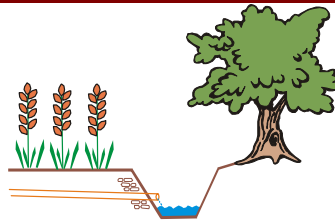


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## **CHERRY BURTON VILLAGE**

### **Flooding of Village**

**Prepared for Cherry Burton Parish Council  
By Jenny Lambert BSc (Hons) Dip Ag Eng  
November 26<sup>th</sup> 2008 (Version 2)**

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Appendix 1 Historic Drainage System

Appendix 2 Old Ordnance Survey Maps

Appendix 3 Proposed Storage Area

Appendix 4 Sketch Plan showing Location of Proposed Bypass Ditch/Pipe behind Canada Drive

Appendix 4a Longitudinal Section of Proposed Bypass Ditch behind Canada Drive

Appendix 4b Longitudinal Section of Proposed Alternative Pipe behind Canada Drive

## 1 INTRODUCTION

The village of Cherry Burton was severely flooded during the summer of 2007. Two separate areas of the village were affected. The first was along The Meadows which lies to the south of the village and the second was along Canada Drive which lies to the north of the village. Flood water entered many properties. These areas are shown on the aerial photograph below.



The purpose of this report is to understand the major factors which contributed to the flooding and to consider possible solutions which will significantly reduce the risk of future flooding through the village.

## 2 SEVERITY OF RAINFALL IN JUNE 2007

Without doubt the summer of June 2007 was exceptionally wet. It is however difficult to accurately quantify just how extreme the event was. However the following statistics have been published:

- River levels in Sheffield reached their 1 in 200 year levels. (The Pitt Report)
- Some areas got four times their average rainfall during June. The East of England got, on average 314% of its June rainfall.(Met Office)
- Some parts of the country had the wettest May to July since 1766 (250 years ago!) (The Pitt Report).
- *‘Two separate major flooding events occurred during the summer: one in late June, the other in late July. The June floods primarily affected parts of Yorkshire and the Humber, Derbyshire, Lincolnshire and Worcestershire, after a deep and slow-moving area of low*

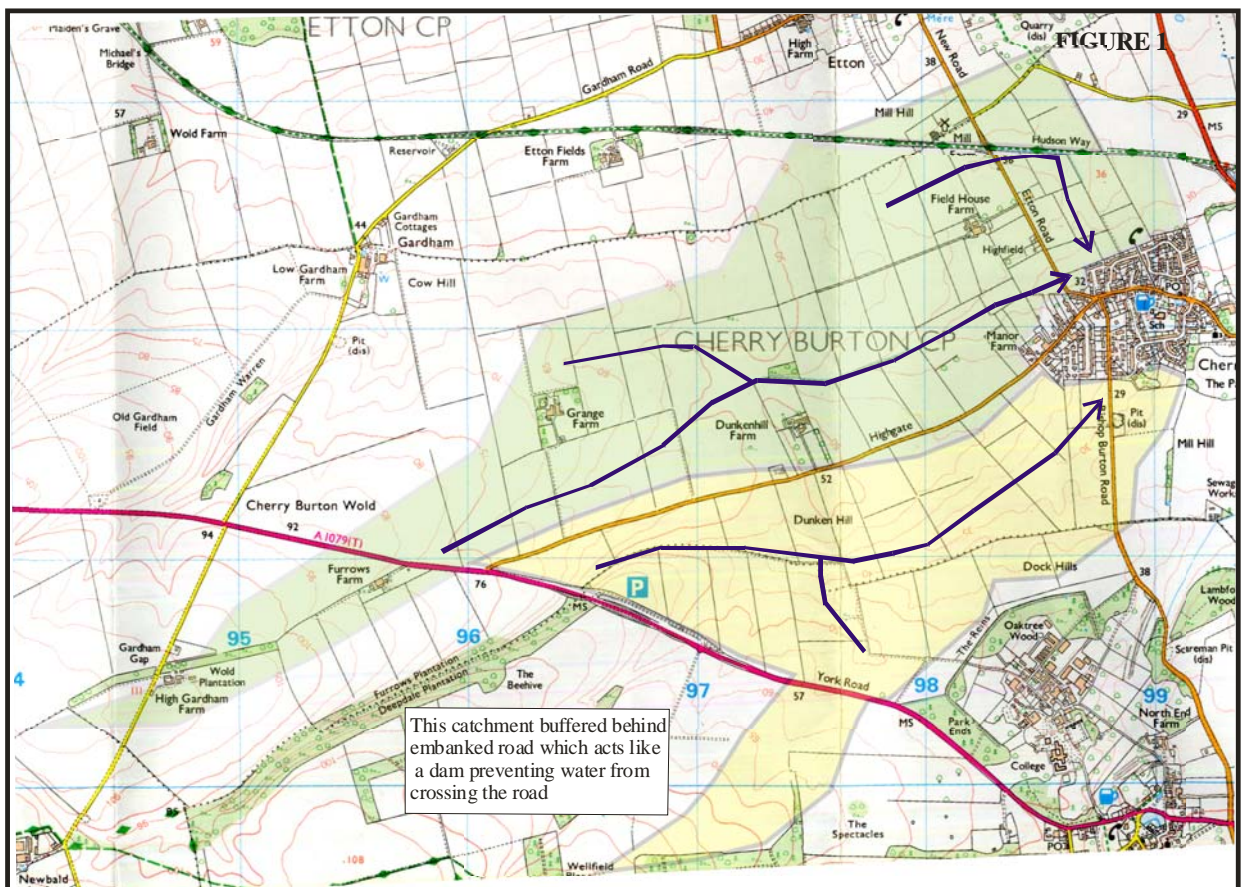
pressure brought prolonged heavy rain on 24–25 June. Up to 111mm (4½") of rainfall fell, with some places receiving over four times the average monthly rainfall. Urban northern cities Hull and Sheffield were particularly badly affected. A ‘one in 150 year’ rainfall event in Hull overwhelmed the city’s pumped drainage and sewerage system, resulting in over 7,000 houses, 90 local schools, and dozens of businesses being flooded.’ House of Commons. Environment, Food and Rural Affairs Committee, Flooding, Fifth Report Session 2007-08.

It is reasonable to assume that the rainfall event that occurred in Cherry Burton is, historically, only likely to occur only every 100-200 years. However it is possible that global warming and the inherent complexities of climate change may increase the likely frequency of such events.

### 3 FLOODING IN THE VILLAGE

The flood water entered the village from two directions as indicated on the plan at Figure 1 below.

Figure 1



The contributing catchments are shown coloured. Water from the catchment shaded yellow crossed the Bishop Burton Road just south of the village and entered The Meadows. Water from the catchment shaded green crossed Etton Road just north of the village and entered Canada Drive.

There is a surface water drainage system which runs through the village but the quantity of flow emanating from these catchments exceeded the capacity of these drains and consequently overland flow occurred with flood water discharging into properties on the low lying land.

