



The drainage
of
Wilbraham
Fulbourn
and
Teversham
Fens

**THE DRAINAGE OF WILBRAHAM
FULBOURN AND TEVERSHAM FENS**

I have gathered a posy of other men's flowers, and nothing but the thread that binds them is mine own.

Montaigne (1533-1592)



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Frontispiece and tailpiece by Pat Nutbourne

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My interest in landscape history was first aroused when acting as chauffeur for Christopher Taylor on a field trip attended by my wife. His observations about the - seemingly unremarkable - countryside through which we passed together with his book on the Cambridgeshire landscape were a revelation to me. This interest was then given structure by David Trump of the University of Cambridge Board of Extra-mural Studies (now Continuing Education) whose patient tuition, courteous advice and constant encouragement I had pleasure in acknowledging in the first edition of this book. The contribution of the many others who responded to my requests for advice, documents and memories were recorded at that time and I remain conscious of my continuing indebtedness to them. And especially to Pat Nutbourne who drew the frontispiece and has redrawn the tailpiece and Patrick Sadler who created many of the original figures that, with amendments, appear again in this edition.

The purpose of this new edition is to incorporate new material; to record developments in the relationship between the Wilbraham River Protection Society and the Environment Agency and to respond to a continuing interest in a publication long since out of print.

I have previously acknowledging the assistance provided by the Public Records Office at Kew; by Anne Taylor and her staff in the Map Room of the University Library and by Philip Saunders and his staff in the County Records Office, Cambridge in response to my requests to inspect maps and documents. I obtained much hydrological data from members of staff and publications of the Environment Agency and David Noble's report. Patrick Matthews, Land Drainage Manager South Cambridgeshire District Council (SCDC) provided information about the planned restoration work on Wilbraham New Cut. Details of the designation, notification and later revision of the Sites of Special Scientific Interest (SSSI) in Wilbraham,

Tevesham and Fulbourn Fens was kindly provided by Shona Smith on behalf of the Conservation Manager, SCDC and by Paul Allen of The Wildlife Trust. I am much indebted to many others and in particular to Steve Boreham in the University Department of Geography for information about the effects of intermittent flow on freshwater invertebrates and other aquatic life in Wilbraham River; Sharon Hearle of The Cambridge Green Belt Project for sharing her knowledge of the protected species found on Little Wilbraham River; Bryan Hyde-Smith who allowed me access to copies of the Hicks family papers relating to the maintenance of Great Wilbraham River; Oliver Rackham of Corpus Christi College who lent me the negative from which Figure 27 was printed; Wendy Roberts who instructed me when transferring the original text to disc; Alec Tompson for explaining the joint project to restore some of the of drainage ditches and reed beds in Wilbraham Fen; Tim Barfield of Natural England for the most recent information on the restoration of the SSSI in Wilbraham Fen; Richard Townley for information about the location and content of the Townley papers; helicopter pilot Merlin Usher-Smith whose flying skills made possible Figures 4 and 8; Dick McConnel who provided Figure 7, and David White who lent me the photograph reproduced as Figure 26. It gives me pleasure to record my gratitude to each and every one of them: there would have been no publication but for their generous help This, the third edition, would not have come about but for the active cooperation of John Smithson, the chairman of Wilbraham River Protection Society and the encouragement of Richard Townley.

And last, but not least, this edition would have been impossible but for the invaluable assistance of Patrick and Haleema who in the absence of an extant disc scanned in text and illustrations from a copy of the second edition, improved some of the figures and made my inexpert formatting of the document fit for publication.

Desmond Hawkins

PREFACE

It is a great pleasure again to be asked to write the introduction to this book, now in its third edition. The fact that it is the third edition is a mark of its value and interest to the people of Little Wilbraham and to historians far and near. As a landscape historian I have always tried to teach that it is the landscape, as much as documents and books, that holds the key to history. And if looked at carefully and studied in detail the landscape will reveal both its own and our past. Desmond Hawkins believes this too and, perhaps because of this, has written one of the best local landscape histories I have read. It takes a small area of the Cambridgeshire countryside, examines it in detail and, with the help of documents, maps and the memories of local people, unravels the fearsomely complex story of a remarkable piece of fenland.

This study is also an example of how landscape history can contribute to planning for the future of the environment. With the information contained in this book it should be possible to make better decisions on what is to happen to Wilbraham Fen in the next millennium. Too often today decisions are made on landscapes without any understanding of their past, usually to the detriment of their future.

This book illustrates superbly the complex interweaving of natural, technical, social and economic factors that have been part of the history of this fen, and indeed of much of the Fenland, throughout the ages. In doing so it also shows what work needs to be carried out to ensure its survival. Most of all this book gives a wonderful insight into the mysterious land of ditches and reed beds that, like the author, we have viewed so often from the A 14 interchange. I commend it to all who are interested in the past and in the future of the English landscape.

Christopher Taylor FBA

"The Fens between the high grounds of Teversham and Hinton west; of Fulbourne south; of great and little Wilbraham east; of Bottisham and Quoy north - 1240 acres."

William Hayward 1605

INTRODUCTION

The interested traveller who, at risk to life and limb, pauses to view the landscape from the A14/A1303 interchange at Quy some four miles east of Cambridge, will see to the south a shallow basin surrounded for the most part by gently rising ground backed by modest, distant hills. In the foreground an area of reed and scrub, bisected by a brimming ditch, merges with meadows on the left and on the right is bounded by an embanked, meandering stream. Beyond the reed beds successive fields of corn and sugar beet extend onto the flanks of the surrounding hills. Among the clumps of trees that mark the otherwise imperceptible margins of the basin may be discerned, from right to left, the church towers in Teversham, Cherry Hinton, Fulbourn, Great and Little Wilbraham; five of the seven villages adjacent to this most southerly extension of The Fens first surveyed in detail by Hayward almost four centuries ago.¹

Descending from the roadside vantage point to make a closer inspection of the terrain our traveller discovers, with surprise, still-standing gateposts among the reeds marking the entrance to abandoned fields. The ditches that divide the former fields join deep drains that seem to run at random through the area. The embanked stream, its bed above the adjacent fields and ditches, flows through a narrow isthmus of low ground to leave the basin between the flanking ridges that form its northern boundary. It is now evident that the landscape that first

engaged our traveller's interest is not a remnant of primeval fen but an artefact whose cultivation was and remains dependent on artificial drainage. Why this complex drainage system was created and how it works is not self-evident and when it was put in place proved, on enquiry, to be beyond the span of local memory.

To seek answers to these questions, a survey of the watercourses was first carried out during the winter and spring of 1987/88. No better time could have been chosen as, after two years of more than average rainfall, the streams, drains and ditches were full of water, the volume and direction of flow of which provided clear evidence of their present purpose (Fig 1). The field survey was followed by a search for documentary evidence bearing on the history of the drainage of Wilbraham, Fulbourn and Teversham Fens, and which continues. Reliance has been placed for the most part on the holdings at the Public Record Office at Kew and the main archives in Cambridge so it is possible that documents bearing on the early history of the drainage of this small area have been overlooked. Should this be the case it is to be hoped that their discovery will not invalidate the main conclusions of this study.

The area of interest is covered by the Ordnance Survey map, scale 1:10,560, sheet TL 55NW and may be seen in its topographic context on OS 1:25,000, sheet 1004 (TL45/55) within vertical grid lines 49 to 56 and horizontal grids 55 to 60. The villages of Little and Great Wilbraham, Fulbourn and Teversham are situated on the east, south and west of an area of some six square kilometres in extent below the 10-metre contour, to this day marked on the map as Little Wilbraham, Fulbourn and Teversham Fens. Within this area rectangular fields and drains are seen characteristic of reclaimed former fen. To confine interest to the land below the 10-metre contour

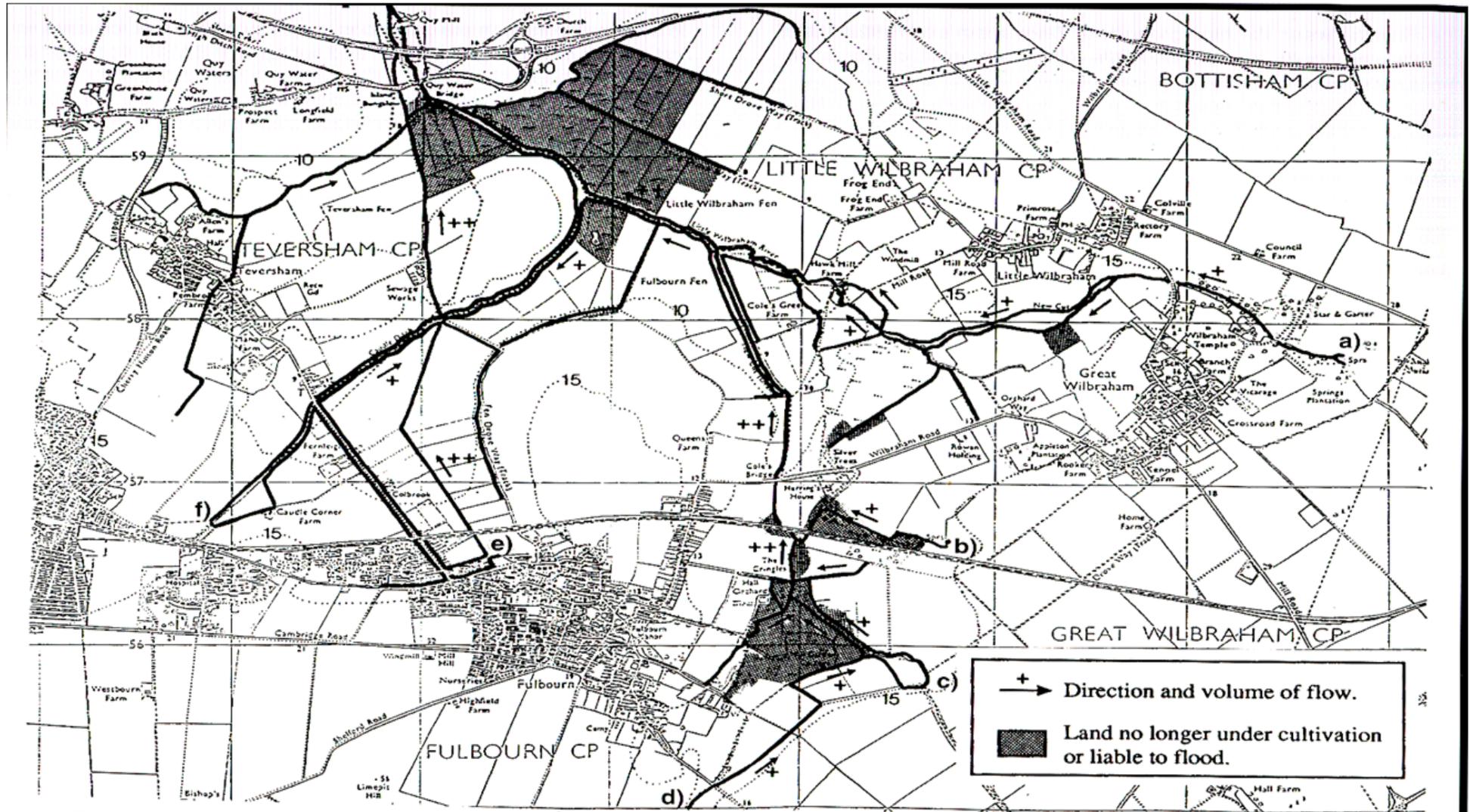


Figure 1. Map showing area of Wilbraham, Fulbourn and Teversham Fens. Superimposed are the main watercourses and public drains, the flow within them and the land no longer under cultivation or liable to flood.

Reproduced from the 1987 Ordnance Survey 1:25000 Pathfinder map 1004 with permission of the controller of Her Majesty's Stationary Office

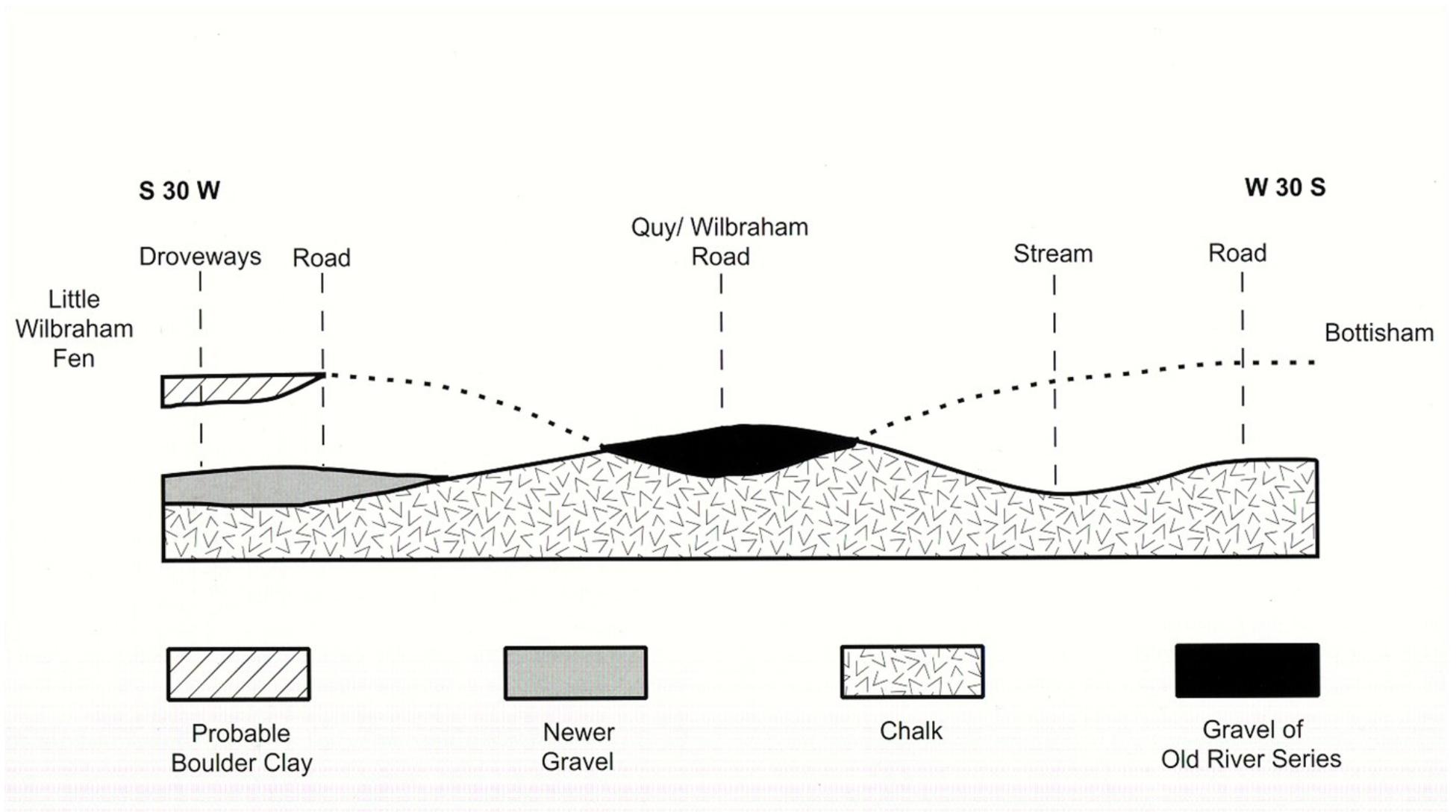


Figure 2. Geological section, Wilbraham Fen to Bottisham. The gravel laid down in the bed of an ancient river system now caps the low ridge that forms the northern and north-eastern boundaries of the fen.

(After Penning and Jukes-Brown)

line would be too restrictive as the springs feeding the streams traversing this low-lying area, other than the Temple Springs, arise for the most part just below the 15-metre contour. The latter serves to mark the eastern and southern, and the 10-metre contour the western and northern limits of the area of interest. The contour lines and spot-heights confirm that there is little gradient to promote natural drainage. A spot-height in Little Wilbraham Fen two metres below another on the embanked river near its exit from the basin makes clear the problems of drainage and explains the cartographic symbols of marsh, reeds, scrub and rough pasture in this area.

NATURAL DRAINAGE

Geology

The low ridge that forms the north-eastern and northern boundaries of the area of interest and the isolated gravel deposits extending westward towards Cambridge were laid down in the bed of an ancient river, part of the March and Wilbraham Series. The springs now rising near the 15-metre contour probably discharged into this river then flowing westward from Stow-cum-Quy. The declivities on either side of this river became eroded by weathering and the action of the springs themselves but the gravel, resistant to chemical action, protected the underlying chalk and, in time, became a ridge along the line of the old river bed (Fig. 2). This caused the waters from the springs to become impounded and form a mere in the area now occupied by Little Wilbraham Fen, its depth determined by the height of the gravel ridge over which its waters spilled before running northwards to join the Cam. The gravel deposits south of the ridge were probably laid down by

the streams both before and after the formation of the mere. As the escaping waters eroded the ridge at the present site of the Quy Water bridges, the level of the mere fell and peat deposits formed in the shallows. Most of the shallowing mere was converted into fen but a marshy pool on which punts were used to shoot wildfowl persisted in Little Wilbraham Fen until the early 19th century²

The British Geological Survey 1: 50,000 Series, Sheet 188 and One-Inch Series, sheet 205 show peat deposits surrounded by first and second terrace gravel occupying much of the area below the 10-metre contour. The narrow sinuous extension of the peat running northwards from the gap in the gravel-tipped ridge forming the north and north-east boundaries of the basin marks the line of the natural drainage before the watercourse was diverted into Bottisham Lode.³ Underlying the whole of the area of interest is a stratum of Lower Chalk some 55 ~ to 70 metres thick divided by a narrow band of hard, compact Totternhoe Stone, known locally as Burwell Rock. This relatively impermeable layer comes to the surface on the north-east, east and southern margins of the basin at or near the 15-metre contour and gives rise to the springs that feed the streams traversing the basin.

