relevant responsibilities in the vicinity of the flooded properties and have been consulted during the preparation of this report.

- Lead Local Flood Authority (City of York Council)
- The Highway Authority (City of York Council)
- Water and Sewerage Company (Yorkshire Water Services)

Neither the Environment Agency nor any of the Internal Drainage Boards are considered to have any responsibility for the cause or resolution of the flooding in this case.

6. Recommendations

The identified deficiencies causing the flooding, and recommended actions and timescales to address these, are shown on Table 1 in Appendix 1.

7. Conclusions

A number of factors combined together to cause the flooding experienced at Badger Hill.

Lack of knowledge of critical drainage infrastructure, combined with subsequent lack of maintenance by several parties, caused a build up of problems over the years.

The intense storm of 10 June, and the flooding that ensued, have highlighted deficiencies in several areas of the Badger Hill Estate and on Hull Road that are long-standing and have not been addressed by those responsible for their maintenance.

There has been concerted action and co-operation by the relevant responsible bodies to ensure that the immediate flood risk was minimised. An in-depth study of the drainage network by CYC and YWS is required to ensure that other factors are not causing wider scale under-capacity problems.

Asset records have been up-dated to unsure that infrastructure is logged and maintenance regimes established by the relevant bodies.

Residents should be informed of the change to planning law regarding additional front garden paving, and asked to ensure that debris is not dumped into road gullies.

Performance of the drainage system should be monitored and residents should be encouraged to report any future flooding problems to CYC's Flood Risk Management Team on 01904 553466 or FRM@York.gov.uk

Emergency contacts are as follows:

YWS - 0845 1 24 24 24
CYC - 01904 625751

Abbreviations

CYC	City of York Council
EA	Environment Agency
FIR	Flood Investigation Report
FWMA	Flood and Water Management Act 2010
LDA	Land Drainage Act 1991
LLFA	Lead Local Flood Authority
UoY	University of York
WRA	Water Resources Act 1991

Appendix 1

Figure 1: Location Plan

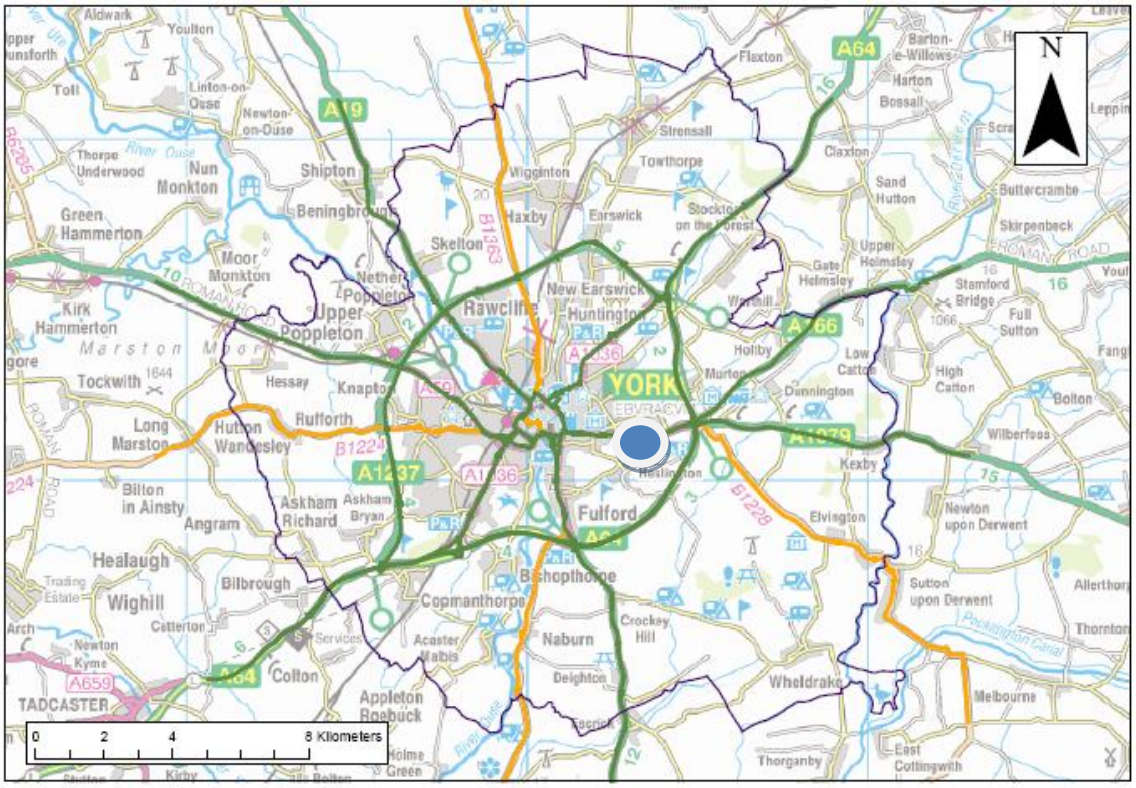


Figure 2: Yorkshire Water Services Public Sewerage Network

Map Notes:

0 50 100 150 200 250
Metres

Figure 3: Flooding Key Plan

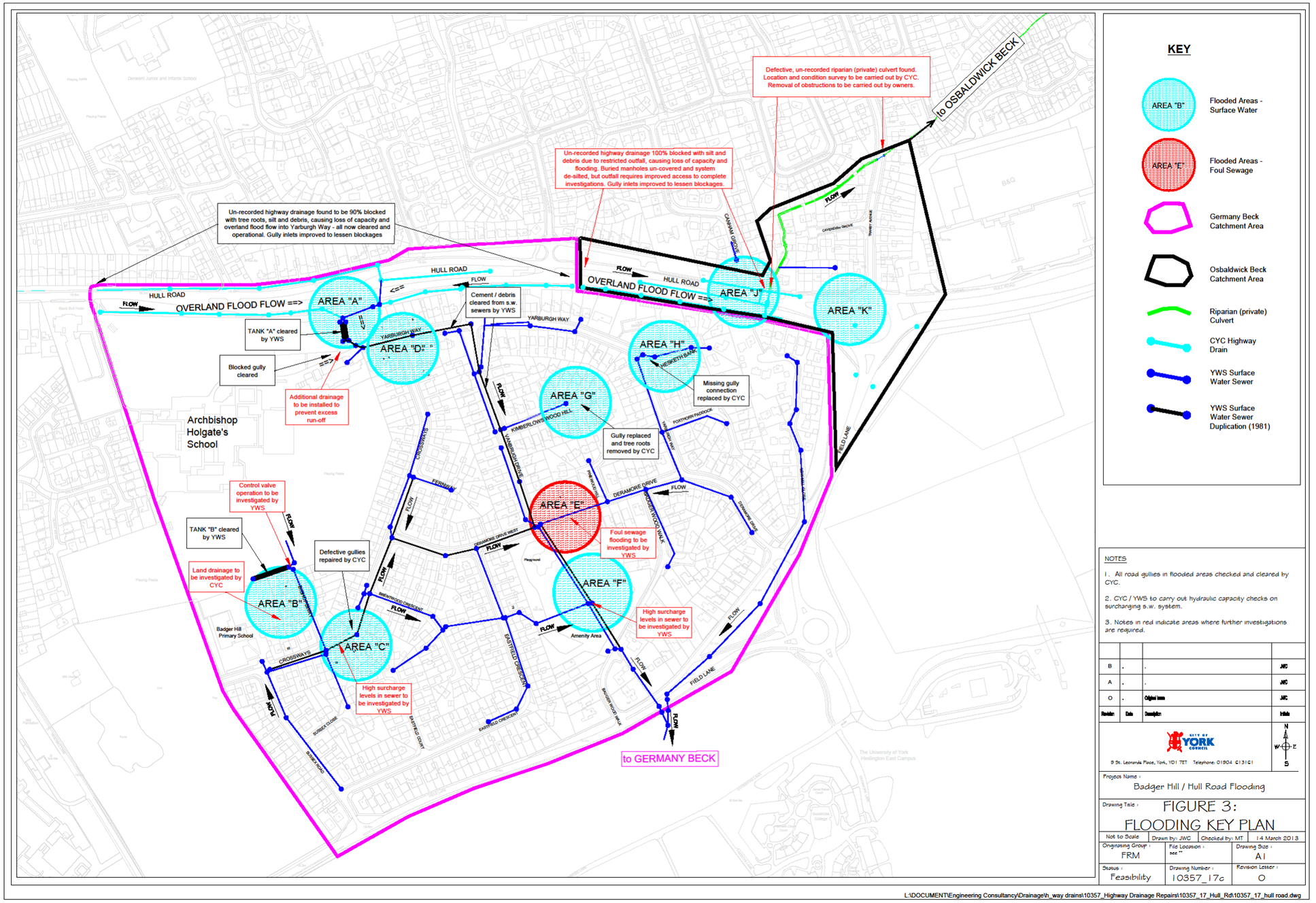


Figure 4: Badger Hill Flood Relief Scheme (1981) – Proposed Plan