The flood water eventually discharged into North Drain, a watercourse to the east of the village.

The extent of the flood was possibly reduced by the relatively recent modification to the A 1079 which cuts through the 'yellow' catchment area. This road is embanked by several meters with apparently no culvert underneath it. It therefore acted as a dam preventing water from west of the road flowing towards the village.

#### **4 EXISTING CHARACTERISTICS OF THE DRAINAGE CATCHMENTS**

Cherry Burton lies some 15km north of Kingston upon Hull. It is part of the Yorkshire Wolds and is underlain by chalk at depth although there are overlying deposits of till and glacio-fluvial drift in some areas around the village. Consequently the soils vary considerably, from freely draining shallow chalky soils to the west and heavier clayey soils to the south and east.

Cherry Burton lies at the confluence of two largely 'dry' chalk valleys running broadly from west to east. Beyond the village, to the east the topography flattens out as it approaches the flood plains of the River Hull. A smaller valley runs into the village from the dismantled railway to the north. There is a catchment of approximately 30 hectares north of the railway which drains through a culvert (approx 300-375mm diameter) into an open ditch above the village.

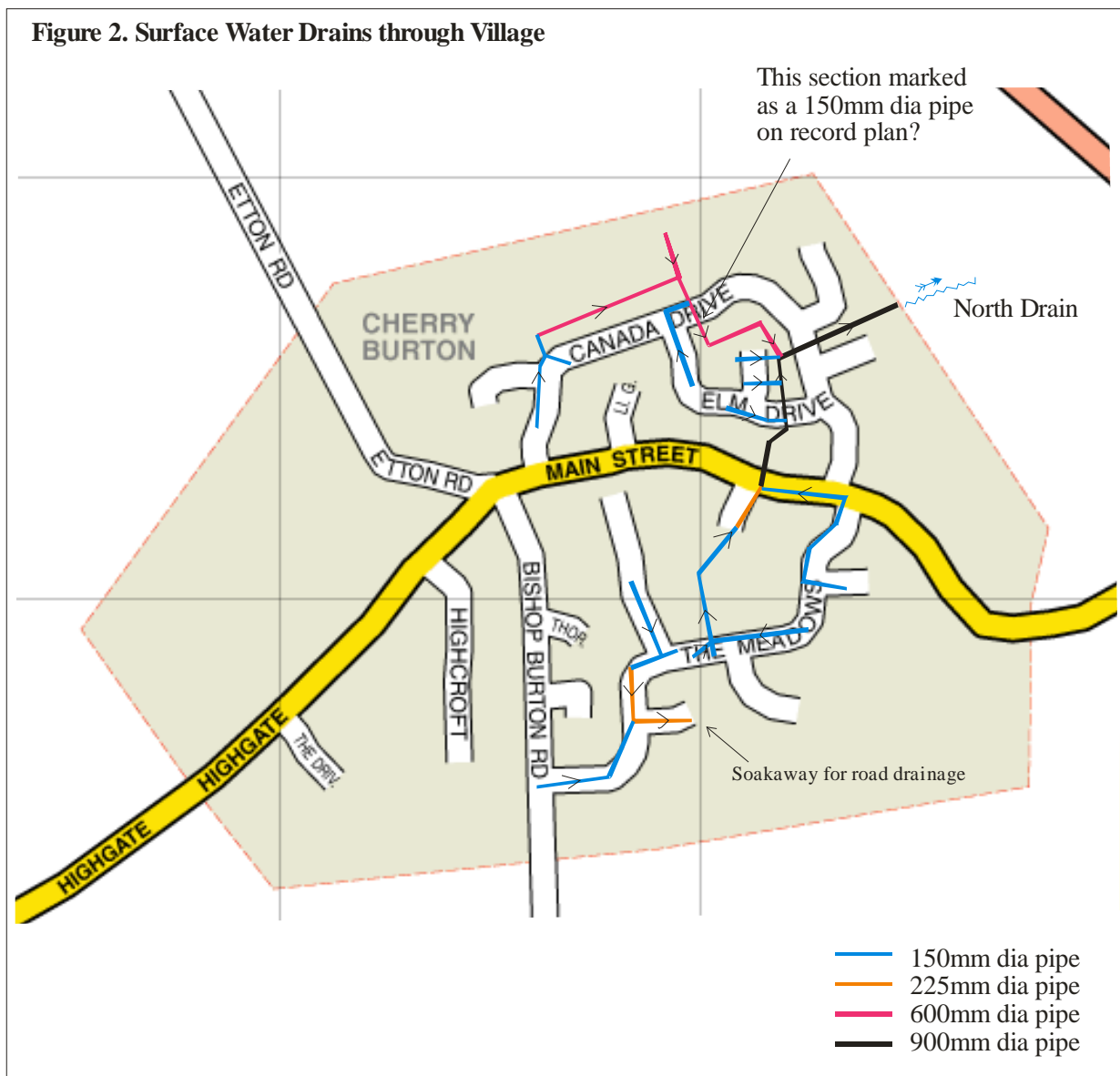
A total catchment of around 750 hectares falls towards the village. The catchments above the village consist generally of large arable fields. Further to the west some of the steeper dale sides are grass with some shrub/woodland.

Despite the existence of these quite pronounced valley features there are currently no significant watercourses entering or running through the village. There is little evidence of any ditches within the catchments themselves- the exceptions being a section of ditch close to the railway and another section in the valley feature north of Dunkeswell Farm.

However the watercourse known as North Drain starts just to the east of the village, where a 900mm dia surface water pipe discharge into it, and it then runs eastwards across agricultural land to cross under the B1248, through a golf course and more agricultural land towards Leconfield and onwards to the River Hull.

## 5 EXISTING DRAINAGE THROUGH THE VILLAGE

The main surface water drains that are believed to exist through the village are shown on Figure 2 below.



The ‘yellow’ catchment drains towards The Meadows. There is a series of road gullies outfalling into pipes and eventually into a soakaway. When the capacity of the soakaway is exceeded the water flows along The Meadows to be picked up by road gullies which discharge into a 150mm diameter pipe at the side of number 34. This pipe increases in size to 225mm diameter beyond the school and then enters a large 900mm diameter pipe under the road.

The 'green' catchment draining towards Canada Drive has a 600mm diameter pipe as its primary outfall. This eventually enters the same 900mm diameter pipe that takes the water from the 'yellow' catchment and the rest of the village. The 900mm diameter drain tips out into the head of North Drain.