Field Survey

Visual inspection of a landscape with bold topographical features may by itself provide evidence of the natural drainage but where such features are absent or the watercourses have been much altered by man, other methods must be used. Such is the case in this landscape where the effects of water abstraction and drainage have subtly altered the surface contours of the land. The number of springs may not have



Figure 3. Hawk Mill Farm, Little Wilbraham, Spring 1992 showing soil and crop marks. Most of these are due to cryoturbation during the last Ice Age. Key: a) Little Wilbraham, b) Hawk Mill farm, c) collapsed frost mound, d) probable former course of Little Wilbraham River, e) Wilbraham New Cut, f) former course of Great Wilbraham River with later



Figure 4. The sinuous parish boundary between Fulbourn and Great Wilbraham looking towards Hawk Mill Farm (to the right of the straw stack). Running between the harvested fields to the west and Great Wilbraham Common and ploughland to the east it follows the former course of Great Wilbraham River before its diversion to increase flow at Hawk Mill.

changed greatly since man first settled around its margins but the volume of water discharged into the basin was appreciably greater in the past. As recently as 1922 one of the finest sets of springs in Cambridgeshire were those at Shardelowes Well, then the main source of Great Wilbraham River⁴ and now in most years completely dry.

There is both documentary and anecdotal evidence that the flow of water in both the former Great Wilbraham and present Little Wilbraham rivers has been much reduced in living memory. The appearance of water on the surface of the fields along the spring-line to the west of Shardelowes Well within 48 hours of temporary cessation of pumping at Fleam Dyke borehole some years ago was striking confirmatory evidence that this is due to water abstraction.⁵

In the winter and spring of 1987/88, there were active springs close to the 15-metre contour at the following sites (Fig 1):

- a) In the Springs Plantation east of Wilbraham Temple.
- b) On the north side of the railway half-a-mile south-east of the bridge over the dry watercourse on the Wilbraham to Fulbourn road.
- c) Near Shardelowes Well at the northern end of Fleam Dyke
- d) South-west of the Balsham Road a mile to the south of Fulbourn church.
- e) At Poors Well on the north side of Cow Lane in the north-west part of Fulbourn village.

f) At Caudle Head north of Caudle Corner Farm.

The source of water flowing into the ditch running east-north-east from the village of Teversham was less easy to locate in the fields north of the village.

An examination of the soil in Wilbraham, Fulbourn and Teversham Fens confirmed the presence of the peat deposits shown on the geological map, although much reduced in the fields under arable cultivation. The distribution of the peat-filled channels in the gravels of Fulbourn Fen are said by Worssan and Taylor to mark the ancient course of Great Wilbraham River and its tributaries.³

The level of the land surface overlying the peat deposits will have been higher before artificial drainage than at present and not least before the extensive works undertaken in the four parishes in the late 18th and early 19th centuries. This is because improved drainage leads to progressive shrinkage of the peat from dehydration, bacterial action and wind erosion when the land is taken into arable cultivation. Should this not be kept in mind it is all too easy to assume that the present levels, both relative and absolute, are natural and that the watercourses will have run where the land is now lowest. A reconstruction of the natural drainage must inevitably be somewhat conjectural but by correlating the evidence from field work, geology, aerial photography and parish boundaries, the configuration that emerges will owe more to science than speculation.

Aerial photographs of the area reveal a number of soil and crop

marks in the cultivated fields overlying both the peat and gravel deposits. Vertical photographs taken in March and April 1992 and May 1987 reveal a pattern of irregular circles, some distorted by ploughing, interlocking segments of circles and more elongated sinuous marks of lighter-coloured soil which appear to be composites of arcs and semi-circles (Fig. 3). In some adjacent areas a finer reticulated or polygonal pattern can be seen in fields overlying gravel. The majority of these soil and crop marks have the characteristic appearances of periglacial phenomena.^{6,7}

The larger ones represent collapsed frost mounds which, starting as circles, may coalesce to form composite shapes. These changes, due to cryoturbation of the soil in the last Ice Age, develop when ground water is frozen into lenses of ice beneath the surface and may be particularly numerous near spring lines. The finer reticulated or polygonal pattern results from the seasonal freezing and thawing of the superficial layers of the soil overlying permafrost. Some of the more serpentine soil marks may represent the lines of old creeks or streams. There is such an example between the two watercourses south of the village of Little Wilbraham. But despite its great interest in other respects, aerial photography does not provide unequivocal evidence of the line of the natural drainage of this area.

Parish boundaries are known to be extraordinarily durable. Many of those that appear on modern maps were established more than a thousand years ago and the parishes that surround and extend into the Wilbraham, Fulbourn and Teversham Fens are unlikely to be exceptional in this respect. In a landscape

otherwise largely devoid of natural boundaries, the streams would provide ready landmarks to delineate these social and economic units. The OS 1: 10,560 map, TL 55NW and the more recent OS Explorer 1:25,000 map sheet 209, show that all the parish boundaries below the 15-metre contour, with small local deviations, follow extant or pre-existing streams. The exception is the boundary between Little Wilbraham and Stow-cum-Quy which follows the line of a drainage ditch, The Parish Ditch, around the north-west boundary of Little Wilbraham Fen. The presence of fen in the north of the parish of Stow-cum-Quy no doubt determined the location of this its southern boundary. One cannot assume that the present parish boundaries represent the original courses of the streams as both may have been subject to adjustment and change. The parish boundary, for example, between Teversham and Fulbourn follows the line of what was clearly an artificial watercourse, the Caudle Ditch that ran along the line of the 10-metre contour some distance from the probable line of natural drainage. Conversely, that between Great Wilbraham and Fulbourn almost certainly followed the course of Great Wilbraham River before it was diverted on to Great Wilbraham Common. The bed of this now-abandoned river is still identifiable on the ground and from the air running north from the Cringles under the Wilbraham-Fulbourn Road and along the west side of the common towards Hawk Mill (Figs.3 & 4).

Based on this evidence one can get some idea of the pattern of the natural drainage that existed more than one thousand years ago before it had been modified firstly to provide power for the watermills and subsequently to meet the needs of agriculture (Fig.5). In succeeding sections an attempt is made to answer

the questions posed by this and similar man-made landscapes: why and when were these changes made and how do they relate to the drainage pattern that we see today.

WATERMILLS

The first major changes to the watercourses followed the building of the watermills that for centuries were essential to an arable agricultural economy. Four mills were recorded at Quy at the time of the Domesday Survey, one of which was probably on or near the site of the present, disused Quy Mill, now an hotel. A mill worth 10 shillings is mentioned in the Domesday Survey at Witborham - probably in the present parish of Little Wilbraham. The *Inquisitio Comitatus Cantabrigiensis* records one mill worth 5s.4d. in Wilburgeham (Little Wilbraham) and in the Hundred Rolls of 1279 there is a passing reference to Halk's Mill then held by the Tollemache family. These records almost certainly refer to the predecessors of the now disused Hawk Mill. Two further watermills and one windmill referred to in the Domesday Book and in the Hundred Rolls subsequently came into the possession of the Knights Templars who owned one of the manors in Great Wilbraham throughout the 13th century. One or both of these mills may have been sited on Little Wilbraham River above the bridge on the road between the two Wilbrahams.⁸ The absence of subsequent records suggests that these mills soon fell out of use and are not considered further. At the time of the Domesday Survey there was also a watermill in Fulbourn, the subsequent history of which seems to be largely unrecorded.⁹ There is a mill on the upper reaches of the watercourses south-east of the village on the pre-enclosure map of the parish. The mill was demolished by the

Parliamentary Commissioners to facilitate drainage, with the consent of the owner and the payment of £200 in compensation, when the parish was enclosed in 1808.¹⁰ The watermill was replaced by a windmill elsewhere in the parish and its machinery and millstones were sold by auction in 1809.¹¹ Both the building and memory of it have largely been erased but its former presence lives on in the name Mill Gardens Cottage (Fig. 7)

The site of these mills was determined not only by the streams which appear to have been diverted to serve them but where gravel or chalk subsoils adjacent to the existing fen provided firm foundations for the buildings and access for heavy loads. Their construction and continuing presence significantly altered the natural drainage by creating three different water levels (Fig.6). These were:

1. Quy Water north of Quy Mill, an artificial watercourse providing a head of water for Lode Mill (Fig. 8) the lowest or first level
2. The Little and Great Wilbraham rivers and their tributaries between Quy Mill and Hawk Mill - the middle or second level
3. Little Wilbraham River above Hawk Mill and the watercourse above Fulbourn Mill - the upper or third level.

The later diversion of Great Wilbraham River (see below) to provide more waterpower for Hawk Mill moved this part of the

river to the upper level and created a fourth level: the watercourses, both natural and artificial, feeding Fulbourn Mill. With this in mind the subsequent changes that were made to drain the fen, at first piecemeal but later in a radical and co-ordinated fashion, are more easily understood and the logic that underlies the evolving pattern of ditches, drains and watercourses becomes apparent.

CHANGES IN DRAINAGE BEFORE THE MID-18TH CENTURY

During the medieval period and up to the middle of the 17th century there were growing social and economic reasons for reclaiming fenland for agricultural use. At that time there was probably no major conflict of interest between most of the inhabitants of the parishes for whom the undrained fen was a valuable source of reeds, wildfowl, eels and summer grazing and the proprietors of the mills who required a constant and controllable source of water power. The control of water levels by dams, and sluices and the reclamation of the margins of the fenland was already taking place. Action by some powerful individuals, however, frequently led to conflict and to arbitration. In one such episode in 1367, quoted by Dugdale, "*It was found by the jurors that the Prior of Ely did obstruct the course of the water at Wilburgeham Magna in a certain place called Watholm Dam so that it could not have its currents as it usually had,. it was as such as the Commons belonging to the town of Fulbourne were over-flowed to the damage of the whole country*".¹ Similar individual acts are a recurring theme throughout this period but no clear picture emerges of a concerted plan to improve land drainage.¹² Indeed, there

appears to be little written documentary evidence of any co-ordinated effort to drain the parish fens before the Parliamentary Inclosure Acts of the late 18th and early 19th centuries, but there is some cartographic evidence of change.

A study of the early maps of the region up to the middle of the 18th century was, with two exceptions, of little value due to their small scale and inaccurate detail. The two exceptions are a map by William Hayward (1604), made at the time of his major survey of the fens, and a map of unknown provenance dated between 1680 and 1700. The Hayward map, the primary purpose of which was to record the extent and margins of the fens, includes the area of interest and shows an important detail - the presence of an artificial channel crossing the neck of the promontory of higher ground between Teversham and Fulbourn Fens (Fig.9). The other map produced some 80 or so years later shows the fen margin and two watercourses. The fen edge, insofar as it is depicted, appears much the same and a watercourse is shown running north from Fulbourn Fen along the line of the channel shown on the Hayward map before converging on the other watercourse (Little Wilbraham River) above Quy Mill (Fig.10). This appears to be the first unequivocal cartographic evidence of an attempt to improve drainage in these parishes by the construction of an artificial channel (the Mill Ditch) to shorten and thus increase the gradient of a watercourse. A possible omission from this map, but perhaps incompletely represented, is the Caudle Ditch, the artificial channel running along the southern margin of the promontory across the line of the Mill Ditch conveying water from the springs in the south-west quadrant of the fen to Little Wilbraham River. How these two artificial channels crossed is unclear but it is probable that the Caudle Ditch was carried over the Ryde

Water/ Mill Ditch watercourse by some form of aqueduct: this was certainly so when the Mill Ditch was later diverted, to bypass Quy Mill. The map does not cover the whole of the area of interest but what must be part of the lower course of the Great Wilbraham River is shown to be confluent with the Little Wilbraham River below Hawk Mill.

Little Wilbraham River

It is clear from the disposition of the peat deposits in Little Wilbraham Fen, that the ancient course of the river must have been very different from its present one below Hawk Mill. The river must have run in a more northerly direction into a mere situated where the main peat deposits occur before turning westward towards the gap in the gravel ridge forming the northern boundary of the basin. Hayward's map (Fig. 9) shows a watercourse running northwards through "Fulbourne Common" and another running round the promontory on which Quy Church stands, with a gap between them. This almost certainly represents the course of the river at that time above and below the mere in "Little Wilbraham Common". There is perhaps one clue. The map thought to have been made between 1680 and 1700 (Fig.10) depicts the (unnamed) Little Wilbraham River with a course and configuration much as they are today. The present course of the river, which runs across the peat and gravel deposits in a most unnatural way, is clearly artificial but when it was re-aligned appears to be unrecorded (Fig. 11). If one accepts this and the evidence of Hayward's map (many of the other details appear to be correct) it follows that the river was realigned sometime in the 17th century.

Great Wilbraham River

The peat deposits in Fulbourn and Wilbraham Fens, as shown on the geological map previously referred to, suggest that the ancient bed of Great Wilbraham River was to the west of its presumed course in early historic times. Where the river then ran is not documented but the sinuous boundary between the parishes of Fulbourn and Great Wilbraham, north of the road joining the two villages, almost certainly reflects the course of the river when the parishes were first established (Fig.4). The subsequent changes to its course were certainly man-made but appear to be undocumented. These were:

- 1).The diversion of a section of the river into an embanked artificial channel on Great Wilbraham Common, undertaken sometime before 1797 (Figs.12 & 14). The reason for this is less clear. There are three possible explanations:
 - a) The artificial channel, by increasing the length and volume of the river, served as a distant mill and provided greater reserves of power.
 - b) It captured more springs. This is unlikely as the subsoil is gravel and the spring line some distance away.
 - c) Improved drainage had caused the bed of the river to subside. Again an unlikely explanation as the peat deposits are a little to the north of this.

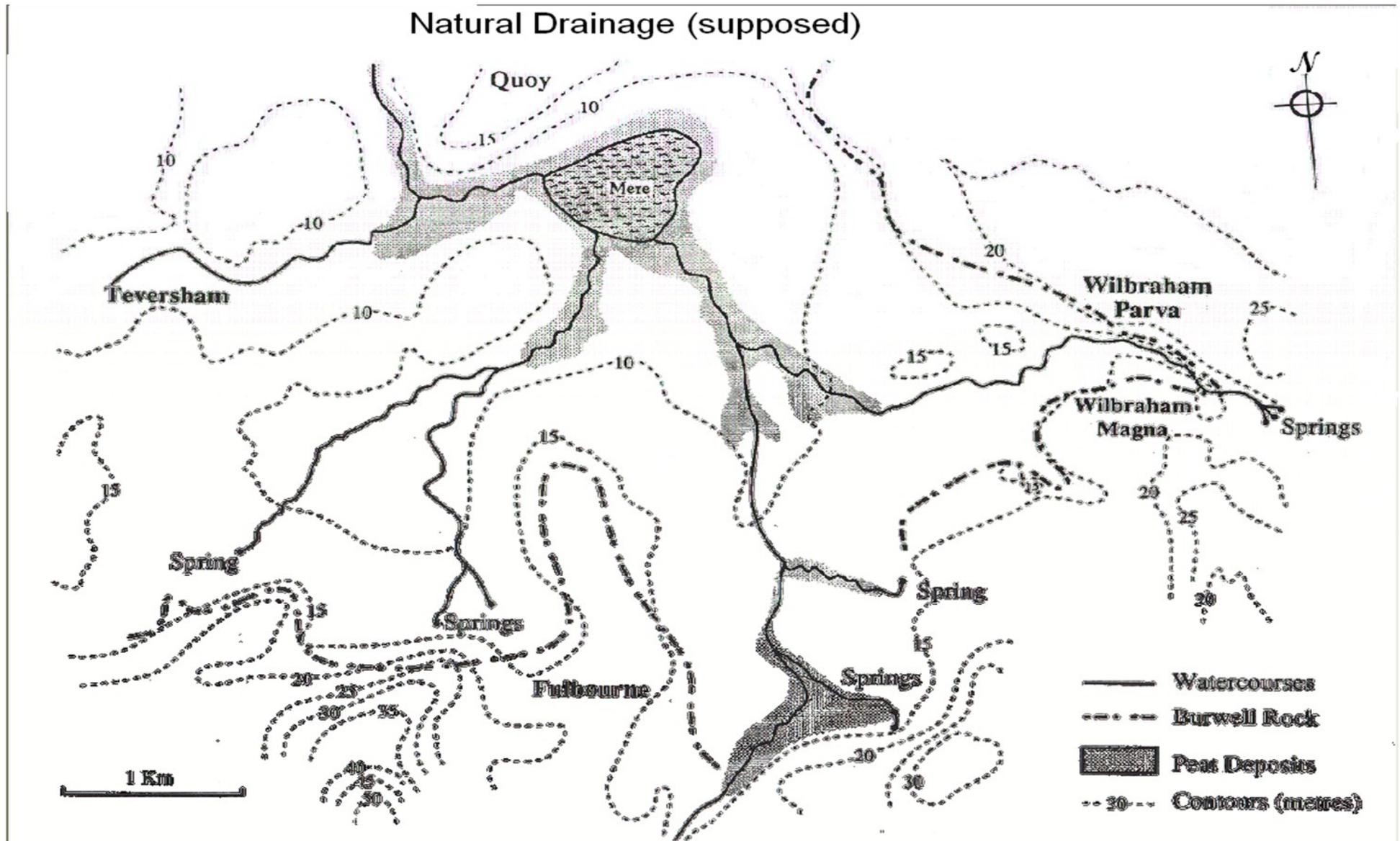


Figure 5. Probable natural drainage before the watercourses had been modified to provide power for watermills. Most of the