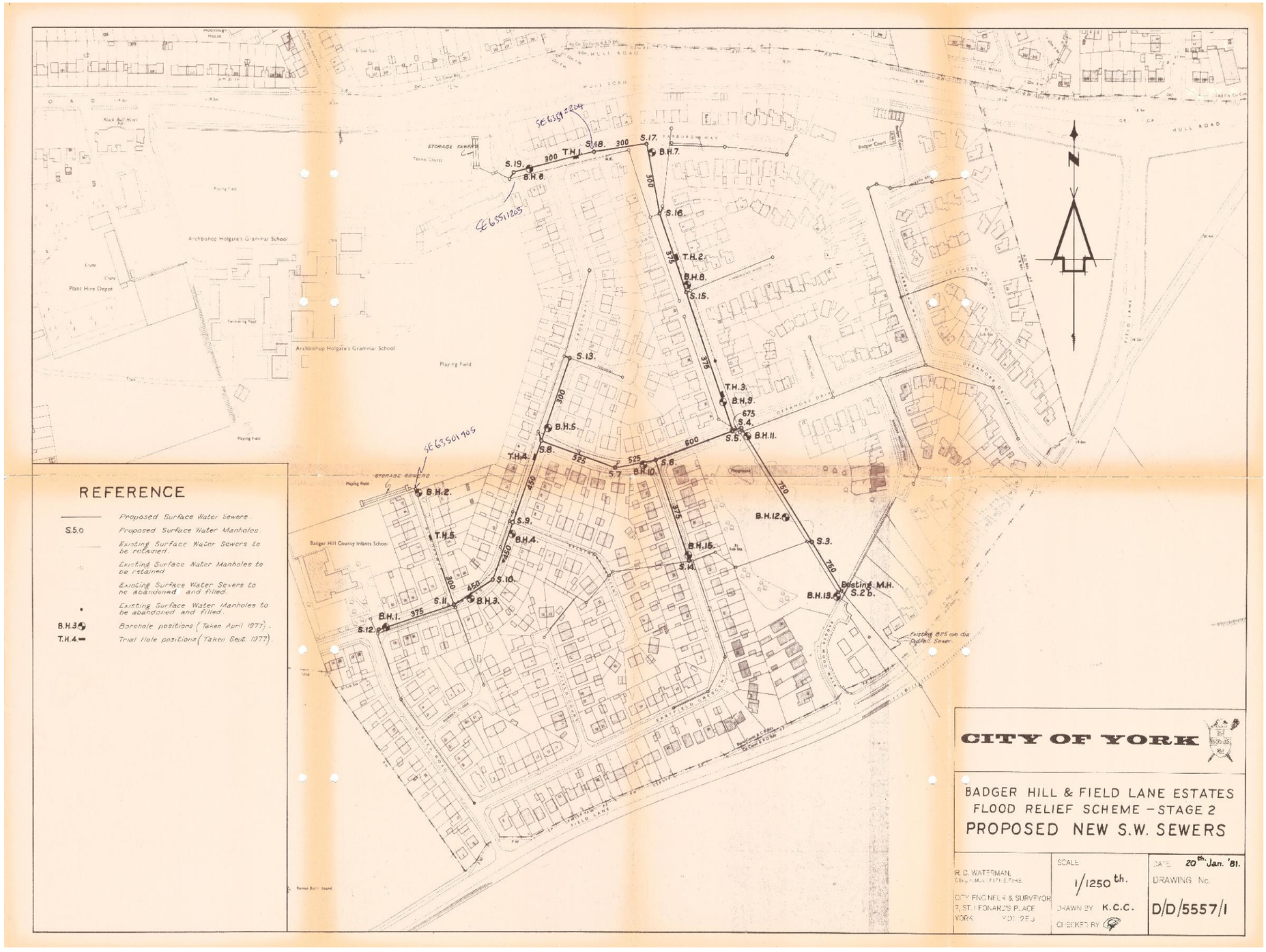


Figure 5: Badger Hill Flood Relief Scheme (1981) – Proposed Longitudinal Section

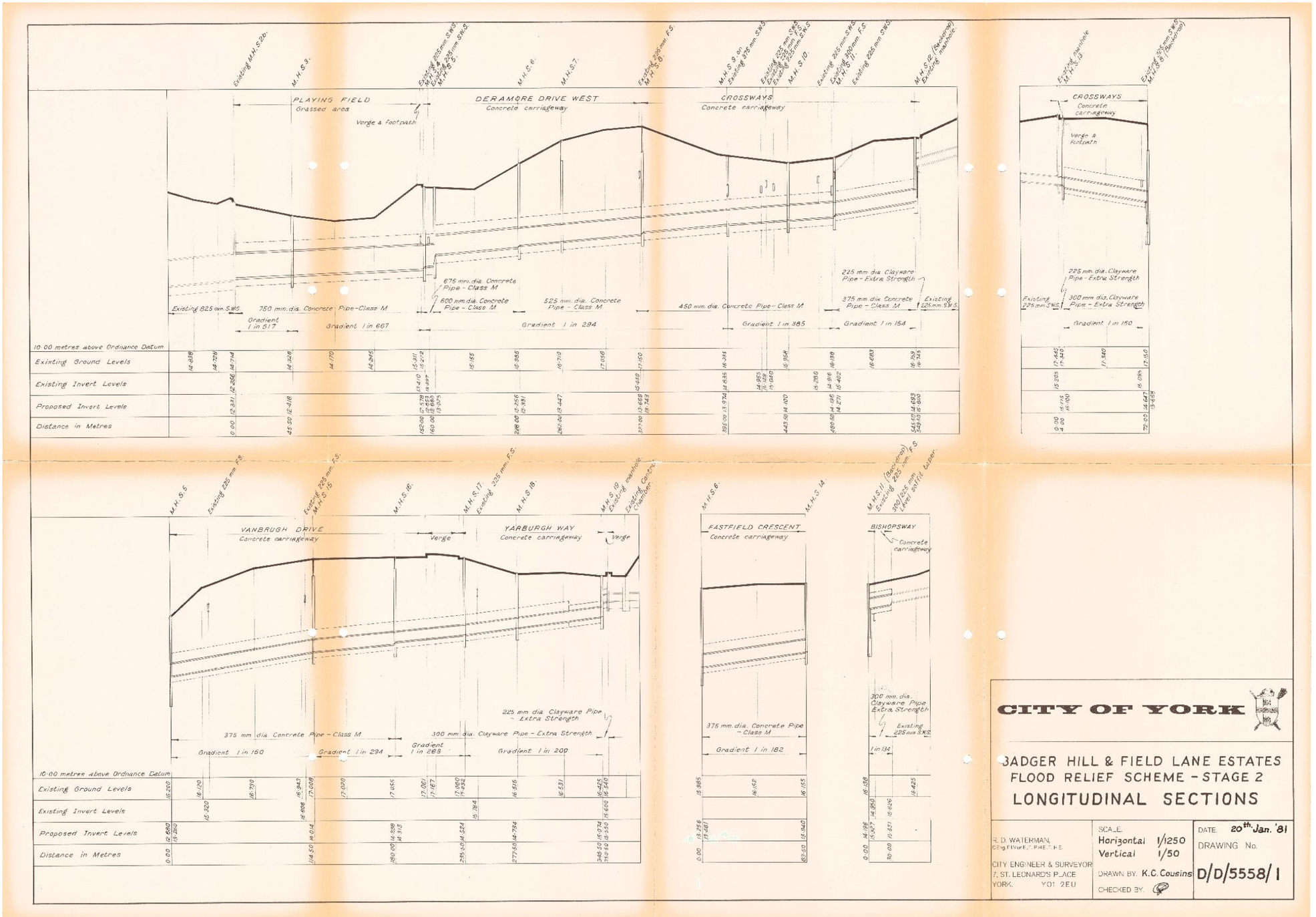


Figure 6: Badger Hill Daily Rainfall Totals: 7-10 June, 2012

	Total Rainfall (mm)	Duration (hh:mm)
Thursday 7 June	13.8	06:18
Friday 8 June	9.4	05:19
Saturday 9 June	8.9	04:41
Sunday 10 June	8.5	00:51