## 6 HISTORIC DRAINAGE

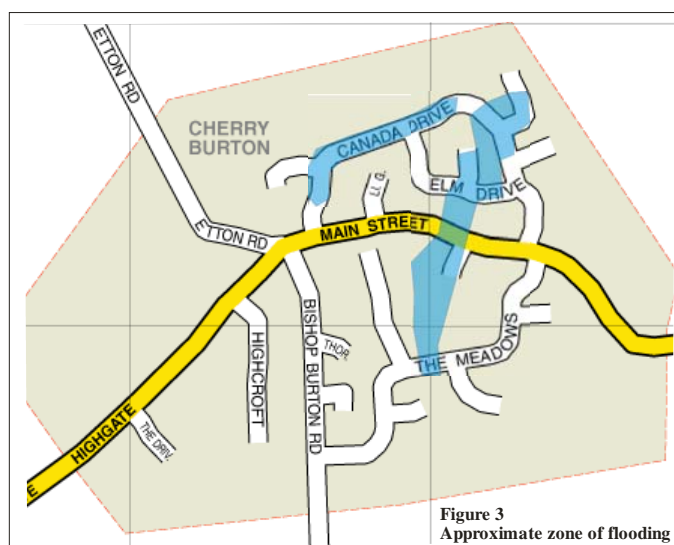
The plan at Appendix 1 shows the drainage through the village prior to the relatively recent housing developments. This plan is dated 1855 and shows quite clearly the existence of several open ditches. Other old maps are attached at Appendix 2. In particular a main ditch appeared to run all the way down the valley feature of the 'green' catchment and then skirted round the north of the village where it picked up a ditch from the railway before dog legging its way southwards towards North Drain. A similar feature is not seen along the valley of the 'yellow' catchment until it approached the village when an open ditch can be seen meandering towards and under the road near the aptly named Shop Dike. This ditch then dog legs northwards to meet North Drain.

It would appear that as the village has developed some of these ditches have been piped such that ditch A-H is the 600mm and K-H is the 900mm diameter surface water drains that exist today. Other ditches have not been maintained and are all but not existent.

## 7 CAUSE OF THE FLOODING

### 7.1 Extent of Flood

The diagram below shows the approximate extent of the flooding that occurred through the village. It is estimated that more than 60 properties were affected including the village school and shop.



## 7.2 Likely Peak Flows

Calculations have been done to try and assess the likely peak surface water flows that occurred through the village during June/July 2007. These should be considered as 'ball park' figures but give a good indication of the magnitude of the problem.

'Yellow' catchment	530 litres per second
'Green' catchment	890 litres per second
'Combined' catchment- flow to North Drain	1275 litres per second

## 7.3 Capacity of Existing Drains

The existing 900mm diameter pipe should have had the capacity to have all but coped with the combined flow (assuming it had a minimum gradient of 0.5%). However it is understood that North Drain was partly silted up such that at least one third of the 900mm pipe was full of silt. This would have significantly reduced the flow capacity of the 900mm diameter pipe. Witnesses to the event state that the North Drain itself flowed freely throughout the wet period and that there was no significant build up of water within the drain. Levels taken along the ditch suggest a reasonable fall which would substantiate this.

During the period of flooding the flow from the 'yellow' catchment crossed Bishop Burton Road and drained towards the low area of The Meadows. The soakaway could not take the volume of water and instead the flow turned eastwards and followed the road into the low area behind number 34. The gullies here are intended for road water only and they and the discharge pipe alongside number 34 could not cope with flood water. The storm drain here has a diameter of only 150mm opening out to 225mm as it passes the school beyond. The 150mm pipe is unlikely to have a capacity above 30 litres per second. Clearly it could not have taken the likely peak flow of 530 litres per second. Consequently significant overland flow will have occurred here and flood water will have followed the topography downwards across the school and towards Main Street. The 900mm diameter culvert starts in Main Street but the only access to it is via a few road linked to the main culvert through small diameter pipes. These drains and gullies would not have coped with the flow and the flood water would continue overland following the lowest route to the North Drain. This would involve the low areas of Elm Drive and Canada Drive.

The flow from the 'green' catchment will have entered the existing 600mm diameter pipe at the rear of 154 Canada Drive. This pipe has an estimated capacity of around 400 litres and so would not have taken the estimated may have been sufficient to take the peak flows of around 890 litres per second that may have occurred. In addition there are reports that there may have been a blockage in the pipe between numbers 124 and 122 Canada Drive

and this could have significantly affected the pipes capacity. This section of pipe is also recorded as a 150mm dia. pipe on a Record Plan. If this is the case, then the 600mm diameter pipe discharges into a section of 150mm diameter pipe and then back into the 600mm diameter pipe (see Figure 2 above). Clearly the 150mm diameter section would act as a significant bottle neck to any flood flows. I understand that a camera survey of this section of pipe has already been done and indicates that there is no such bottleneck and that the pipe is generally clear and free flowing. However this has yet to be confirmed to me.

Witnesses to the flood are confident that the surface waters came from two separate directions ie the water from the 'green' catchment caused the flooding to properties along the section numbers 114-158 Canada Drive and the surface water from the 'yellow' catchment caused the flooding at The Meadows, Elm Drive and to properties along the eastern section of Canada Drive.

#### 7.4 Summary

Had North Drain been fully maintained the existing 900mm diameter outfall pipe would probably have all but coped with the peak flows through the village. The build up of silt in the ditch may have reduced the capacity to less than the peak which may have contributed to the flooding problem.

However, of more significance, is the fact that the surface flows entering the village from the 'yellow' catchment could not enter the 900mm diameter pipe. The 150mm diameter pipe at the back of the school in The Meadows severely restricted the flow causing overland flow. Likewise the other surface water drains through the village (all of similar diameter) are totally inadequate to intercept this flow. Ironically it seems likely that the 900mm diameter pipe may have had capacity to take the flows but the water was unable to gain entry to it because of the inadequacies of the supporting surface water drains.

The existing 600mm diameter pipe running behind Canada Drive would not have had sufficient capacity to take the flow from the 'green' catchment and this would have been accentuated by any blockages or reductions in pipe sizes that were in existence between numbers 122 and 124 Canada Drive.

## 8 REDUCING FLOOD RISK

Chalk catchments are very forgiving and overland flow rarely occurs. However when rainfall intensity is extreme or in other unusual circumstances such as heavy rain on a frozen landscape, the normally dry valleys can run 'rivers' and surface flows and consequential flooding can occur. It is easy to become complacent in such situations because such events are so infrequent. Their potential however should never be ignored.

Some supporters of Climate Change suggest that such freak weather events are likely to occur more frequently in the future. Cherry Burton remains vulnerable to flooding unless mitigation action is taken and the following precautions are suggested.

### **8.1 North Drain**

The ditch should be regularly maintained to ensure that the 900mm diameter pipe has a free discharge at all times.

### **8.2 Maintenance of Pipes**

It is recommended that a camera survey is undertaken along the main 600mm and 900mm diameter pipes and if possible some of the key smaller diameter pipes eg from The Meadows to Main Street . In particular the section of pipe between numbers 122 and 124 Canada Drive should be examined to check for any possible damage to the pipe and also to verify the existence of a section of 150mm diameter pipe. Any damaged pipes found in the survey should be rectified and any blockages removed.