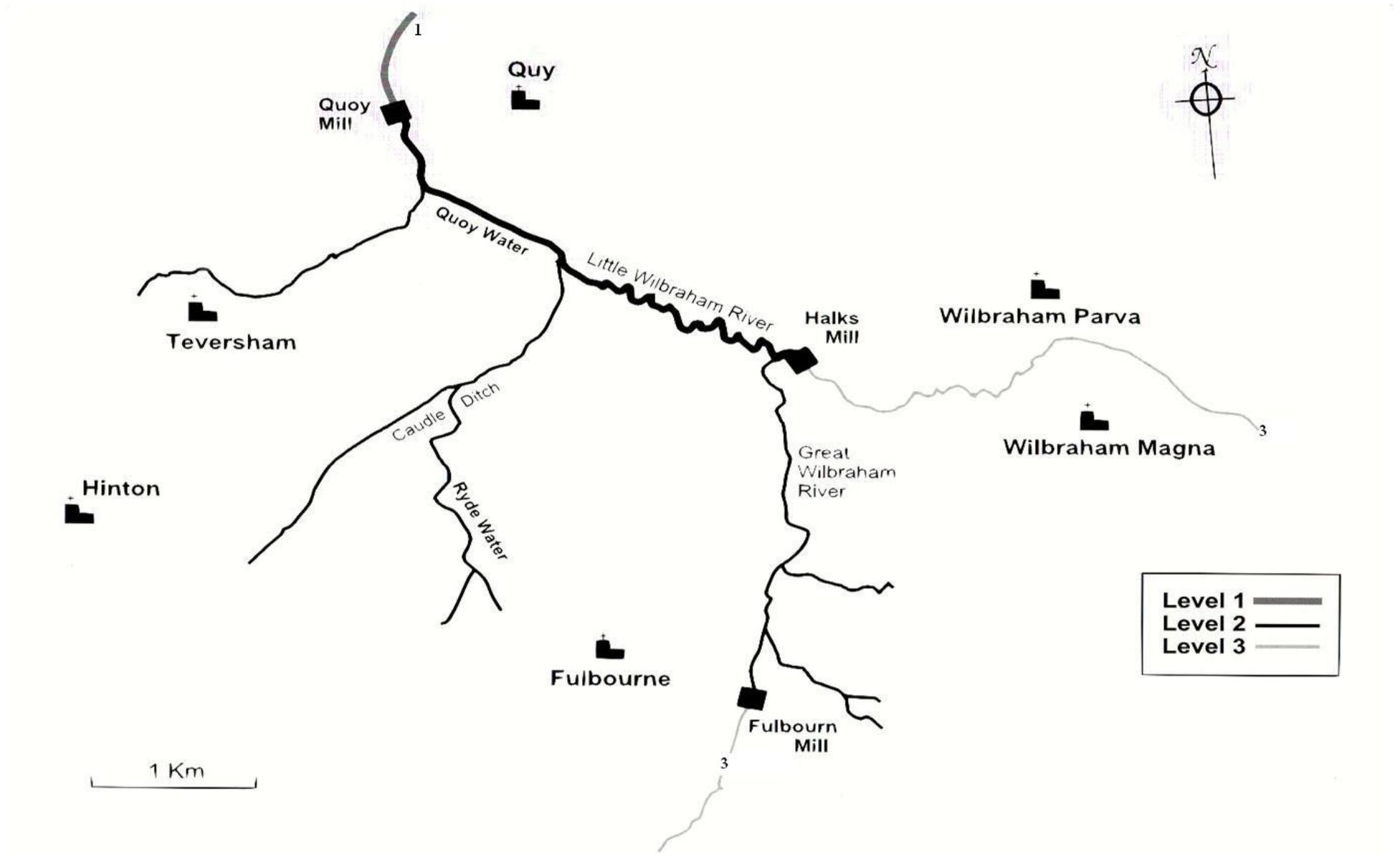


Figure 6. The effect of watermills on water levels. See text



Figure 7. Mill Gardens Cottage, Fulbourn. The watermill, demolished in 1808, stood above the culvert seen to the right of the former miller's house.



Figure 8. Quay Water between Lode and Stow cum Quy , looking south-west. This embanked artificial watercourse runs well above the natural drainage level to provide a head of water for Lode Mill.

(2) The diversion of the lower reaches of the river from its course along the parish boundary to join Little Wilbraham River above Hawk Mill. This was no doubt to increase water power to the mill and appears, on the cartographic evidence, to have been carried out sometime in the 18th century (Fig.14). The diversion of the river into the mill race above Hawk Mill moved the watercourse from the second to the third level and this, together with the reduced gradient of the river bed, will have exacerbated the problems of land drainage in its catchment area. Knowledge of the extent to which new drainage channels were needed to compensate for this is incomplete. One is certain: a New Cut was constructed in the parish of Fulbourn to the west of the lower course of Great Wilbraham river (Figs. 13 &14), which joined Little Wilbraham River below Hawk Mill at the second water level. By the construction of this new channel the drainage of the south and south-eastern parts of Fulbourn Fen was restored or was improved. At the same time or subsequently the springs to the east of the Cringles, in the parish of Great Wilbraham were joined to the new drain by a tunnel under the bed of the Great Wilbraham River.

The Black Ditch

The further modification to the natural drainage that occurred between 1700 and 1757 was the construction of an artificial channel, the Black Ditch, to the west of Quy Water in the parish of Fen Ditton. This enabled the waters from the previously constructed artificial channel, the Mill Ditch, and the stream draining Teversham Fen to discharge into Quy Water below Quy Mill, the lowest water level in the drainage system (Fig. 15A). The alterations to the watercourses carried out before the

Inclosure Acts and for which there is documentary or circumstantial evidence are correlated in Figure 16.

THE LANDSCAPE BEFORE ENCLOSURE

Extensive drainage work had been undertaken in the southern Cambridgeshire fens from the middle of the 17th century, including the adjacent parishes of Stow-cum-Quy, Bottisham and the Swafthams.^{13,14} This had not been an unqualified success due to the unforeseen consequences of improved drainage and to neglect. Vancouver, in his survey of agriculture in the county of Cambridge published in 1794, observed that, in the parish of Bottisham, "*The improved pastures in severalty bear a very small proportion of those which remain in an unimproved state: They skirt upon the fen which at present is in a deplorable situation and subject to frequent inundations by the over-flowing of the highland water and the River Cam whose banks are most shamefully neglected and are as much too low as the bed of the river is too high.*"¹⁵ In Stow-cum-Quy he remarked: "*The miserable condition of the low grounds in this neighbourhood is chiefly to be ascribed to the neglect of the conservators in not scouring out the leading drains into the Cam and in keeping the banks of that river and Bottisham Lode in repair*". Of more immediate interest are his observations on, for example, the parish of Wilbraham Magna: "*The low and fenny grounds in this parish are of considerable extent but labour under the same disadvantages and difficulties with those noted in the parish of Bottisham and with those, are incapable of being drained by the present means adopted for that purpose*". And of the parish of Wilbraham Parva he had the following to

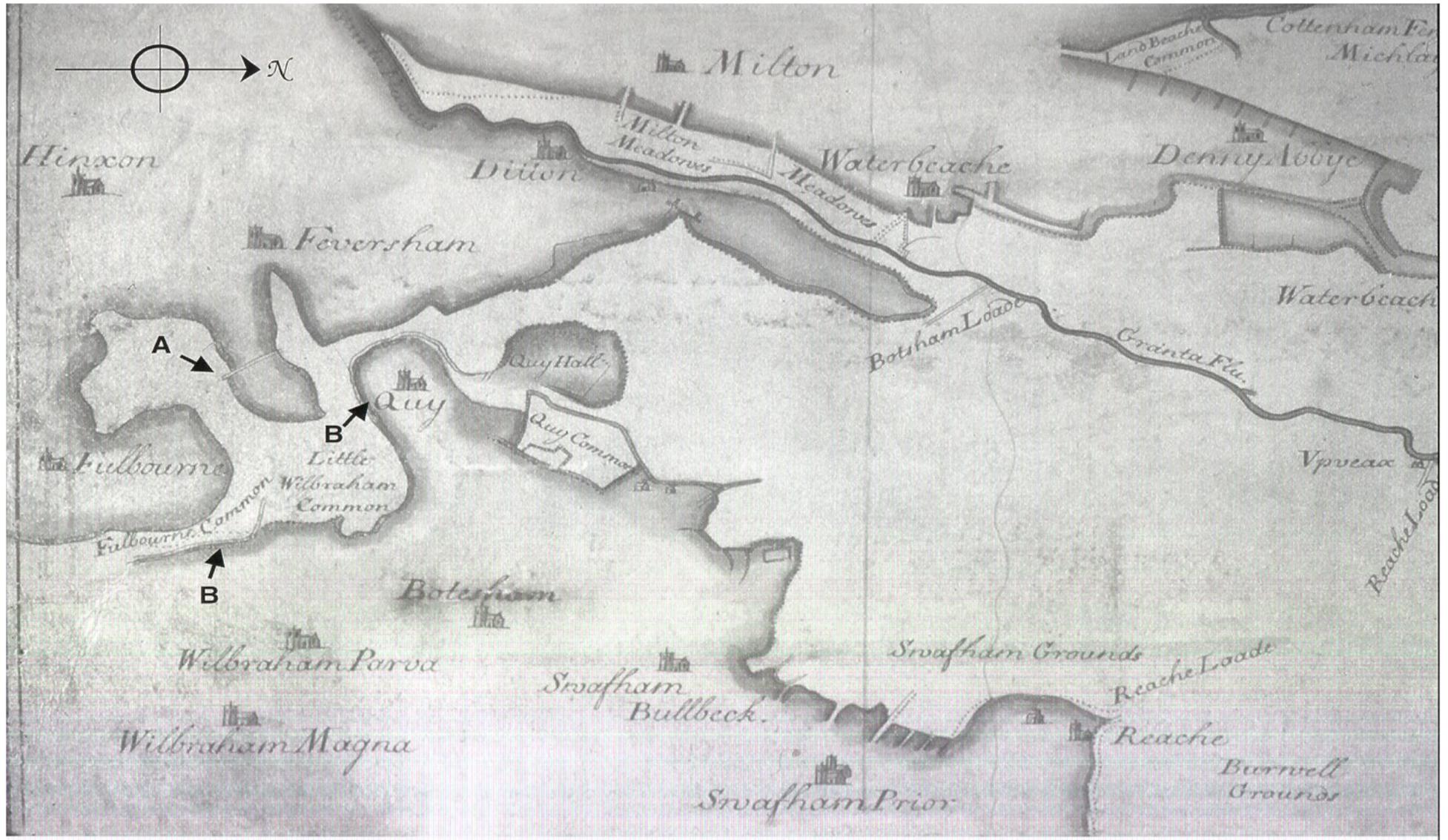


Figure 9. From a PLAN OF THE FENNS by William Hayward dated 1604. An artificial cut is shown (A) crossing the promontory of high ground between Fulbourn and Teversham Fens and the original course of Little Wilbraham River (B)

say: "The greater part of the common which comprises about 500 acres produces little else than sedge and rushes which are mown for litter. It has been proposed to effect the drainage of this common by means of a tunnel placed under the bed of Quy Water but which was objected to by the inhabitants of Teversham. This tract of land would be easily improved to the value of 15 shillings per acre could the command of the water be procured but in its present stage it must continue to labour under the like general calamity of the Fens in that neighbourhood",

The Wilbraham common land is in part depicted in Chapman's map¹⁶ of 1768 - as is part of the original course of Little Wilbraham River - though much of the area of interest is obscured by the compass star in the top left-hand corner (Fig.17). This shows the common land of Little and Great Wilbraham to be confluent and that some reclamation and enclosure of fields had already taken place along the edge of and within the fen in both parishes above the 10-metre contour. Of the state of the fen in Fulbourn and Teversham at that time, there is no such direct evidence but one may deduce from the scale of the drainage works subsequently undertaken that the need to improve land drainage was no less and the cost of putting this into effect as great as in the contiguous parishes.

Cambridgeshire has gone far into this measure [enclosing] since 1770 and in consequence its farmers have an opportunity of redeeming the county from the imputation it has long lain under of being the worst cultivated in England, and of proving that the same industry, spirit and skill which have manifested in other parts of the kingdom exist also in this, the open-field state

and system precluding the possibility of exercising them.

William Gooch 1811

THE INCLOSURE ACTS 1797-1810

The changes that had taken place in agriculture during the preceding one hundred years and the markets created by an increasingly urbanised society during the second half of the 18th century provided the stimulus for change from a medieval system of farming to one which allowed more efficient use of the land. In addition, investment of capital in the drainage of fen land had been shown to be financially rewarding, at least in the short term. Locally, both enclosure and land drainage were brought about by Act of Parliament: separate Bills were enacted for Little Wilbraham and Great Wilbraham in 1797, for Fulbourn in 1808 and for Teversham in 1815. With minor variations between the parishes, the Acts provided for the enclosure of the open common fields, heath land and common grazing and for reclamation of the fen. Their prime purpose was to make better use of the land, to make it more productive and in doing so they probably changed the appearance of the landscape more profoundly than at any time since the parishes were first settled. Although enacted separately, the public works necessary in each parish to drain the fen before it could be taken into cultivation were interdependent. That there was some form of master plan appears to be both implicit and explicit in their enactment and implementation. This was certainly so in Great and Little Wilbraham where the necessary changes were carried out at the same time by the same Parliamentary Commissioners. It is perhaps worth looking briefly at the

wording of part of the Parliamentary Inclosure Act for Little Wilbraham, which reads as follows: *'and whereas there is, in the said parish of Little Wilbraham upward of 500 acres of common or waste ground, a great part of which is under water and cannot be converted into tillage and improved without being properly drained, which drainage cannot be effectually carried out into execution without the construction of new works, scouring out the drains or water courses running into or through the said parish of Little Wilbraham and a part of the parish of Fulbourn, Teversham, Ditton, Quy and Hornsey'*.¹⁷

And in another section: *'And be it further enacted by the Authority aforesaid that it shall and may be lawful to and for the said Commissioners and they are hereby empowered and required to alter and straighten the course of any riverlet, brook or stream whatsoever running between the parish of Little Wilbraham and any adjoining parish ...'*. It would thus appear that the Parliamentary Commissioners who undertook the preliminary surveys had in mind an overall plan for the drainage of the confluent parish fens. That there was a 13-year gap between the enactment of the first and last of the Bills necessary to fulfil the plan reflects perhaps both an inherent conservatism and a natural desire by the landowners to see results elsewhere before making the major financial commitment that was involved.

Little Wilbraham

It is not entirely clear from the Parliamentary Act, nor from the report of the Commissioners following the completion of the necessary public works, how much of the drainage was new and how much a refurbishing of a pre-existing system. They

state, for example, that *"We have scoured out, widened and made straight all the ancient Brooks, Ditches and Water Courses, and repaired the ancient tunnels and bridges in the said parish of Little Wilbraham"*.¹⁷ The total cost of enclosing 1,970 acres (including 469 acres of common) was £3,339.14s.7d. Of this £578.10s.2d. was expended on drainage (including the cost of tunnels and bridges) which involved the construction or refurbishing of 436 chains (5.2 miles) of public drains (Table 1).