Figure 7: Badger Hill Rainfall Intensity - 10 June 2012

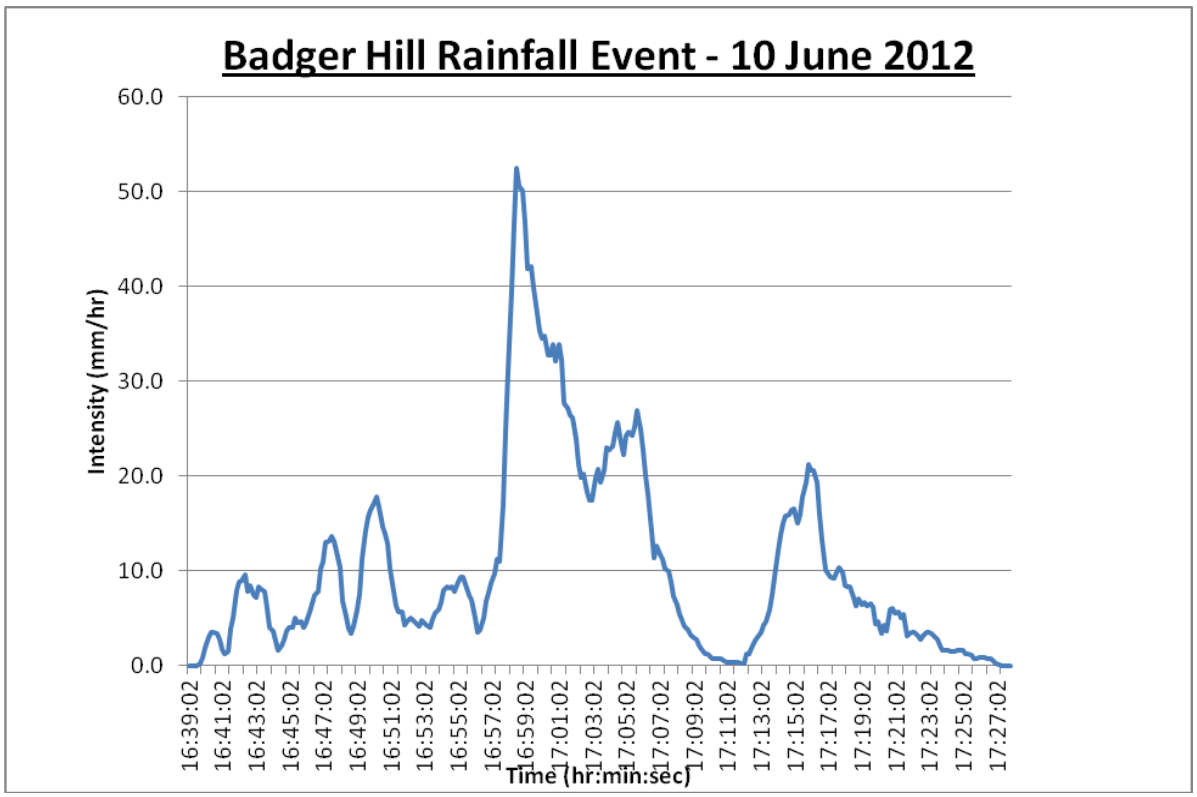


Table 1: Identified Defects and Actions

Authority / Stakeholder	Identified Defects	Actions Taken To Date	Recommended Actions and Timescales
CYC	Lack of drainage records on Hull Road (western half) and siltation of manholes, pipework and gullies.	Western half of Hull Road de-silted and fully operational. Asset register updated.	Carry our yearly maintenance.
	Lack of drainage records on Hull Road (eastern half) and siltation of manholes, pipework and gullies.	Eastern half of Hull Road de-silted. Manhole access improved (outfall still partially blocked). Asset register updated.	Clear outfall and blocked riparian culvert in Spring 2013.
	Blocked / broken gullies and tree root infestation	All reported flood locations checked and cleared. Renewed 4 Nr. defective gullies and cleared tree roots.	Carry our yearly maintenance checks on tree rooted areas.
	Ditch in-filled at Badger Hill Primary School, causing flooding.	None, due to ground conditions.	Investigate further and take any necessary remedial action in spring 2013.
Archbishop Holgate's School	SW pipes and road gully silted up.	Gully cleared.	Install additional gully in summer 2013
	Disabled pathway discharging water onto Yarburgh Way, by-passing storage tank.	None.	Intercept flow and connect upstream of storage tank, in summer 2013.
YWS	Incomplete drainage records for storage Tank 'A' at Hull Road / Yarburgh Way junction, blocked orifice in control MH, silt build up in tank.	Completed updating of records and de-silting of tank.	On-going YWS cyclical maintenance to ensure silt levels do not build up in tank.
	Siltation of storage Tank 'B' and inoperative controls, causing flooding.	Tank de-silted. Records updated.	On-going YWS investigation into vandalism of asset and fitness for purpose in 2013.
	Flooding on Yarburgh Way / Crossways due to siltation and cement debris.	CCTV work and cleaning carried out by YWS.	Maintain pipework in future as required.
	SW flooding on Crossways / Bishopsway / play area off Deramore Drive.	None.	YWS undertake to investigate further and carry out works within regulatory business framework in 2013.
	Foul sewage flooding at Deramore Drive.	None.	YWS undertake to investigate further and carry out works within regulatory business framework in 2013.
Riparian culvert owners	Defective culvert blocking outfall from highway drainage from Hull Road (Area "J").	None – awaiting improved access for cleaning on Hull Road.	CYC to liaise with residents to clear outfall in spring 2013.