### **8.3 The Meadows**

The primary problem facing the village is the lack of an adequate outfall from The Meadows to the 900mm diameter pipe which starts at Main Street. There are two possible solutions to this problem and these are outlined below:

#### **8.3.1 Source Control**

The water from the 'yellow' catchment could be prevented from discharging into the village by constructing a small dam across the dry valley which lies above the Bishop Burton Road. Levels have been taken and indicate that the construction of a bund approx 3m high across the valley could create storage for 20,000 cubic metres of flood water. This would give significant protection from extreme events.

The plan at Appendix 3 shows the proposed location of the bund. A soakaway trench would be required on the topside of the bund to allow normal flows to infiltrate into the chalk at depth. In addition a throttle pipe would be needed to allow higher flows to drain away and to drain down the storage area gradually whenever it fills up. The throttle pipe would need to be sized according to the capacity of the outfall. The throttle pipe could be allowed to discharge directly over the field below (encouraging further infiltration) or alternatively would need to be piped into the road drain in Bishop Burton Road. The final solution would be subject to soils analysis.

Given the present outfall (the soakaway and then the 150mm diameter pipe besides number 34 The Meadows) a capacity of only 10 litres per second would probably be appropriate for the throttle pipe. This would give protection from the 1 in 50 year storm. If the outfall were improved then the throttle pipe could be allowed to discharge a higher flow which would in turn give a much better level of protection for the same storage area.

It is possible to reduce the bund height which would reduce the flood storage volume and increase the consequential flood risk. There may be alternative positions for the bund too. However the proposed position, in the main, affects one land owner only and is likely to be on suitable soils (ie shallow soils underlain by chalk).

### **8.3.2 Improved Outfall**

The capacity of the outfall pipe from The Meadows to Main Street should be improved if at all possible. This is the most significant bottleneck in the village drainage system. Ideally (and subject to a detailed level survey) a 600mm diameter pipe should be laid from The Meadows (there may just be room between the garage and house of the lowest property, number 34, and there is also a larger gap by number 38) through the school to connect with the 900mm diameter pipe in Main Street. It would be necessary to ensure that the water could get into the pipe and this might be by way of a series of large gullies (to be discussed with Highways). In addition the provision of a ditch just south of the gardens with an inlet chamber into the pipe would be a means of ensuring that all the surface water is caught before it reaches the school.

In fact an open ditch from the back of the gardens of The Meadows through the school field with a large inlet chamber connecting it to the 900mm diameter pipe at Main Street would be an economic means of securing considerable flood protection to much of the village. Such a ditch would only function in extreme conditions and could possibly be largely incorporated as a broad swale within the school grounds. Alternatively, for the safety of the school children it may need to be fenced but this would have to be done in such a way that periodic maintenance was facilitated.

### **8.3.3 Outfall at Main Street**

Should the provision of an improved outfall from The Meadows be unfeasible then an alternative would be to intercept the water at Main Street and divert it directly into the 900mm diameter pipe. This would need to be discussed with Highways but again a series of major gullies might be appropriate or a ditch/cattle grid along the boundary of the school and the road (may have safety implications?). This would be relatively cheap to secure but although it might protect the properties in Elm Drive and Canada Drive it would not prevent flooding of the school and The Meadows.

### **8.3.4 Outfall at Elm Drive/Canada Drive**

Likewise a better connection could be made from the low area in Elm Drive and Canada Drive to the existing 900mm diameter pipe.

## 8.4 Canada Drive

### 8.4.1 Improved outfall

The existing 600mm diameter pipe has a slack grade and does not have the capacity to deal with the flows from the 'green' catchment during exceptional rainfall events. A new bypass ditch around the back of Canada Drive should be considered. A sketch plan of this proposal is attached at Appendix 4 together with Cross Sections at Appendixes 4a and 4b. The land rises at the back of the north eastern corner of Canada Drive and then drops off quite steeply towards North Drain. The exclusive use of ditches is restricted by their excess depth and by excess grade which can cause erosion. The topography is such that whilst an open ditch could be employed for much of the length it will be necessary to either pipe a section or alternatively to protect the open ditch with some form of revetment and to reduce its depth by undertaking some limited re-contouring of the highest land. The revetted ditch is the preferred option as a pipe can always become blocked and is always subject to a maximum flow.

The proposed ditch/ditch and pipe would outfall into North Drain downstream of the existing 900mm diameter pipe and would have the added advantage of releasing capacity within this culvert which would better enable it to cope with flows from the 'yellow catchment' and the village itself.

This recommendation will require co-operation from the land owners and is subject to a soils survey including the employment of a digger to test the geology at depth.

### 8.4.2 Flood Storage

The catchment above the dismantled railway is partly contained within an embankment running along its northern side. This could be utilised to provide flood storage by installing a gate valve across the existing culvert such that in extreme conditions it could be manually closed preventing water from discharging towards the village and allowing the surplus water to build up behind the embankment. This would be a relatively cheap way of providing some flood storage within the 'green' catchment.

It would also be possible to create flood storage within the broad valley feature to the west of Manor Farm much in the same way as it is proposed in paragraph 8.3.1 above.

### 8.4.3 Contributory Factors

The following contributory factors should also be considered:

- The potentially blocked pipe adjacent nos 122/124 Canada Drive should be checked and any blockage removed.

- The possibility of a ‘bottleneck’ between numbers 122/124 (with a reduction in pipe size from 600mm diameter to 150mm diameter) should be examined and removed if permissible.
- An upgrade in pipe size from in front of number 156 Canada Drive to the head of the 600mm diameter pipe (or new ditch) with appropriate gullies should be considered to ensure that water flowing down the road can get into the pipe.
- A better connection into the existing 600mm dia pipe from the low spot in the road in front of 124 Canada Drive should be installed.

## 9 CONCLUSIONS

There is no doubt that Cherry Burton will flood again if remediation works are not implemented. Flood risk can never be completely eliminated because housing developments have been built across the lowest lying land. The village used to have a system of ditches running into and through it but these have disappeared or been replaced with pipes as development has ensued. The nature of the catchment is such that overland flows only occur in exceptional weather conditions and consequently the necessity of keeping ditches clear is not always apparent.

Main ditches through the village have been culverted using large diameter pipes. Although the capacity of these may have been exceeded during last year’s exceptional wet weather the main threat to the village under more normal events is the inability of surface water flowing into and through the village to actually get into these main pipes.

The risk of future flooding can be reduced by providing buffer storage within the agricultural catchment above the village and by improving the drainage systems that run through and around it. The degree of protection will depend on the monies available, the practicalities and other issues such as Health and Safety that will prevail.

A suggested list of recommendations, in order of priority, is set out below;

Ensure North Drain and all pipe work through the village is correctly maintained.

- a. Improve the outfall from The Meadows to the 900mm diameter culvert in Main Street. The cheapest option would be a pipe from The Meadows to the school grounds and then a ditch alongside the back of the properties and (subject to levels) through the school grounds to outfall via an inlet chamber into the 900mm diameter culvert. The existing pipe work through the school grounds could remain to take ‘normal’ flows, the new ditch just coming into play during extreme events. The ditch must act as both a carrier and an interceptor of surface water. Omission of the new pipe from The Meadows to the

school grounds would reduce the cost significantly but would mean that the few properties in The Meadows would be vulnerable to flooding.