The following major works were undertaken:

- 1) The construction of a New Cut 110 chains (2,420 yards) in length from the road bridge between the Wilbrahams along the southern boundary of the West Field to rejoin Little Wilbraham River 12 chains (264 yards) above its junction with Great Wilbraham River. This served as a conduit for water to drive Hawk Mill. The disused section of the river south-west of the village, joined to a new public drain by a tunnel under the New Cut, became a drain for newly-enclosed fields and common land in the adjacent parish of Great Wilbraham (Fig.18)
- 2) The construction of four public drains alongside the newly created Short and Long Drovers. These discharged into the pre-existing drainage ditch (the Parish Ditch) running around the northern limit of the fen, on the boundary between the parishes of Little Wilbraham and Quy.
- 3) Construction of a tunnel, made of a hollowed tree trunk, under the bed of the embanked Wilbraham River to convey the water from the above drainage ditch into a newly constructed drain running to the west of Quy Water south of the Cambridge-

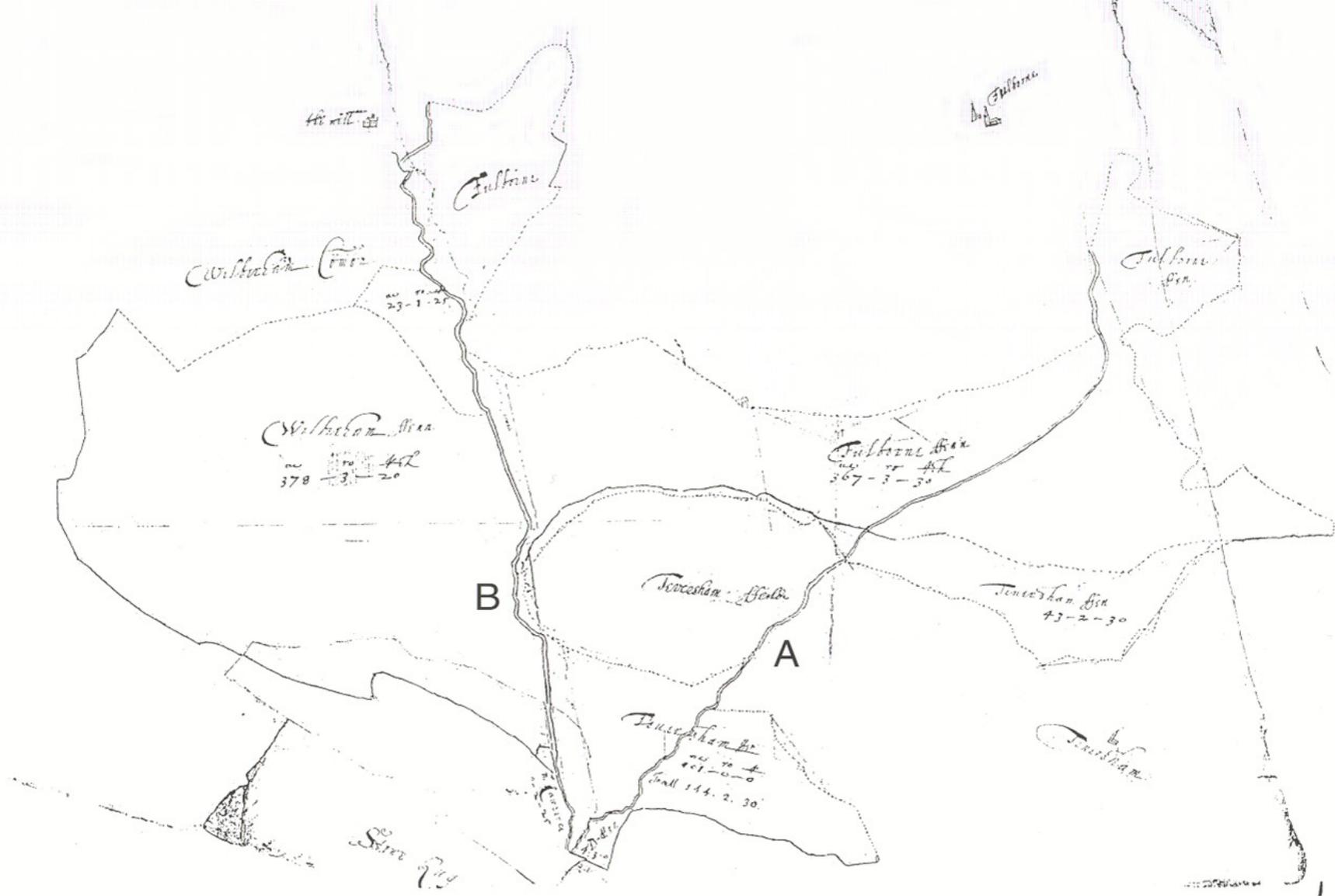


Figure 10. Map of Wilbraham, Fulbourn and Teversham Fens made during a major survey of Cambridgeshire Fens between 1680 and 1700. The watercourses converging towards Quy Bridge are the Mill Ditch (A) the artificial channel traversing the promontory of higher ground between Fulbourn and Teversham Fens and the Little Wilbraham River (B). (to compare with other figures the map should be inverted)

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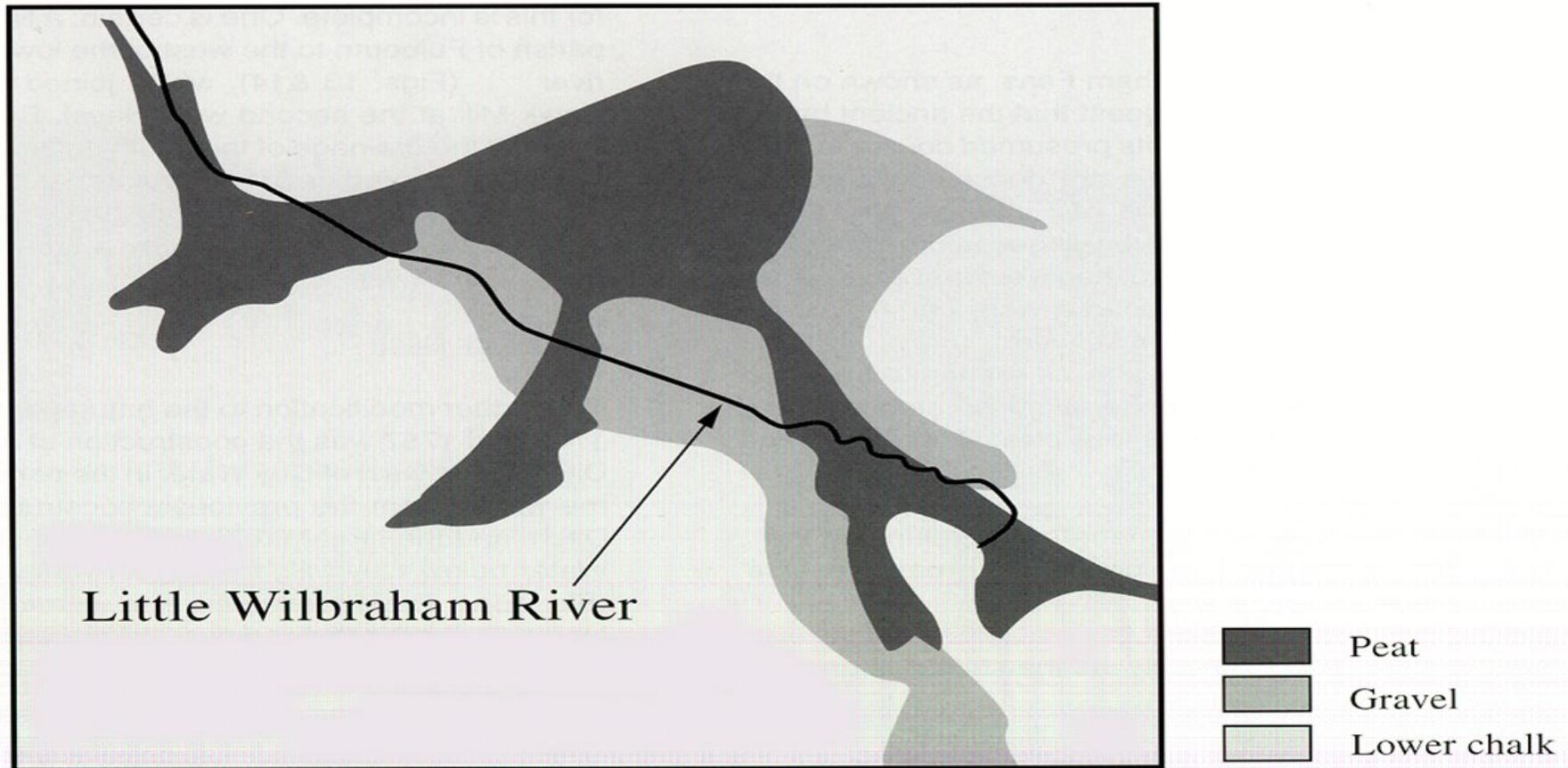


Figure 11. Course of Little Wilbraham River between Hawk Mill and Quy Mill. The present course of the river is clearly artificial as it bears no relation to the underlying drift geology



Figure 12. The former Great Wilbraham River in its course on the common, circa 1930. Flow was by then much reduced due to neglect of the watercourses and groundwater abstraction.



Figure 13. Fulbourn New Cut looking south from its junction with Little Wilbraham River,, Spring 2000.

Hawk Mill Confluence of Waterways

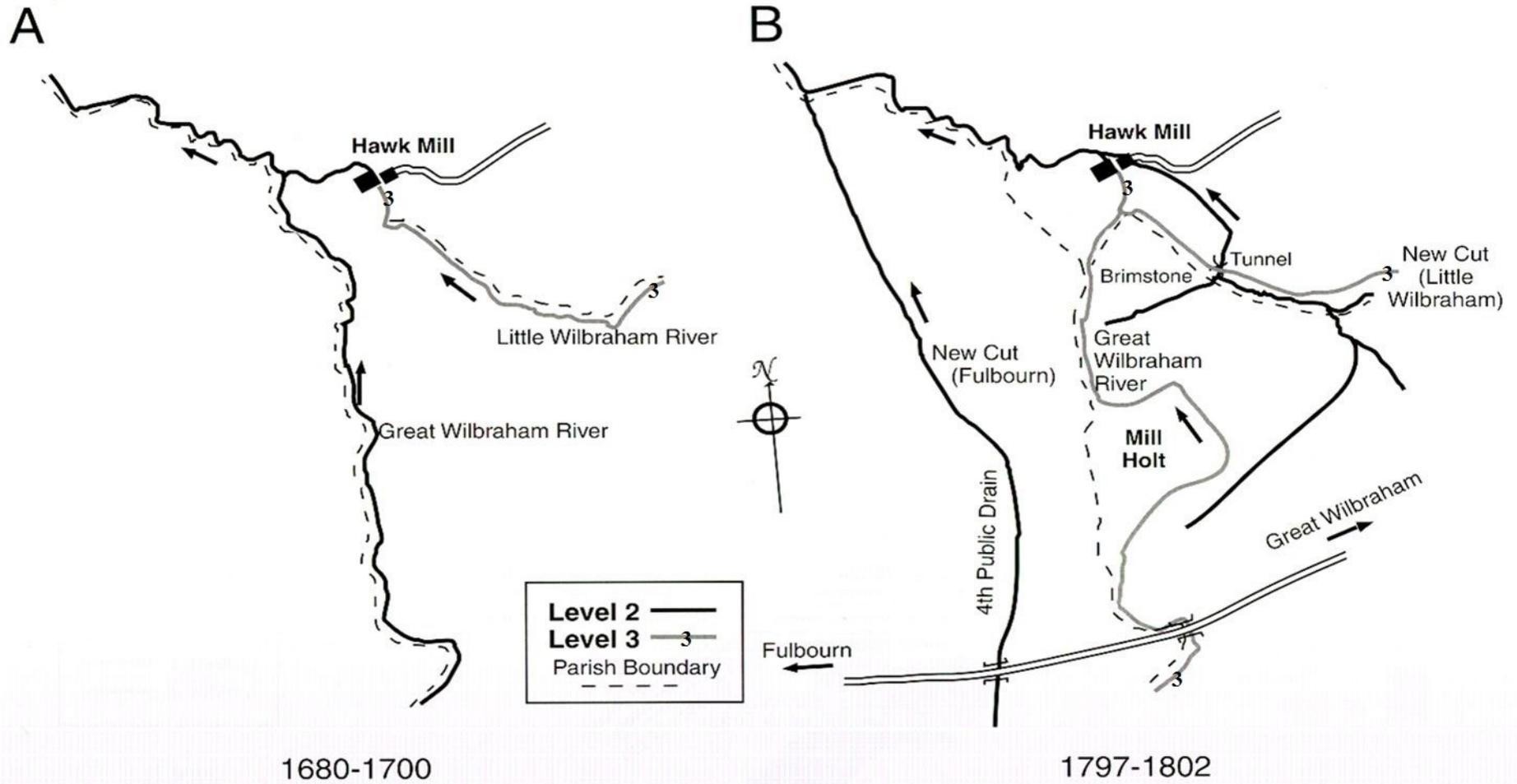


Figure 14. The waterways in the region of Hawk Mill—See text.

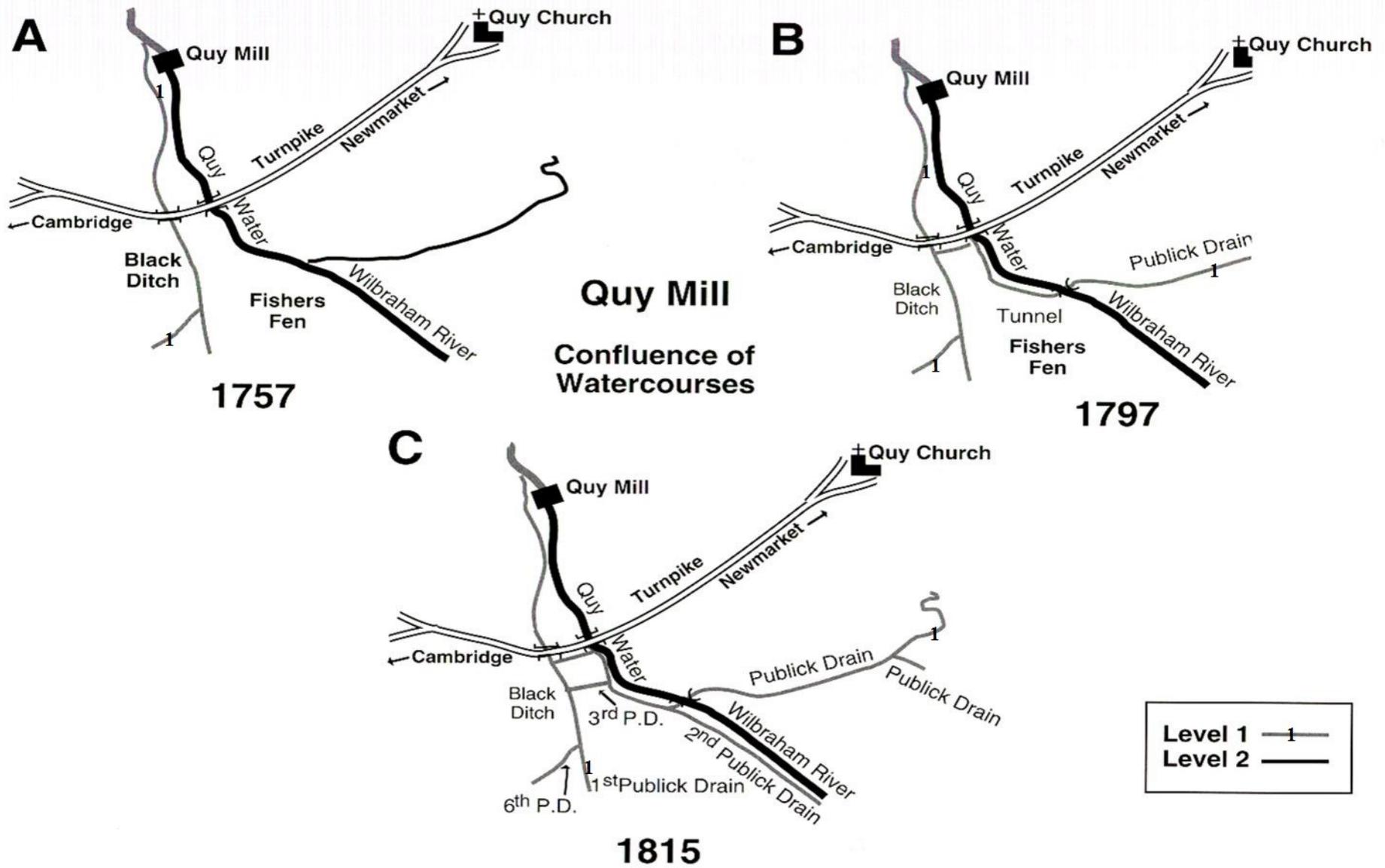


Figure 15. The watercourses in the region of Quoy Mill. See text

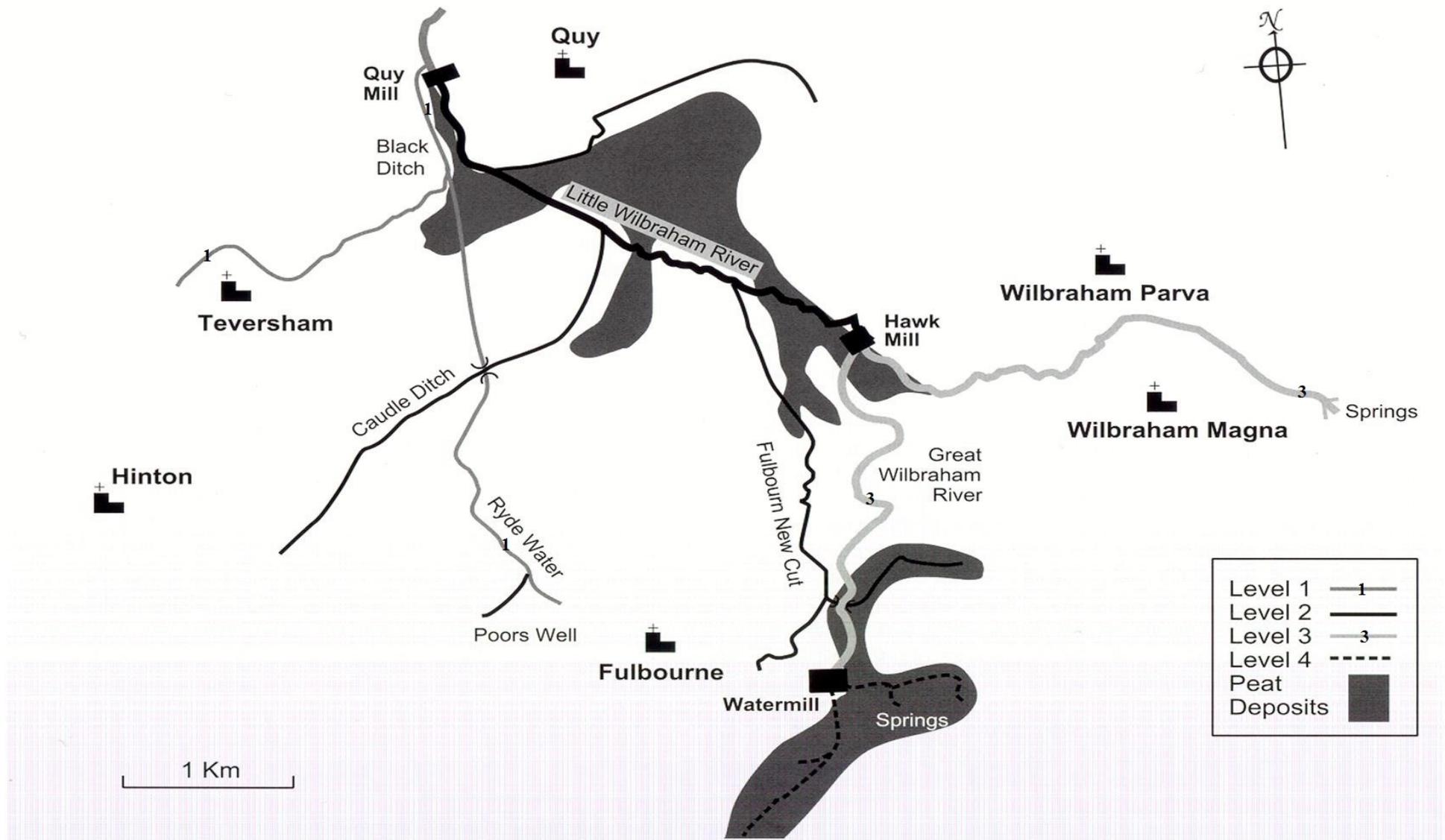


Figure 16. Changes to the watercourses and drains carried out before 1797 to increase water power and to improve



Figure 17. Part of Chapman's pre-enclosure map, Newmarket and Adjacent Villages, dated 1768, showing the original course of Little Wilbraham River from Temple Springs (a) to Hawk Mill (b). The river was later diverted into a New Cut running along the southern boundary (c) of the unenclosed West Field.



Figure 18. Wilbraham New Cut looking east, Spring 1988. The bed of the New Cut is some two metres above the old course of the river on the right which marks the parish boundary

Newmarket turnpike. The new drain was joined to the Black Ditch which ran into Quy Water below Quy Mill: the lowest of the water levels (Fig. 15).

4) The cutting of the new public drain referred to above running from the tunnel around the east and north sides of the old enclosures to the east of Hawk Mill to join the river below the mill (Fig. 14B).

An allotment of 20 acres was made in the west of the parish to provide revenue for the upkeep of the awarded watercourses and public drains. This responsibility was assigned by the Commissioners to *"the Church Wardens and overseers of the parish of Little Wilbraham and their successors"*.

Table 1: Little Wilbraham. Parliamentary Inclosure Act 1797

Total enclosed	1,970 acres
(Common land)	(469 acres)
Public drains	416 chains(5.2miles)
Total cost	£3,339.14s.7d.
Drains, tunnels & bridges)	£578.10s.2d.

Great Wilbraham

In Great Wilbraham, 2,400 acres were enclosed at a cost of £2,994.4s.10d of which sum £316.8s.0¹/₂d was spent on the construction of 240 chains (3 miles) of public drains and on tunnels and bridges.¹⁷ (Table 2)

The drainage works carried out in compliance with the Act and integrated where necessary with those in the adjacent parishes were as follows:

1) The scouring out and straightening of the old course of Little Wilbraham River along the parish boundary between the two villages. The original course of this part of the river is shown in Chapman's map (Fig.17).

2) The construction of a tunnel under the Wilbraham New Cut to connect the old river bed- now converted to a public drain - with the new drain by-passing Hawk Mill (Fig 14B). .

3) The construction of public drains on the north, east and south-east sides of the 56 acre cottagers' common allotment and subsidiary drains for the new enclosures to the west of the village and north of the new road to Fulbourn running westward from the village. These were connected to the new drain (the old river bed) along the parish boundary now joined, via the tunnel, to the drain around Hawk Mill, referred to above.

4) The construction of a new drain and tunnel to carry the waters from the springs arising south-east of the bridge on the new Wilbraham-Fulbourn road under the bed of Great Wilbraham River in the region of the Cringles. This was

connected to the watercourse running northwards to join the pre-existing Fulbourn New Cut which discharged its waters into Little Wilbraham River below Hawk Mill (Figs 13 and 14B).

All these newly constructed public drains were thus part of the second or middle level drainage system whereas the realigned Little Wilbraham River in its New Cut above Hawk Mill and Great Wilbraham River were at the third or upper level. Land was allocated to produce revenue to maintain the awarded watercourses which, as in Little Wilbraham, became the responsibility of the Churchwardens and Overseers of the parish. An amendment to the text of the award in 1801 introduced ambiguity on the extent of these responsibilities that later had serious consequences for Great Wilbraham River and eventually lead to litigation (see Appendix)

Table 2: Great Wilbraham. Parliamentary Inclosure Act, 1797.

Total enclosed	2,400 acres
Public drains	240 chains (3 miles)
Total cost	£2,994. 4s. 10d.
(Drains, tunnels & bridges)	(£316. 8s. 01/2d.)

Evidence that improved drainage soon achieved the objectives of the Parliamentary Acts is provided by the absence of complaint or litigation (apart from that associated with a dispute over the solicitor's and Commissioners' fees) and by Gooch who some 10 years later says, when criticising the poor state of the 30 acres allotted to cottagers in Little Wilbraham for

common grazing: *"I have viewed this common and found a wretched desert in the midst of the finest crops"*.¹⁸ And when commenting on the increased productivity of the fields in the parish following enclosure, states, *"Common before enclosure of little value, two-thirds of it now worth ten shillings per acre, one-third twenty shillings per acre"*. Of Great Wilbraham he has this to say: *"Fen improved by drainage so much that what before enclosure let only at two shillings and sixpence per acre has been sold since at £25 per acre"*. That such results were achieved so soon may have encouraged the owners and tenants of land in Fulbourn to embark on the more formidable and extensive drainage works required in that parish.

Fulbourn

The map produced in 1806 by the surveyors for the Parliamentary Commissioners is of particular interest as it shows the pre-existing watercourses and the intended changes to them. A subsequent map of 1810 shows how these were to be put into effect. The total bill for enclosure of this parish was £10,689.16s.8d of which £1,371.6s.11d was expended on drainage.¹⁹ It was necessary to refurbish or cut 15 public drains of a total length of 1,070 chains (13.3 miles), all of which need not be considered in detail (Table 3).

The important new drains were as follows:

- 1) The 1st public drain which diverted the water from the springs at Poors Well to the west of the village (previously

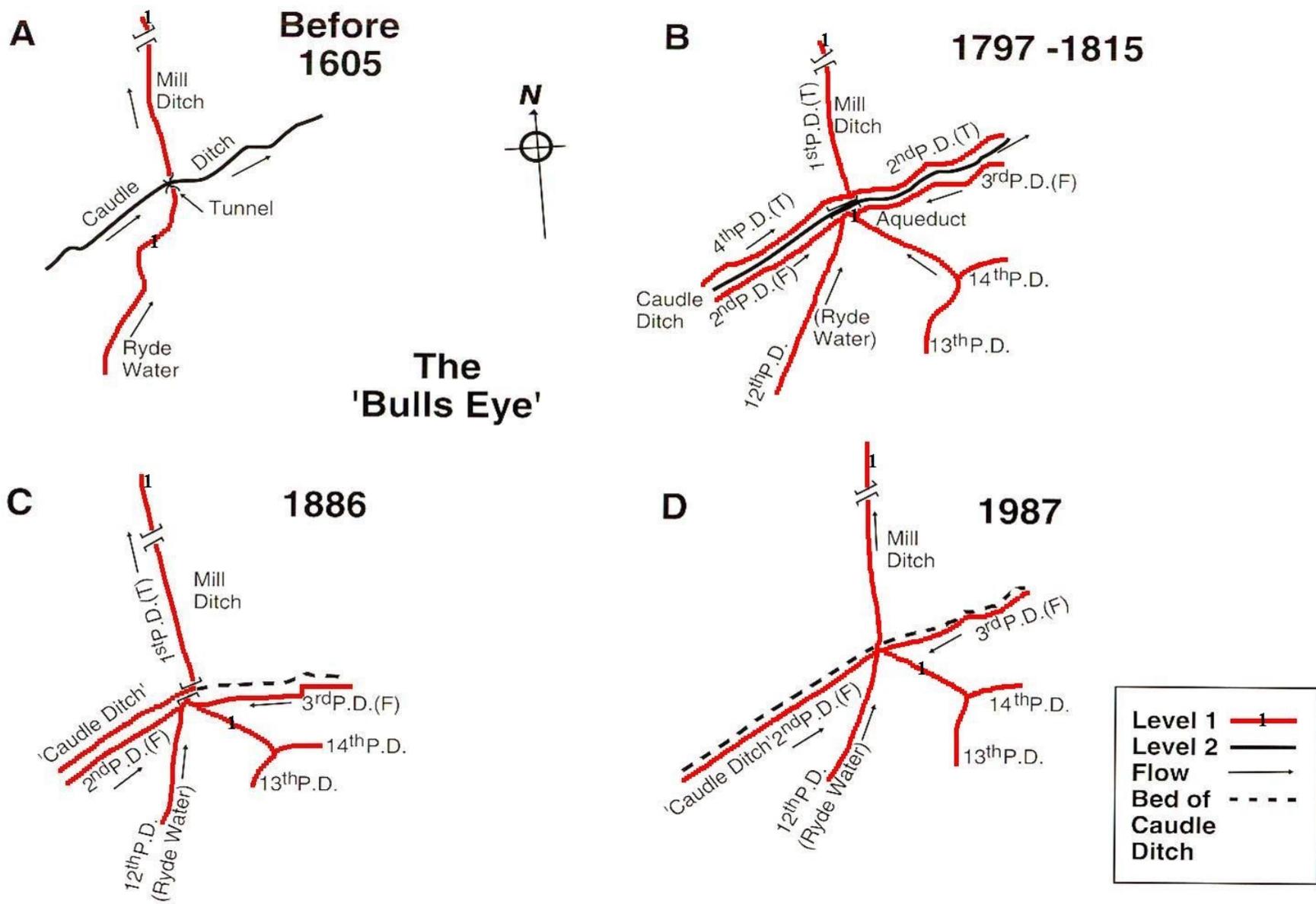


Figure 19. The changing configuration of the public drains at the “Bulls Eye” on the Fulborn/Teversham parish boundary.

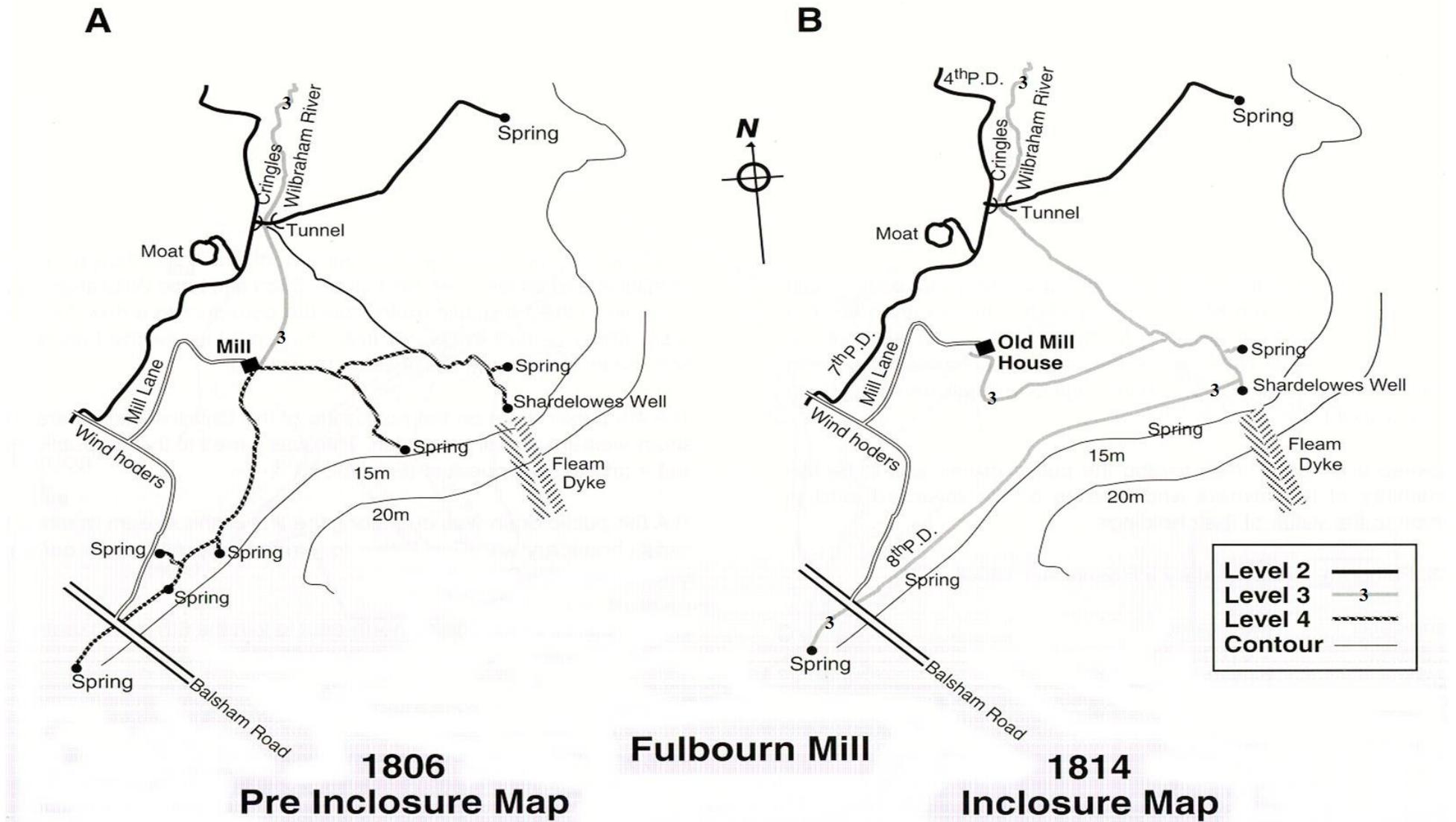


Figure 20. The watercourses before and after the demolition of Fulbourn watermill. See text.

conveyed across the fen to the north by the old river - the Ryde Water - which joined the Mill Ditch in the parish of Teversham) westward and then north-west just below the 15-metre contour to join the Caudle Ditch near Caudle Head. The Caudle Ditch, running north-east along the fen edge on the 10- metre contour to join Little Wilbraham River, was carried across the Mill Ditch by a new aqueduct. This diversion of flow from the springs at Poors Well into the Caudle Ditch was intended both to improve land drainage and increase water power at Quy Mill.

2) The 3rd public drain running on the south side of Little Wilbraham River passed under the New Cut in a tunnel where it was joined by the 5th and 6th public drains. After running north-west alongside the river and then south-westerly beside the Caudle Ditch, it joined the 13th public drain just south of the aqueduct at the "Bulls Eye"(Fig. 19B).

3) The 4th public drain which was the southern extension of the pre-existing Fulbourn New Cut in the north-east part of the parish (Figs. 13 & 14B). This received water from the new 7th public drain and from the springs in the parish of Great Wilbraham, by the tunnel under the bed of Great Wilbraham River.

4) The 5th and 6th public drains on either side of the Fulbourn New Cut (confusingly later mis-named the 5th public drain) which served both as land drains and "sock" ditches to receive any overspill from the higher, embanked main drain between them.

5) The 8th public drain which diverted the water from the springs (that formerly provided power for the watermill) north-east and south-west of the Balsham Road into the upper reaches of Great Wilbraham River just below Shardelowes Well. This was an important part of the scheme to drain the fen north-east of the dismantled Fulbourn Mill (Fig. 20B).

6) The 12th and 13th public drains which, converging just south of the new aqueduct, joined the Mill Ditch (Fig.19B). They drained the fen previously traversed by the old Ryde Water. It is of interest that the Commissioners' map of 1806 depicts these prospective drains as being confluent with the Caudle Ditch: a hydrological arrangement that could not have worked.

The upkeep and cost of maintaining the public drains was to be the responsibility of the owners and tenants of the awarded land in proportion of the to the value of their holdings.

Table 3: Fulbourn. Parliamentary Inclosure Act 1808

Total enclosed	(not stated)
Public drains	1,070 chains (13.3 miles)
Total cost	£10,689. 16s. 8d.
(Drains)	(£1,371. 6s. 11 d.)