- b. Improve the outfall from the back of Canada Drive by installing a bypass ditch to the north and east of the properties. This ditch should outfall in North Drain downstream of the existing 900mm diameter pipe which will also release some additional capacity in this pipe to cope with flows from the 'yellow' catchment and the village itself.
- c. Improve the connection from the roads to the main culverts. In particular at Main Street, Elm Drive and Canada Drive (behind numbers 46 and 124).
- d. Upgrade the existing 150mm diameter pipe from behind 156 Canada Drive to the existing 600mm diameter pipe (or new bypass ditch).
- e. Consider the provision of a storage area upstream of the village, to the west of Bishop Burton Road, to reduce the flows from the 'yellow' catchment during extreme events.
- f. Consider providing a gate valve on the existing culvert under the dismantled railway to provide some buffer storage within the 'green' catchment area during extreme events.

The final solution will probably be a combination of the various different scenarios itemised above depending on the finances available and third party restrictions.

The recommendations will also be dependent on further studies, particularly a soils survey before a detailed design can be drawn up.

## **10 OTHER POSSIBLE CONTRIBUTING FACTORS**

There have been changes in land use over the last 50 years or so. In particular hedgelines have been removed and on chalk landscapes hedgelines often holdback surface water giving it time to infiltrate. They can also lengthen the time it takes for water to get to an outfall thereby reducing peak flows.

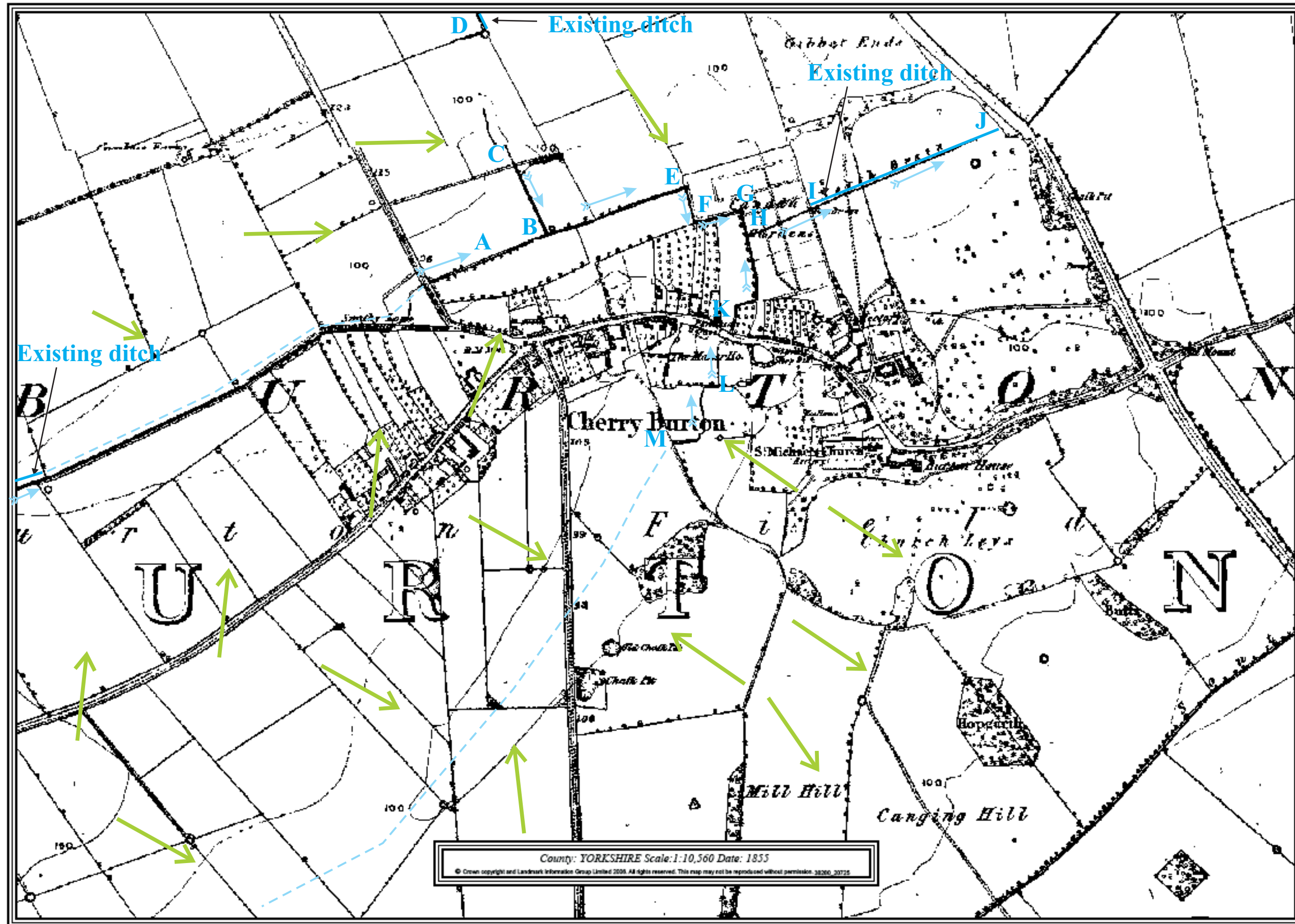
The geology of the area is such that the soil types and topography alter just to the south and east of the village. Heavier drift deposits overlie the chalk and surface water from the chalk valleys will tend to gather on the flatter areas with their heavier soils. There may be minor lenses of clays/marls within the chalk which act as perched watertables creating seepage lines which could also contribute to the flows through the village. The extent of this is unknown but there is certainly no evidence of any seepage water in normal situations. The magnitude of last year's event and the surface flows which are likely to have occurred are sufficient to explain the flooding that occurred within the village.

## 11 DISCLAIMER

This is an independent report commissioned by Cherry Burton Parish Council and gives an overview on the cause of last year's extensive flooding of the village and provides suggestions for possible mitigating actions. It has been based on information provided by members of the Parish Council and has also incorporated a site survey and a topographical survey undertaken by LSTC Ltd.

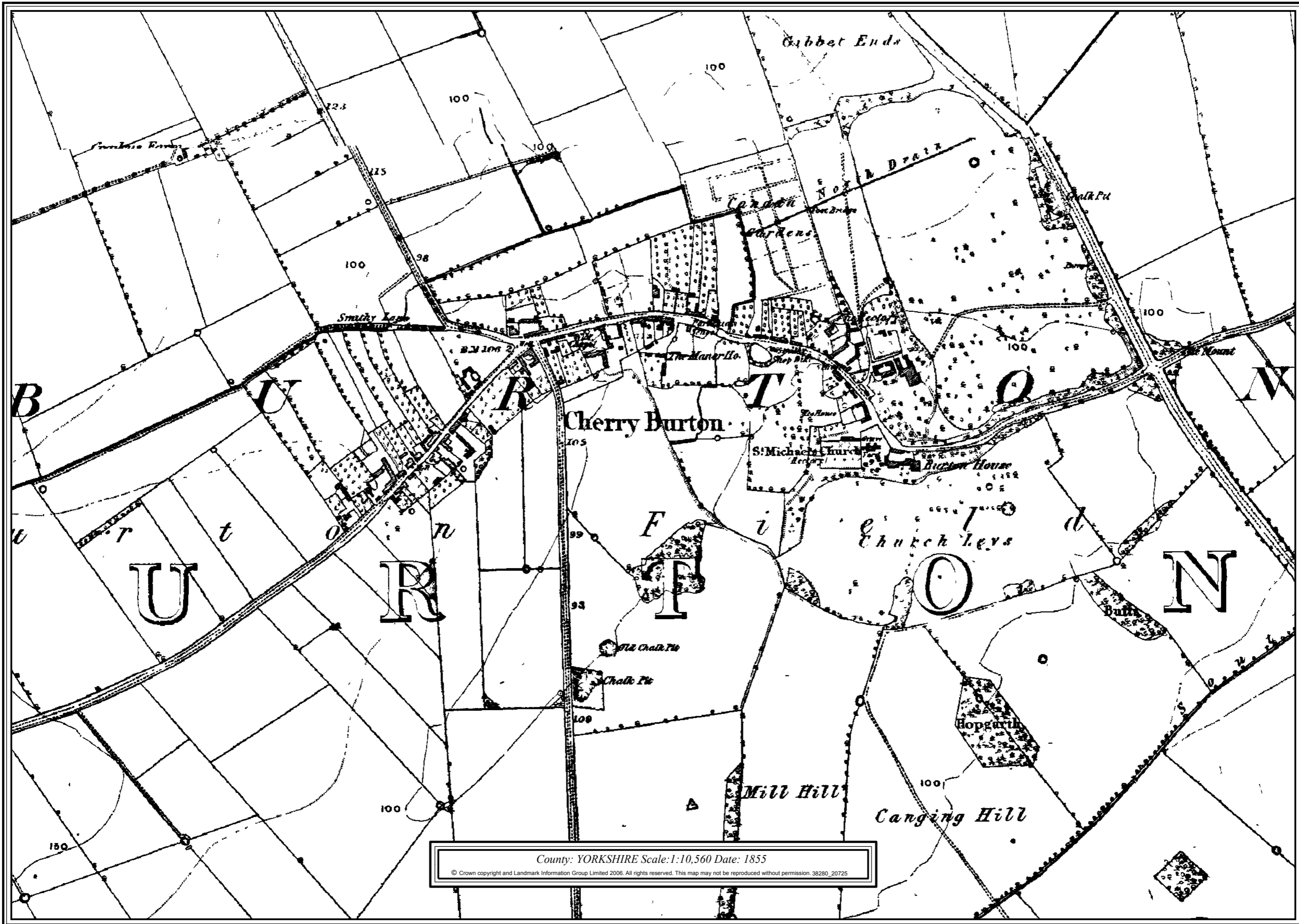
The letter and report submitted to the Parish Council by Alan Smith is acknowledged and much of this report concurs with the conclusions Mr Smith reached.

The report should be reviewed as and when additional information is forthcoming eg camera surveys and negotiations with the owners and occupiers of the land on which mitigating measures are suggested.

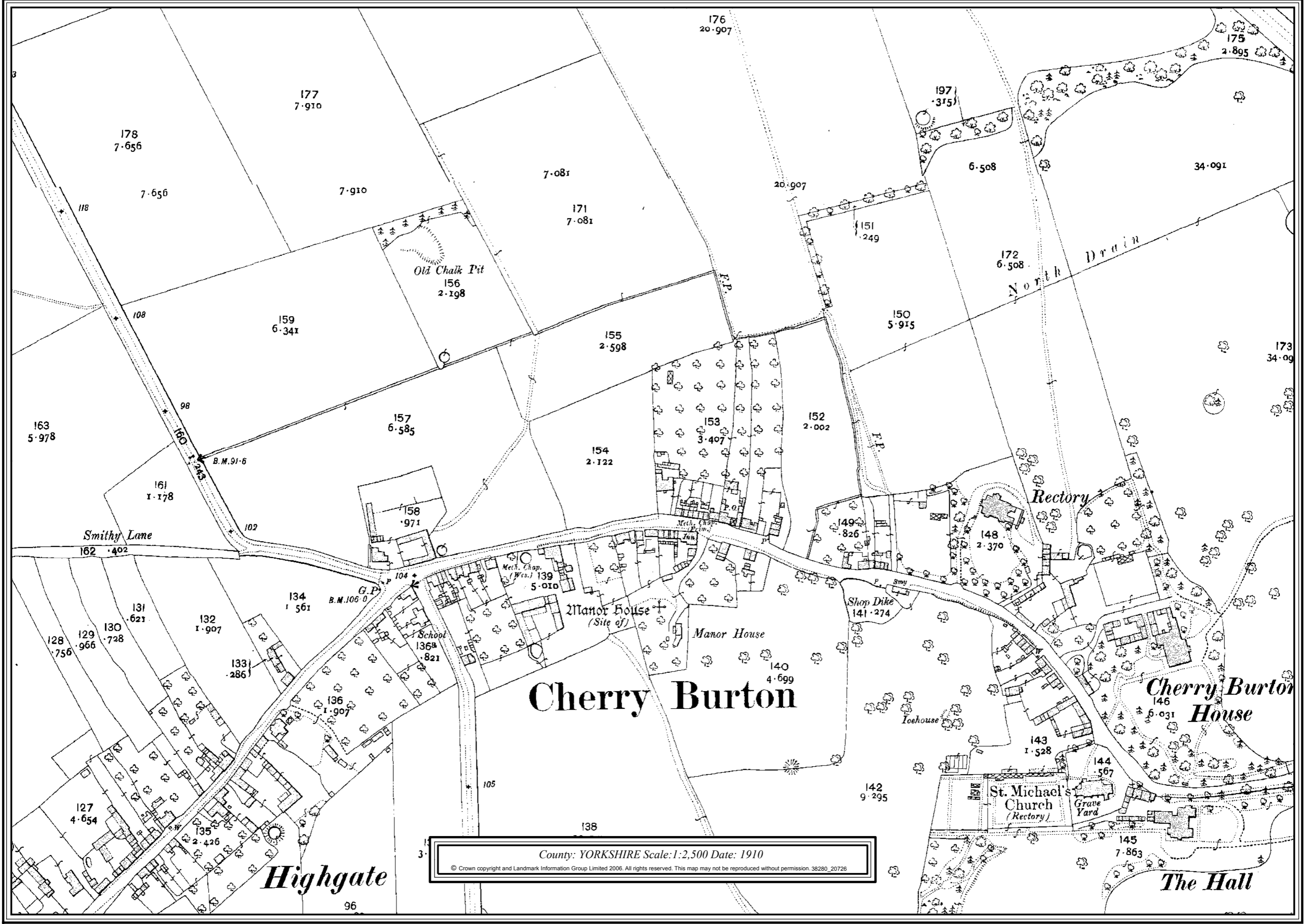


**NOTES**

Former ditch section A- H has been replaced with a 600mm dia pipe with the exception of a short section from E, through the garden of 122 Canada Drive which is recorded as a 150mm dia pipe.  
 Former ditch section K-I has been replaced with a 900mm dia pipe.  
 Former ditch section K-M has been realigned and replaced with a 150mm di pipe from The Meadows to the school and then a 225mm dia pipe from the school to point K