Teversham

The drainage work necessary to reclaim the fen in this the smallest of the parishes was less formidable than in Fulbourn but rather more extensive than in either of the Wilbrahams. The total cost of enclosure was £3,354. 13s. 2d of which £515. 13s. 8d was spent on drainage.²⁰ There seems to have been some delay in implementing the Act passed in 1810: the map of the awards was published in 1815. In all, 509 chains (6.36 miles) of ditches and drains were refurbished or newly dug (Table 4).

The main drainage works were as follows:

- 1) Deepening the Mill Ditch, now renamed the 1st public drain (Teversham) which conveyed the waters passing under the aqueduct from the parish of Fulbourn northwards into the Black Ditch in the parish of Fen Ditton and thence into Quy Water below Quy Mill (Fig.19B).
- 2) Digging a 2nd public drain running north-east and then north-west parallel to and 20 feet from the Caudle Ditch and Little Wilbraham River. This joined the 1st public drain near the aqueduct to a new 3rd public drain which carried the water from the tunnel under the bed of Little Wilbraham river to the Black Ditch (Fig. 15C).
- 3) A 4th public drain on the north side of the Caudle Ditch to drain the south-western part of the parish. This was joined to the 1st public drain just north of the aqueduct (Fig. 19B).

4) A 6th public drain was dug along the line of the stream marking the parish boundary with Fen Ditton to join the 1st public drain before its junction with the Black Ditch.

5) A 7th public drain running north-east to join the 6th public drain. This drained the new enclosures to the south of the village.

Table 4: Teversham. Parliamentary Inclosure Act 1810

Total enclosed	(not stated)
Public drains	509 chains (6.36 miles)
Total cost	£3,354. 13s. 2d.
(Drains)	(£515. 13s. 8d.)

The extent of the drainage work carried out in each parish to bring the fen under cultivation or make the land more productive and the crude, comparative costs derived from the bills and other sources among the Commissioners' papers, are set out in Table 5. The acreages quoted in the table refer to the whole parish, not to the area drained and enclosed, and are in modern units of measurement. It will be seen that Great Wilbraham, much of the parish being above the 15 metre contour, required the least, Fulbourn and Little Wilbraham almost the same and Teversham the most drainage per acre. The cost of the public drains per chain was greatest in the parish of Little Wilbraham and least in Teversham with the other two parishes somewhere in between. The reason for this is unclear. The experience gained by both surveyor and contractor leading to greater efficiency as the drainage work progressed; fewer or less serious technical problems; a fall in the cost of labour and

materials: any or all of these may have contributed to a reduction in costs. A more detailed analysis of the available evidence would be of interest but peripheral to the main purpose of this study.

Table 5

Parish	Area (acres)	Drains (chains)	Acres /chain	Cost (£)/chain	Cost (£)/acre
Lt Wilbraham	1,988	416	4.8	1.39	1.7
Gt Wilbraham	2,919	240	12.2	1.32	1.0
Fulbourn	5,261	1,070	4.9	1.28	2.0
Teversham	1,220	509	2.4	1.01	2.7

The drainage works undertaken by the Parliamentary Commissioners in the four parishes are correlated in Figure 21. They may be summarised as follows:

1. The ditches and public drains newly dug or refurbished in the parishes of Little Wilbraham, Fulbourn and Teversham below the 10-metre contour became part of a drainage system at the first (lowest) level. This system was joined to the Black Ditch which discharged its waters below Quy Mill. This was solely for land drainage.
2. The ditches that drained the fen and other low-lying land above the 10-metre contour were connected to public drains that discharged their waters into Little Wilbraham River above Quy Mill and below Hawk Mill (the second level), as did the Caudle Ditch carrying water from the

springs at Poor's Well and Caudle Head. This system served to improve land drainage in the parishes of Great Wilbraham and Fulbourn and increase flow at Quy Mill.

3. Little Wilbraham River in its New Cut and Great Wilbraham River, at the third (upper) level, played no part in land drainage except for the area of fen north-east of the demolished Fulbourn Mill. They served as conduits for the water from the springs in the south-eastern quadrant of the basin and provided water power for Hawk Mill.

The point of convergence of the watercourses and drainage ditches in the region of the aqueduct on the boundary between the parishes of Fulbourn and Teversham became known as the Bull's Eye, referred to later in the text.

THE SLUICE

The sluice is situated on the upper part of the Wilbraham New Cut (Fig.22). Its purpose was no longer recalled on local inquiry but tradition had that it was a sheep-dip. Although it may have been so used this clearly was not its main purpose which was to divert water from the watercourse. The bricks of which it is built together with the time the New Cut was constructed and the fen drained point to it having been put in place sometime in the nineteenth century; there appears to be no documentary evidence to verify this. The method of operation was that baffle

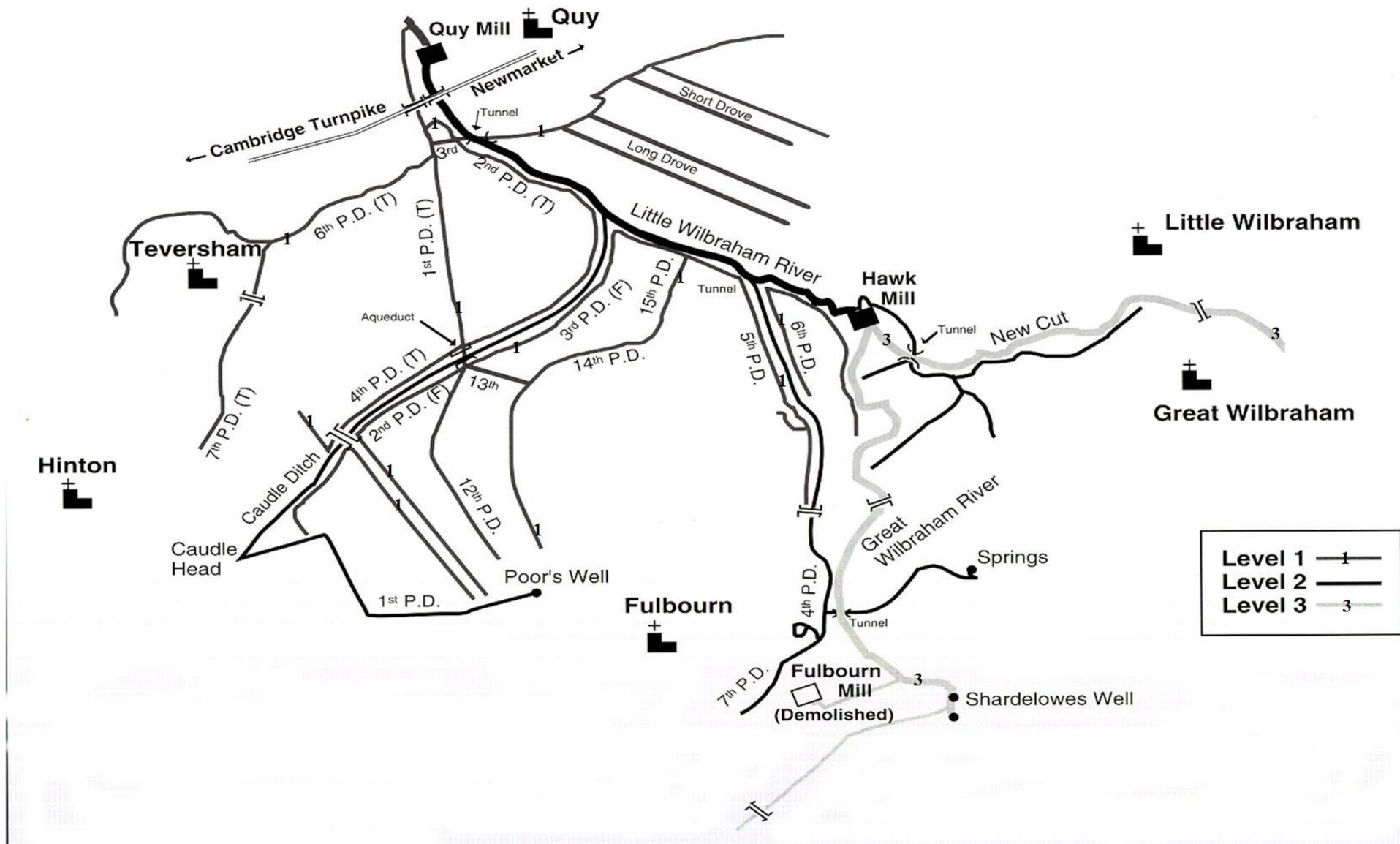


Figure 21. The watermills, rivers and public drains in the four parishes after the Parliamentary Inclosure Acts 1797-1810. The system is at three levels.

boards were lowered, either partly or completely, at the downstream end of the sluice to reduce or stop the flow of water running along the New Cut. As the level of the water rose it flowed through a square aperture in the wall of the sluice, seen on the right in Figure 22, into a leat or conduit running some 300 metres north west to the High Street where it ran in a channel between the road and the properties on the south side and thence along Fen Road to a drainage ditch alongside the Long Drove (Fig. 23). Its purpose was to provide water for livestock grazing the fields in the former Wilbraham Fen, probably those nearer the village, and it served also to augment the water-supply for properties in that part of the village. The utility of the system and how it was operated were made clear when thought to be under threat by a Bill before Parliament in 1910 to permit the Cambridge University and Town Water Works Company to build a pumping station at Fleam Dyke. The Parish Council instructed the Clerk to write to the Company as follows: *"In the event of the Bill being passed it will seriously affect the water supply running through the Parish of Little Wilbraham from 6pm Saturday to 6am Monday weekly, which we claim one fifth of the water running from the Springs, called the New Ditch. If the water is taken away it will be a very serious matter for the Parish as it runs down the Fen to supply water for the Cattle and for the Poor Common. It also supplies water for Domestic use to the inhabitants of the Parish ..."*²¹ There is no evidence that the intermittent diversion of water from the river into the land drains adversely affected drainage of the fen. There is however contemporary evidence that when the sluice was incorrectly operated. the miller at Hawk Mill complained.²² The configuration of the sluice together with other evidence point to its subsidiary use as a sheep dip.²³

THE NEXT HUNDRED YEARS: 1820-1920

"But by the perfect system of drainage now adopted, the loose fen has been so much condensed that many of the old fenmen say the clay has risen, as it is much nearer the surface now than years ago, forgetting as they do, that it is condensation of the loose spongy soil which has brought the surface nearer the clay"

Samuel Jonas (1847)

The reclamation and enclosure of Fulbourn and Teversham Fens took place too late to be commented upon by Gooch but improvement in productivity and land values probably matched those achieved in Little and Great Wilbraham. The necessary changes were not brought about without dissent. As early as 1812 a petition was received from the proprietors and occupiers of land in Fulbourn complaining of *"serious injury to their lands from the aqueduct made to convey the water arising from Poors Well and Caudle Head springs into the Wilbraham river and requesting to have the said aqueduct removed"*. An enquiry conducted by the Commissioners showed that the trouble arose from a breach having been made in the bank of the river, obstructions placed in the various drains and the neglect of the occupiers of the land adjoining the drains for which they had responsibility.¹⁰ In 1839 the tenant of Hawk Mill complained that the water flow had been much reduced following drainage of the adjacent lands and the expected increase in flow at Quay Mill appears not to have been maintained. The premium charged for this by the Commissioners, it seems illegally, was eventually returned with interest to the miller's executors.

Cartographic Evidence of Change

With the improvement in standards of map-making following the establishment of the Trigonometrical Survey of England and Wales in 1791, maps become an increasingly important source of accurate documentary evidence of the course of waterways and their modification. The draft Ordnance Survey Map of the country east of Cambridge, dated 1810, is too tentative to be of value for this purpose. Baker's map of 1830 is better but, due to the small scale and some errors of detail, provides little additional information. The first edition of the one-inch Ordnance Survey Map published in 1836 is more valuable as the main watercourses and public drains are shown in some detail (Fig. 24). It will be seen that the 1st public drain in the parish of Fulbourn is already out of use and the springs at Poors Well are re-connected to the 12th public drain, replacing Ryde Water. The Caudle Ditch is shown still connected to Little Wilbraham River. There are three cartographic details which are clearly incorrect: the 3rd public drain (Fulbourn) is shown as being disconnected from the conjoined 12th and 13th public drains south of the aqueduct; the Black Ditch stops at the turnpike at Quy Water Bridges; and the old course of Little Wilbraham River and the New Cut are shown as being confluent above Hawk Mill. These features are inconsistent with other contemporary and later documentary evidence.

The first of the large scale Ordnance Survey Maps published between 1886 and 1888 shows that the Caudle Ditch no longer exists east of the aqueduct which is still present but out of use (Fig. 19C). Confusingly, the 3rd public drain is now named "Caudle Ditch" and the arrow indicating the direction of flow within it is incorrect. The demise of the real Caudle Ditch east of the aqueduct was almost certainly due to lowering of the land surface as a result of the improved drainage. This no doubt led to progressive embankment of the Little Wilbraham River and

perhaps sinking of the bed of the Caudle Ditch where it crossed the peat immediately south of its confluence with the river. The next edition published in 1902 confirms these changes, shows further minor alterations to the drainage system in the region south of the Cringles and that three areas no longer under cultivation had reverted to reed beds and rough pasture. The first of these is in Fulbourn Fen south of the 3rd public drain and east of the aqueduct; the second in the angle between the now disused Caudle Ditch and Little Wilbraham River on either side of the 3rd public drain and the third, and already most extensive, in the north-west part of Little Wilbraham Fen between the Parish Ditch and Wilbraham River. That there had been increasing problems with drainage receives some support from other sources. As early as 1842 a new drainage ditch was required in Fishers Fen just south of the Quy road bridges, to improve the drainage of Little Wilbraham Fen, and it was necessary to clean out, cut and repair a drain "*long since discontinued*" to assist this process.²⁴ It was necessary in 1863 to construct a brick tunnel under the embanked bed of Wilbraham River, replacing the hollowed tree trunk which had become useless as it was then six feet above the drainage ditches in Little Wilbraham Fen: an indication of how much the peat had shrunk in a little over sixty years.

Neglect and Decline

In the second half of the 19th century the drainage system had begun to deteriorate and by the beginning of the 1914-1918 War much of the system had become derelict. This was in part due to changes in land levels but in the main to lack of regular



Figure 22. The sluice, looking downstream. Baffle boards were lowered at the far end to divert water through the square aperture seen on the right into a conduit leading to an open channel beside the High Street.



Figure 23. The channel along the southern margin of the High Street in 1906 with culverted access to adjacent properties.

maintenance. The recession in agriculture, changes in land use and division of responsibility may all have contributed to this. Following the repeal of the Corn Laws in 1846 the price of wheat fell sharply, fluctuated at a lower level in the intervening period and then collapsed after 1875. The price of meat and dairy products fell less quickly and lost little more than 10 percent over the same period.²⁵ As the market for meat and dairy products was growing there was a trend for those with both initiative and capital to move, where possible, from arable farming to grazing. If this national trend was followed locally the less exacting standards of land drainage for pasture, as compared with arable land, could be met at less cost. Locally, the division of responsibility between the four parishes for what was intended to be an integrated drainage system led to uncertainty on the part of the parish officers (later the District Council) and landowners about the nature and extent of their obligations. It was in the interest of both the riparian landowners and the proprietors of the watermills that there should also be regular maintenance of the embanked watercourses, many lengths of which ran above the level of the adjacent fields. The amendments made in 1801 to the text of the Inclosure Award for Great Wilbraham were ambiguous and created uncertainty about where the responsibility for maintenance of Great Wilbraham River lay (see Appendix). Documentary evidence of this may be found among the Hicks family papers.²⁶ In the late 1840s Mr R F Townley of Fulbourn Manor had called on Edward Hicks (1814-1889) of Wilbraham Temple, the major landowner in the parish of Great Wilbraham, to clean out part of the river which was flooding the land of one of his tenants. In an exchange of letters between November 1853 and May 1854 with Clement Francis, the solicitor acting for Townley, Hicks sought proof that he had this liability. The evidence adduced by

Francis was an extract of the relevant section of the Inclosure Award and a deposition by James Muggleton, a 65 year labourer from Quy, before A G Brimley, a Justice of the Peace and Mayor of Cambridge, made in December 1853. In this he declared that *"I have undertaken the cleansing and scouring out of the Wilbraham River from Hawke Mill to Cringles Corner for forty years and upwards and that during the whole of that period I was engaged and paid as follows namely by the Reverend James Hicks, Clerk, of Wilbraham Temple in Great Wilbraham in Cambridgeshire as to the cleansing and scouring out of so much of the said River as lies between Cringles Corner and the Spike Battens on Wilbraham Common until his decease and after his decease by Edward Hicks Esquire of Wilbraham Temple aforesaid and by John Collett the occupier of Hawke Mill as to the cleansing and scouring out of so much of the said River as lies between the Spike Battens and Hawke Mill until his decease and after his decease by William Kent Collett his son And I further declare that to the best of my knowledge and belief no other person or persons than myself or those employed by me were engaged or employed in cleansing and scouring out the said River during the period aforesaid and that no other person or persons than myself or those employed by me did cleanse and scour out the same during the said period and that the said River was cleansed and scoured out by me once in seven years or thereabouts during the said period"*, In a subsequent letter to his own lawyer, F S Pipe Wolverston, Edward Hicks says that after a private examination of Muggleton in Clement Francis' office he believed most of the sworn declaration to be incorrect but he acknowledged that *"the estate is somehow or other liable"* and *"the work even for my own benefit should be done"* but without admission of liability. The response to Townley's solicitor suggested by Pipe