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# Cherry Burton

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Highgate

Cherry Burton House

St. Michael's Church (Rectory)

The Hall

Manor House (Site of)

Manor House

Rectory

Old Chalk Pit

Smithy Lane

North Drain

Shop Dike

Icehouse

Grave Yard

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Manor House

Manor House

Shop Dike

Rectory

Icehouse

Cherry Burton House

St. Michael's Church (Rectory)

Grave Yard

The Hall

Highgate

# Cherry Burton

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132  
1.907

133  
286

136  
821

Manor House

Manor House

Shop Dike

Rectory

Icehouse

Cherry Burton House

St. Michael's Church (Rectory)

Grave Yard

The Hall

Highgate

# Cherry Burton

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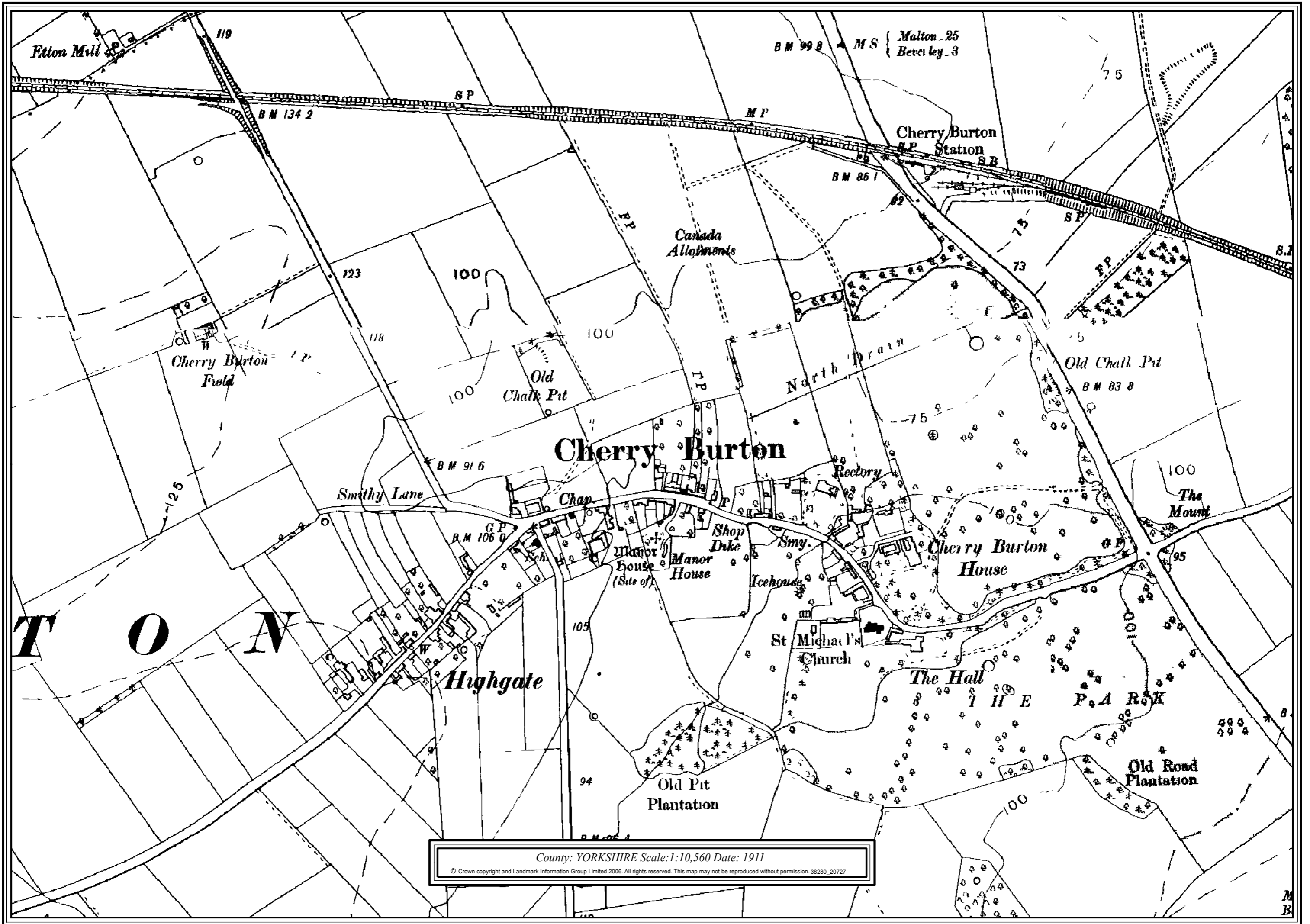
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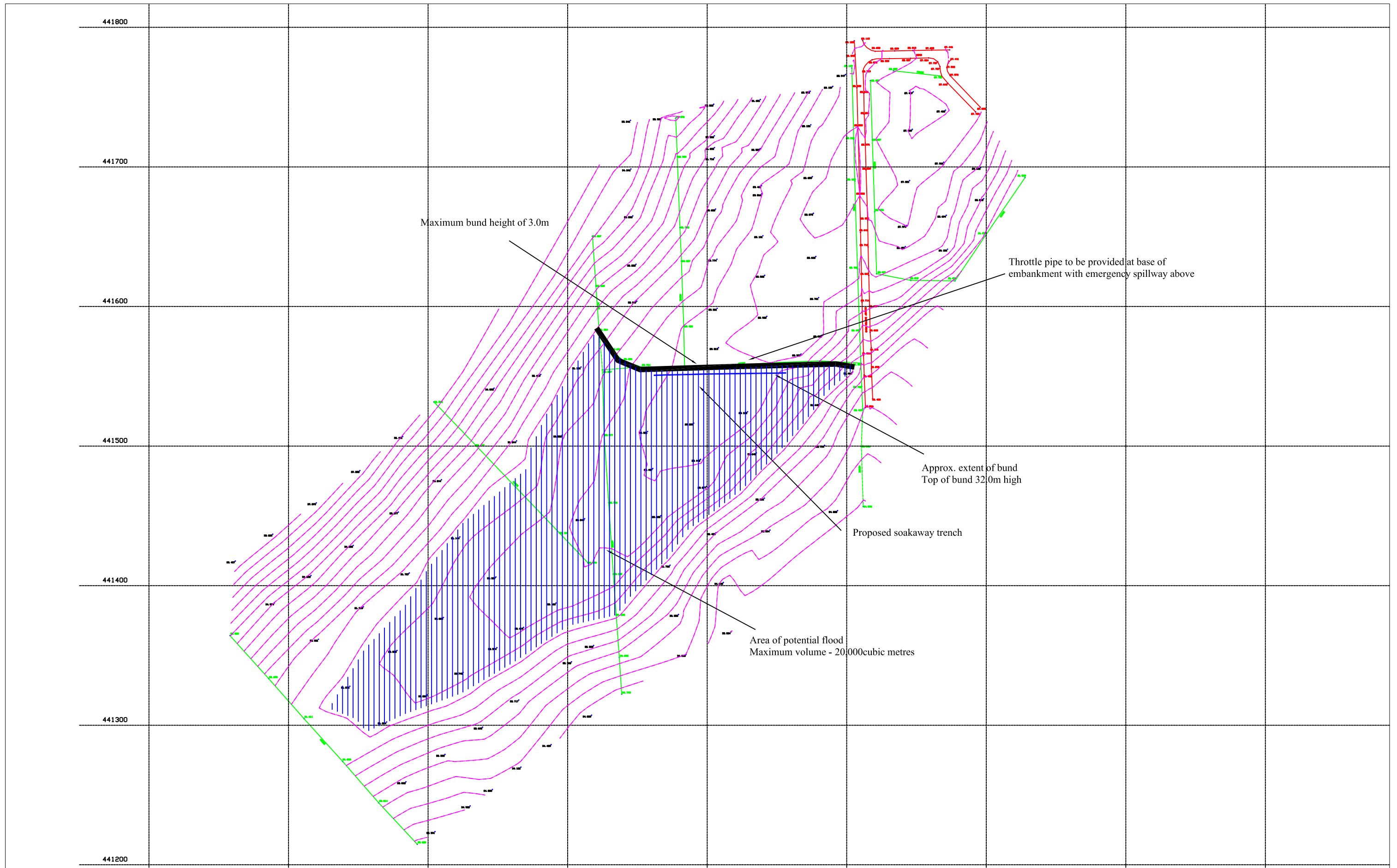
# Cherry Burton