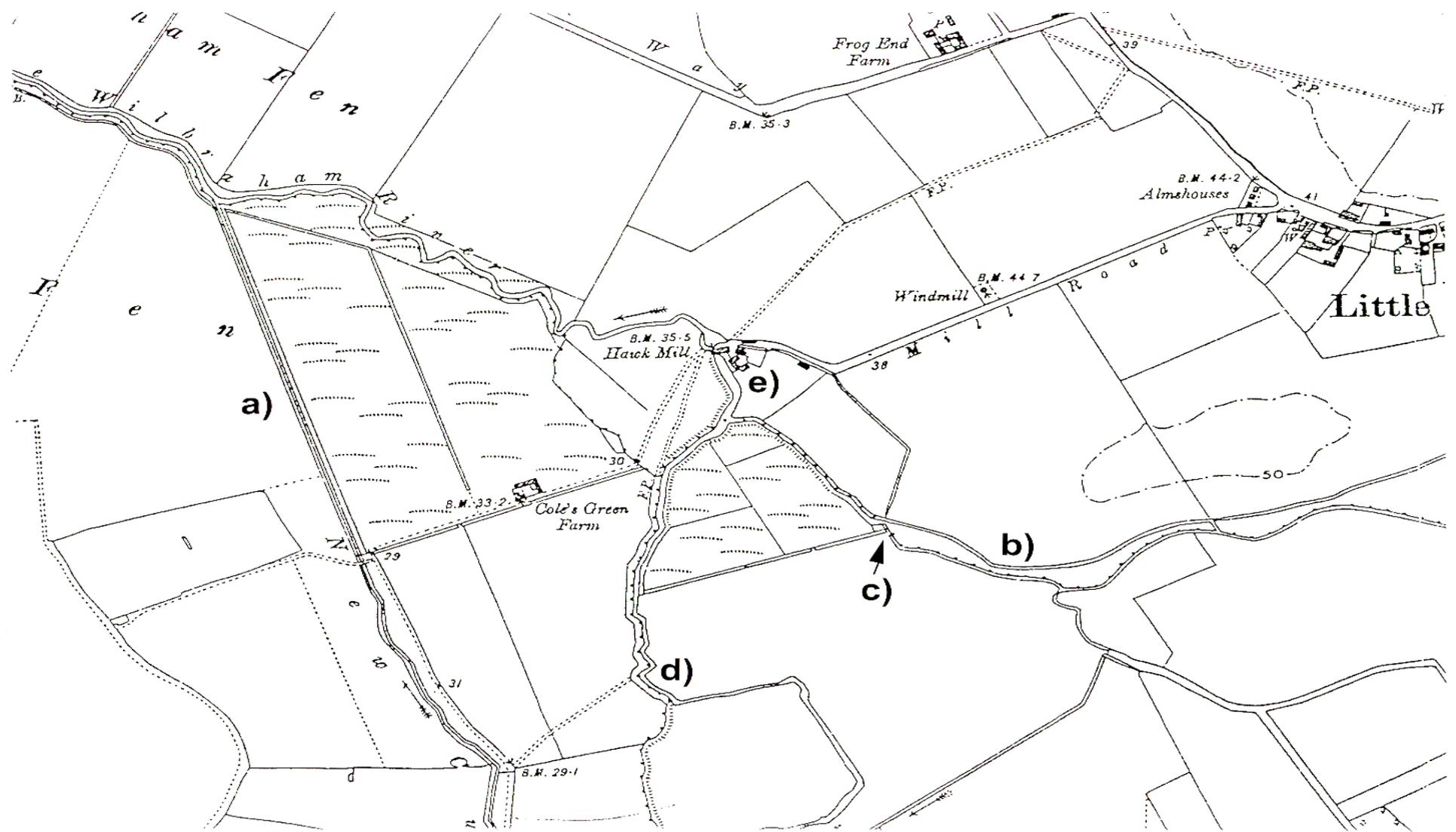


Figure 25. The watercourses and public drains in the region of Hawk Mill Farm. Key: a) Fulbourn New Cut, b) Little Wilbraham New Cut, c) culvert for drain under New Cut, d) Great Wilbraham River, e) mill race.
 (Ordnance Survey map, 1903 edition, reproduced with permission of the Syndics, Cambridge University Library)

Wolverstan reads as follows: "*Sir, As a tenant for life I do not feel called upon to incur the expense of a lawsuit but I beg to draw your attention to this fact that you have not given any explanation of the origin of this supposed liability so that if inconvenience arises at a future time the blame will lie with you.*" And so the assignment of responsibility for maintenance of the river under the Inclosure Award remained unresolved until the progressive deterioration in the state of the river eventually led to litigation.

Following the Local Government Act of 1894, Chesterton Rural District Council took on, over a period of years up to 1919, the duties assigned to the parishes officers under the Inclosure Awards to maintain the awarded watercourses and drains. Under the Act the District Council acquired the Public Works Trust Funds of Little and Great Wilbraham set aside for this purpose. For Fulbourn, maintenance costs were normally charged to the General District Expenses Account but this was found to be illegal and other arrangements had to be made.²⁷ Despite this unification of responsibility the drainage system continued to deteriorate due to lack of maintenance and by the beginning of the First World War much of the arable land in the former fen had gone out of cultivation. A particular problem arose over the responsibility for maintenance of the lower courses of Great and Little Wilbraham rivers above Hawk Mill in an area shared between three parishes (Fig.23). The Great Ouse Catchment Board accepted responsibility for the river below Hawk Mill and the District Council, for reasons that are not entirely clear, the Great Wilbraham river from its source to the Cambridge - Newmarket railway. Who was responsible for maintaining the river between the railway and Hawk Mill and for the lower part of the Little Wilbraham New Cut remained

unresolved. Some maintenance work on the watercourses, however, continued on an *ad hoc* basis. For example, in 1919 the Drainage Board, together with the District Council, cleaned out Great Wilbraham River. In doing so the bed of the river was lowered too much and as a result water from Little Wilbraham New Cut, on reaching the Mill Race, flowed upstream into Great Wilbraham River. A temporary sluice had to be put in place to enable Hawk Mill to be used, at most, for two hours a day. The problem was eventually overcome and by 1924 when Hawk Mill and Farm were up for sale, the amount of water coming down Great Wilbraham River was said to be: substantial. And for much of this time another factor leading to impaired flow at both Quy and Hawk Farm watermills had entered the equation: water abstraction.

Water Abstraction

To meet an increasing demand for water by the growing town, the Cambridge University and Town Water Works Company built a pumping station in 1891 at Fulbourn adjacent to Poors Well. The station was upgraded in 1897 by the installation of larger pumps in a substantial brick building which still stands, now named Telford House, the offices of a firm of civil engineers. This reduced the volume of water reaching Quy Mill. An outbreak of typhoid fever in 1903 at the (then) Fulbourn Asylum less than a mile away and attributed to an inadequate sewage disposal system, gave rise to public concern. This and the growth in demand for piped water led to the construction of a new bore hole and pumping station situated more distantly but in the same catchment area, on Fleam Dyke. Work on this began in 1911 but completion was delayed until 1921 due to the 1914-18 War. After the Fleam Dyke pumping station was

opened with an abstraction capacity of 2 million gallons a day, later increased to 3-3.5 million gallons, the Poors Well station was closed. To meet an ever increasing demand for water during World War II, the pumping station was reopened, renovated in 1954 and finally closed in 1987 when alternative sources became available.²⁸ An early and recurring problem was that when abstraction was increased during periods of dry weather the water table was so lowered that wells in Fulbourn and Little Wilbraham had to be deepened by between five and ten feet and flow in Great Wilbraham River was so reduced that in 1913 and again in 1921 during periods of severe drought the river almost ceased to flow.²⁹ The problem was exacerbated by a lack of regular maintenance of the awarded watercourses and public drains. The more recent effects of licenced abstraction on flow and land drainage are considered later.

DECLINE AND DERELICTION: 1920 -1960

In the absence of regular maintenance the state of the awarded watercourses and public drains continued to deteriorate. When it became widely accepted that the drainage of the district had broken down, the Clerk to the Great Ouse Catchment Board, the authority responsible for the river below Hawk Mill, proposed that an Internal Drainage Board be set up to address the problem. This was opposed by a number of landowners and tenants, no doubt due to the depressed state of agriculture and continuing uncertainty about where responsibility lay to put things right. Throughout much of this period the problems associated with the Wilbraham and Fulbourn watercourses and public drains were seldom absent from the agenda of the Ditches and Drainage Committee of the District Council. In 1931 the committee received a complaint that the land to the west of Great Wilbraham river, south of the Wilbraham/Fulbourn road, was constantly under water due to the poor state of repair of the

riverbank, but despite this there was still enough flow in the river to drive the mill (Fig. 24). In the same year the owners of Hawk Mill and Coles Green Farm complained to the District Council that the water overflowing from the Fulbourn New Cut made useless some 30 acres and was doing great damage to a total of 68 acres of their land. In the following year the flooding suddenly got worse and at the same time far less water was reaching the mill.³⁰ This was found to be due to a breach in the west bank of Great Wilbraham River opposite where the Osier Ditch joined the river. The escaping waters ran into and overloaded the 4th public drain and on reaching Fulbourn New Cut, the banks of which were in a state of disrepair, spilled over into the 6th public drain which overflowed and caused further flooding of the adjacent fields of Coles Green Farm. Further problems arose due to neglect of the banks of Little Wilbraham New Cut just beyond the tunnel and as a result the area of reclaimed fen known as Brimstone, south of Hawk Mill became permanently flooded. The problem was addressed but not solved by the District Council by breaching the roof of the tunnel to divert the water coming down the New Cut into the lower drain running north-westerly to join the river below Hawk Mill.³¹ As a result the mill was deprived of all water power and, in 1937, went out of use.

Litigation

The intractable problems of inundation and six or seven years of fruitless negotiations to seek redress, led the owners, the White Brothers, to start legal proceedings against the District Council, claiming damages for negligence, trespass, nuisance and breach of statutory duties. The action was not heard until 1941 and meanwhile the land remained derelict (Fig. 27). After a hearing lasting nine days before Mr Justice Atkinson at the Cambridge Assizes and the Royal Courts of Justice, it was adjudged, amongst other matters that the responsibilities assigned under the Inclosures Award for Great Wilbraham now

devolved on the defending District Council. It was their duty to maintain in good condition the bed and banks of Great Wilbraham River from its source to its junction with Little Wilbraham New Cut and the latter watercourse from its source to the junction with Great Wilbraham River, together with the culvert beneath it. The mill owners, it seems, remained responsible for the millrace, that is the section between the junction of the two rivers and the mill. (Fig. 25) The judgement so far as Great Wilbraham River was concerned was not upheld on appeal when damages of £2,078 8s 0d, made up of £1,434 1s 6d for failing to maintain Fulbourn New Cut and £644 6s 6d for failing to keep Little Wilbraham New Cut from its source to the culvert in proper condition, were awarded to the plaintiffs.³² As a result the river between the Cambridge - Newmarket railway line and Hawk Mill gradually became derelict and its headwaters continued to find their way into a system of drainage ditches neither designed or intended to take that volume of water. During the 1939-45 War the attention of the War Agricultural Executive Committee was drawn to the derelict state of the land in Fulbourn and Wilbraham Fens but no action was taken to reclaim it for agricultural use. Some maintenance and repair work continued elsewhere in the drainage system and although a number of proposals were made to improve land drainage after the cessation of hostilities, the position remained essentially unchanged as none was adopted.

Soil Survey

In an attempt to find a solution to these intractable problems, a meeting was convened in 1953 attended by representatives of the Great Ouse River Board, Cambridgeshire County Council, Chesterton Rural District Council and the Cambridge Agricultural Executive Committee, at which the current state of the drainage was reviewed.³³ In a catchment area of some 20,000 acres, nearly half of which were described as "quick run-off areas", some 2,200 acres were considered suitable for inclusion in an internal drainage district of which 1,600 acres

would benefit from improved drainage. A survey of the area was undertaken by a soil consultant (B S Furneaux) in May 1953 who in his report submitted in October of the same year set out the scale of the problem and suggested a solution.³⁴ As this is by far the best and most detailed record of the state of the drainage of the area since Vancouver's observations nearly 160 years earlier, it repays detailed study. The report was based both on visual observations and analysis of the topsoil, subsoil and level of the water table from 89 deep borings. He found a layer of peat from 10 to 42 inches in depth overlying the mineral subsoil in 51 of the samples and the water table to be at or only a few inches below the land surface over large areas of the land surveyed. Symptoms of waterlogging were widespread where crops had been sown. All the soils examined were deep and porous and could be readily drained but in large areas of land adjoining the rivers "*the water is unable to fall far below the surface because there is no adequate system for the removal of the surplus.*" He looked in detail at five areas, the first being the land adjacent to Great Wilbraham River from its source at Shardelowes Well to the Wilbraham Road. Much of the area was badly waterlogged with abandoned plough land and, where sown, many of the corn crops were yellow in patches due to waterlogging and manganese deficiency. There was waterlogged rough grazing, with 36 inches of peat beneath, south and south-east of the old Mill House which, with improved drainage, he believed could be made into excellent land. There was sufficient fall (6¹/₂ feet) between the old Mill House and Coles Bridge on the Wilbraham road to make this possible.

The second area was that between Coles Bridge and Hawk Mill. West of Fulbourn New Cut the land was entirely under the plough with a badly waterlogged strip alongside it. There were two moderately well drained fields to the east of the Cut, the rest of the land being under grass. North and east of Coles Green Farm the land which overlay 16 to 22 (in one place 42)

inches of peat was rough pasture infested with rushes. With improved drainage this *"would make a good piece of black land"*.

The third area looked at in detail was Fulbourn Fen south-east of the Caudle Ditch and south-west of Little Wilbraham River. The higher ground was under the plough and being soundly cropped but much of the rest was a reedy swamp with pools of water where there was said to have been a peat fire although some 24 inches of sandy peat remained. There was also much derelict grassland invaded by hawthorn scrub. Were the water table to be lowered by about two feet the land could be farmed. The soil to the south and south-west of this derelict area, below the level of the Caudle Ditch, was made up of 10 inches of peat over a white, calcareous light loam. It supported nothing but a mass of reeds and wild mint and was surrounded by brimming ditches. Given proper drainage, this was potentially excellent land.

The fourth and perhaps the most difficult area was Little Wilbraham Fen. Of the 16 borings two, in what may have been the course of the original main river, revealed peat more than 42 inches deep and all but three of the rest found 12 to 34 inches overlying a light to medium loam calcareous alluvial deposit. Towards the western end, where the Parish Ditch passes under the embanked Quy Water, was a swamp in which *"generations of reeds and rushes have grown up, fallen and decayed"*. Elsewhere there were pools of water among acres of reeds and rushes surrounded by brimming ditches. Hawthorn bushes occupied much of slightly drier land. Livestock were conspicuously absent but rabbits abounded, living in the banks of the main river.

The author of the report summarised his impressions thus:

"From an agricultural point of view this fen is a pitiful sight. There is every evidence of its having been well farmed at one time. There is a well laid out system of drove-ways and dykes. The latter are now choked and neglected. Culverts at gateways were breaking down, though not from traffic upon them. The quite rapid flow of water, in spite of all these obstructions, showed quite clearly that there was still adequate fall in places to produce a measurable improvement. One must admit with shame that the land which was once well farmed is now, in 1953, fast falling derelict. Such scenes led one to wonder whether the cry of the importance of agriculture to-day is anything more than words. All of this land could be brought to a state of excellent productivity, both as arable land or under grazing, if the problem of improving - nay restoring its drainage were tackled with resolution".

The last area looked at in detail was Teversham Fen the soil of which consisted of black peat between 32 and 42 inches in depth overlying a calcareous silt. The eastern half of the fen was in *"a deplorable state of dereliction"* growing nothing but rushes, sedges and reeds, with large stretches under water. The drainage ditches were choked with weeds and difficult to identify and even in the drier areas the water table was no more than a few inches below the surface. Further west large areas of low-lying land were still under water or showed signs of having recently been so.