T O W N

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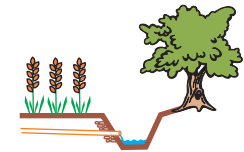
# CHERRY BURTON FLOODING REPORT

## Sketch Plan of Proposed Bund and Storage Area

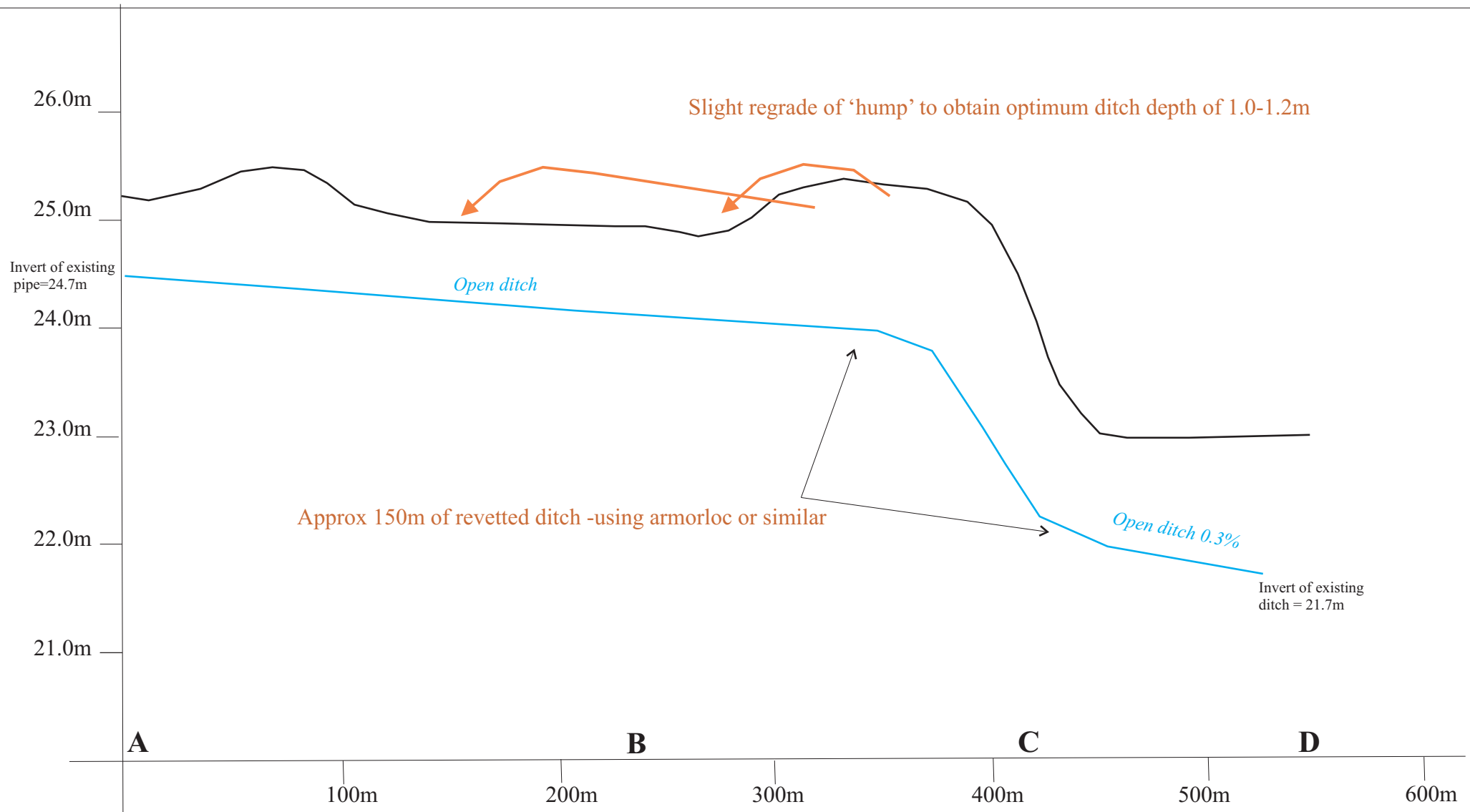




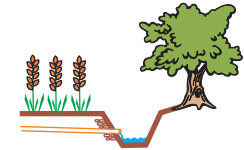
**CHERRY BURTON; FLOODING REPORT**  
**Sketch Cross Section of Proposed Bypass Ditch**



Land Drainage Consultancy Ltd.  
 Tel 01377 236010



**CHERRY BURTON; FLOODING REPORT**  
**Sketch Cross Section of Proposed Bypass Pipe/ Ditch**



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