Proposed Solution

The underlying problems of the area under review was succinctly expressed by Furneaux as follows before going on to make recommendations about their solution: *"The present deplorable condition of the land is largely due to two causes:*

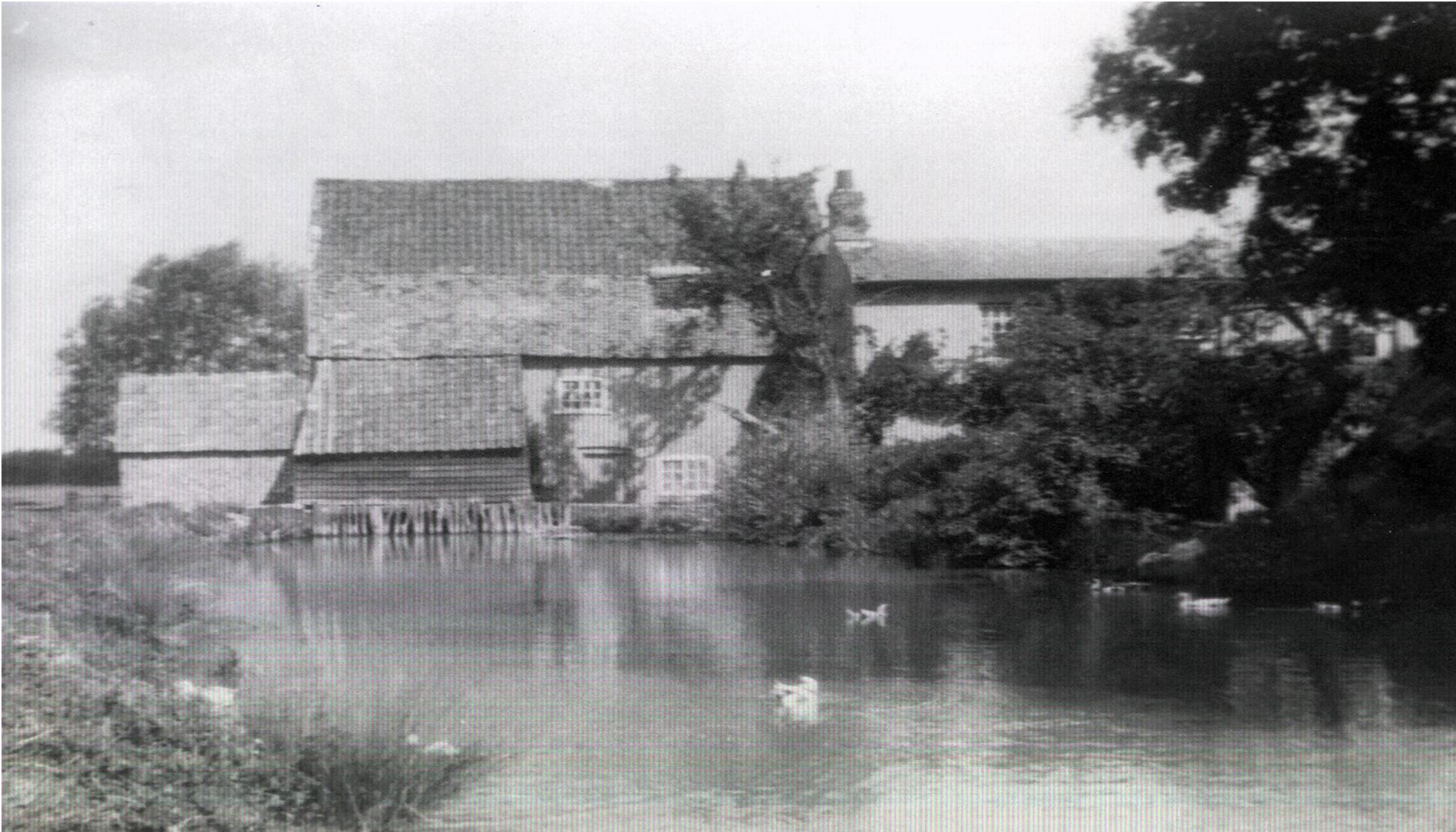


Figure26. Hawk Mill 1929. The mill was still in use but flow was much reduced due to abstraction from the new borehole at Fleam Dyke and the derelict state of the watercourses.



Figure 27. The fields of Hawk Mill Farm. Luftwaffe reconnaissance photograph September, 1940. The dark areas around the farm are waterlogged land due to overspill from Fulbourn New Cut (a) and Wilbraham New Cut (b). The land along side the old Caudle Ditch (c) and between the Long Drove (d) and Little Wilbraham River (e) had long been out of cultivation.

the creation of a high level river system for the milling of corn and the neglect of its maintenance, which has overloaded the low level system whose function is to drain the land'. He proposed that the drainage should be redesigned so that all the main channels ran into the lowest part of the system. As at that time Quy Mill raised the water level by five or six feet and Lode Mill a further six to eight feet above the natural drainage level, they would have to be by-passed. The main channel running at the lowest level would discharge into an enlarged Black Brook (Ditch) which ran northwards from Quy Mill along the original course of the natural drainage of the area. This solution presupposed that the owners of Quy and Lode Mills would be prepared to give up their milling rights. The "water amenities" at Quy Hall and Anglesey Abbey would be maintained by pumping some of the water from the new low level main channel into the higher level Quy Water running alongside it just north of Quy Mill. This radical solution was not adopted due to the expense and an inability to reconcile the interest of agriculture with those of "certain owners of land in the district who have a right to a head of water".³⁵

At or about this time the headwaters of the Great Wilbraham river were purposely and permanently diverted into the Fulbourn 4th public drain at the Cringles, and thence into the Fulbourn New Cut, to discharge into Little Wilbraham River below Hawk Mill (Figs. 13 & 25). The drainage system was not overloaded by this intervention as the flow from the springs at Shardelows Well was now much reduced by water abstraction at the Fleam Dyke pumping station. This act of expediency was responsible for the demise of Great Wilbraham River between the railway and Hawk Mill.

Scheduled Sites

As the neglect of the drainage system over some 80 years led low lying parts of the fen to revert to its former state so it became colonised by a wide range of aquatic and grassland flora. In recognition of this and its growing reputation as one of the best ornithological sites in the county the Nature Conservancy in 1951, empowered by section 23 of the National Parks and Access to the Countryside Act of 1949, notified 885 acres of Wilbraham, Teversham and the northern part of Fulbourn Fen as a Site of Special Scientific Interest (SSSI). A further 125 acres of water meadows and woodland were similarly notified in the parish of Fulbourn in the vicinity of the long-demolished watermill. The subsequent modifications to these scheduled sites are referred to later.

RESTORATION AND CONSERVATION: 1960 - 2010

The steps taken to restore the drainage and return the derelict land to arable cultivation during this period were consonant with the prevailing national and European policies of encouraging agricultural productivity by subsidy and by grants to convert marginal land to arable cultivation or ley pasture. A growing public concern about the adverse effect of these policies on the environment and the increasing surpluses of grain, meat and dairy products has led to a gradual change in priorities between productivity and conservation. The evidence adduced by conservation bodies such as the Royal Society for the Protection of Birds (RSPB), the Nature Conservancy Council and English Nature, that wildlife is threatened by intensive agriculture and needs special protection has increasingly been accepted and was given statutory recognition in the Countryside Act of 1981. The last decade of the 20th Century has witnessed the beginning of change from agricultural subsidy to support for

measures to protect the environment. When viewed in this context the paradoxical return of parts of the scheduled sites to cultivation, the partial restoration of awarded drains and watercourses and the tentative schemes for conservation become explicable and the present state of the landscape perhaps less difficult to understand.

Restoration of the Awarded Drains

Until the early 1960's the Rural District Council had maintained the awarded drains by a cycle of trimming and cleaning based on the needs of each parish. At this time a more co-ordinated programme was gradually introduced, not without some opposition. The work had always been performed by "parish ditchers" but as they retired manual labour was replaced by machines. Increasing mechanisation made it possible to undertake a more radical programme of maintenance and repair and to return the beds of the awarded drains to their former levels.³⁶ The introduction of a programme to restore or deepen the ditches on a seven-year cycle has been maintained by the succeeding authority, the South Cambridgeshire District Council.³⁷ This led to a gradual improvement in land drainage and with support from the Ministry of Agriculture, much but not all of the land that had been farmed in the 19th century was returned to arable cultivation. The programme of improvements included the demolition, in 1986, of the tunnel under the old bed of the Caudle Ditch which was obstructing flow, deepening the confluent ditches at the "Bull's Eye" (Fig. 19D) and both widening and deepening the Mill Ditch and Black Ditch to increase their capacity. This was both to improve land drainage for agriculture and to discharge surface water from a major housing development in the adjacent parish of Cherry Hinton.

Following this rehabilitation of the drainage system and despite the strong objection of the Nature Conservancy and the Naturalist's Trust the 885 acres of fen notified as an SSSI in 1951 was reduced to 447 acres in 1971 and further reduced to 148.5 acres (61.1 ha) in 1984³⁷ (Fig.32). Much of the land returned to arable cultivation could be farmed in most years without great difficulty but in several areas below the 10- metre contour, the rise in the water table in winter made cultivation difficult if not impossible until late spring. One such area was the former Fishers Fen where sowing was impossible until the water standing in the fields throughout most winters has been pumped into the adjacent Black Ditch. The regular flooding of this area, exacerbated more recently by leakage from the embanked Little Wilbraham River, made cultivation in most years very difficult and, following designation as permanent setaside, the fields are now returning to their former state. The drainage of the lowest-lying land in Wilbraham Fen was not significantly improved by deepening the public drains because of insufficient fall in Quy Water which provides a head of water for the restored Lode Mill.

The Aquatic Environment

As observed in an earlier section, notification of much of Wilbraham, Teversham and the northern part of Fulbourn Fen as an SSSI did little to protect what had been recognised as an area worthy of conservation. The residual area of 148 acres in Wilbraham Fen appeared not to be greatly affected by the improved drainage of the adjacent land south- west of the embanked Little Wilbraham River/Quy Water apart perhaps from a greater seasonal fluctuation in the water levels in the awarded drains alongside the Long Drove. Why this should be is no more than conjecture as the hydrology of this part of the

fen has yet to be fully understood, but the effect is evident: further colonisation of the drier parts of the fen by hawthorn scrub. The present and prospective state of this residual SSSI and that in the parish of Fulbourn - reduced to 125 acres when re-notified in 1971 and further reduced to 67 acres (27ha) in 1986 - should perhaps be considered in the broader context of the hydrology of the catchment area.

Both the former Great Wilbraham River and the extant Little Wilbraham River were once more important features of the landscape than their present state would lead one to suppose. Not only did they provide power for watermills but bathing and boating excursions, shoals of fish and abundant wildlife - kingfisher, heron, redshank, moorhen, mallard, watervole - all occurred within living memory. Over the last 35 years or so flow in Little Wilbraham River was first diminished then became intermittent due to licenced water abstraction and seepage through its bed and banks where it runs above the natural drainage level. For several years flow ceased altogether when winter rainfall was low. The effect of this on the two important wetland sites has yet to be fully assessed but there can be little doubt that the wildlife corridor that the river represents in an area of intense arable farming has become impoverished. The number and diversity of freshwater invertebrates, the source of the food chain on which fish, birds and small aquatic mammals depend, has been greatly reduced and much of the wildlife formerly associated with the river is now rarely if ever seen. The deterioration in the aquatic environment was not, and is not, peculiar to Wilbraham River but is shared by many if not most of the watercourses that arise in the chalk aquifer to the east of Cambridge.

The Lodes-Granta Groundwater Scheme

The ever-increasing demand for water for domestic, industrial and agricultural use by the City of Cambridge and surrounding villages is met from boreholes in the aquifer from which Little Wilbraham River and other streams arise. Following a comprehensive review of the water needs of the area, the National Rivers Authority (NRA) investigated a number of schemes to maintain the water environment to the north and east of Cambridge and at the same time meet the increasing public demand for water. The scheme adopted, the Lodes-Granta Groundwater Scheme, costing some £1.5 million involved the development of six river support boreholes in the aquifer connected by 30 kilometres of pipeline to outfalls at 13 springheads, the purpose being to augment natural flow or to maintain flow in the rivers when the springs ran dry (Fig. 28). This would, among much else, "*maintain the river and environmental needs and allow increased abstraction by the Cambridge Water Company and Anglian Water from specified sources*".³⁸ The scheme for Wilbraham River, served by a borehole at Dungate Farm, some three kilometres south-east of Fleam Dyke pumping station with a pipeline of over five kilometres in length leading to outfalls at the Temple Springs and at Fulbourn Fen Nature Reserve, was licenced to abstract up to 3,800 cubic metres a day (1.385 million m³ per annum) equally distributed between the two outfalls.³⁹ The augmentation scheme for Wilbraham River finally became operational in 1992 when, following three years of less than average rainfall, long sections of the river were completely dry. When flow returned, some 90 percent the water was lost through fissures in the bed and holes in the bank of the watercourse inundating the adjacent agricultural land (Fig. 29). The remedial action taken by the NRA in 1996, clay-lining 650 metres of the bed and banks of the river above Quy Water Bridge, restored flow in the lower reaches of the river and alleviated the severe flooding of the adjacent land but



Figure 28. The Lodes-Granta Groundwater Scheme gauging station, Little Wilbraham River, winter 1988. Sited one kilometre downstream from Temple Springs it measures natural and/or augmented river flow

deterioration elsewhere was not addressed. The reluctance of the statutory authorities to respond to local concerns led in 1997 to the formation, of the Wilbraham River Protection Society, its purpose being to safeguard the river and its dependent flora and fauna for future generations. After monitoring the situation for a year the Society commissioned an independent professional report on the state of the river and the local operation of the augmentation scheme as the basis for discussion with the Environment Agency (the successor body to the NRA), other statutory bodies and riparian landowners.⁴⁰ Further remedial action to stem water loss from the lower reaches of the river was completed by the Environment Agency by removing trees from the west bank and embedding 120 metres of impermeable membrane where the river runs well above the level of the adjacent land.

Similar but less severe problems of water loss from the river above Hawk Mill were addressed by the responsible authority, South Cambridgeshire District Council, by clay-lining the bed and banks of Wilbraham New Cut in four locations . Because of these and other longstanding problems the environmental objectives of the Lodes-Granta Groundwater Scheme, as stated, have yet to be realised.

The failure of the augmentation scheme to maintain flow and the consequent decline in the ecology of the river has been of long-standing concern to the Wilbraham River Protection Society (Figs30&31). The Environment Agency has been monitoring natural flow at the Temple Springs together with groundwater levels, monthly, at a borehole about one kilometre to the east at Cedar Tree Stud.. This revealed wide fluctuation in water levels and in 2010 the abstraction programme was modified so that when natural flow declines it is augmented continuously. This has restored perennial flow and reduced water loss through the river bed. Neither the Society nor the Environment Agency is happy with this abstraction programme and would prefer to see natural flow restored or pumping

reduced to a minimum.

The Society has met representatives of the Agency over a number of years to explore how natural perennial flow might be restored. One possibility is that the Cambridge Water Company be required to alter abstraction from the aquifer so that the water table in the region of Temple Springs is maintained at or above a predetermined level. The Agency is meanwhile progressing with its Restoring Sustainable Abstraction Programme in an attempt to find a solution acceptable to all.

Water loss through the bed and banks of the Wilbraham New Cut where the watercourse was raised to provide a head of water for Hawk Mill has contributed to the problem, as previously stated. One remedy that is being explored is to restore the river to its former course above Hawk Mill which is two metres below the level of the New Cut and closer to the groundwater. With this in mind the Environment Agency has carried out a topographic survey of the New Cut below the sluice and of the former course of the river above Hawk Mill. Should this restoration come about it would not affect the water level or drainage of the fen as the flow in the restored watercourse would continue to discharge into the mill race and main river.

Conservation of The Fen

Work on the SSSI was begun by the Environment Agency (EA) in the late 90s and continued for several years to restore the reed beds and drainage ditches, install five sluices to control water levels, clear much of the scrub and put up fences and gates. One of the initiatives by the EA at that time was the publication of a water level management plan for Wilbraham Fen, now one of the priority wetland sites in the Anglian Region.⁴¹ The plan, in essence proposed that the water table should be maintained at a more constant level to prevent the reed beds, now progressively invaded by hawthorn scrub, from



Figure 29. Flooding of Fisher's Fen, Spring 1995. When the flow was restored in Little Wilbraham River much was lost through the bed and banks. The watercourse depicted is the 2nd/3rd public drain (Teversham). The river is above the bank and bushes on the left.



Fig 30 The gauging station looking downstream from the road bridge, 1997. Despite the augmentation scheme to maintain flow long sections of the river were dry.



Figure 31. Wilbraham New Cut looking upstream, 1997. The river bed was dry from the gauging station to below Hawk Mill. Water is seen in the drainage ditch to the right of the electricity pylon along the former course of Little Wilbraham River.



Figure 32. The SSSI Wilbraham Fen. Site of proposed sluice to control water levels (A). The numerals relate to an assessment of the condition of the areas by Natural England.

drying out during the summer months. This could be achieved by controlling the outflow of the Parish Ditch, into which all the drains discharge, by a sluice where the ditch passes in a culvert under the river in the western corner of the basin (Figs 32, 33). The sluice has been constructed but, following discussions with the land owner, has not been put in place as final approval has yet to be given by the EA and consent by South Cambridgeshire District Council. As knowledge of the hydrology of the area is incomplete an important part of the plan is the monitoring of groundwater levels over a number of years and only when it is better understood would firm proposals be made about the control of water levels. To this end two deep boreholes and adjacent piezometers are in place just north of the river in the south-west part of the fen. A scheme to raise water levels to flood the meadows at Fulbourn Nature Reserve during the winter months had been managed successfully but the mistaken belief that the two schemes had similar objectives raised some opposition to that for Wilbraham Fen. When studied in detail it was seen to propose nothing inimical to the rearing and shooting of game birds in the fen or grazing in the adjacent pastures.

One of the schemes in the SSSI was a joint project carried out by the landowner in collaboration with English Nature, the predecessor of Natural England. It had two elements: the rehabilitation of the reed beds south of the Long Drove and re-creation of wet grassland between the Long and Short Doves.⁴² This involved the restoration of some of the ditches between the former fields and the public drains alongside the Long Drove, removal of the vegetation litter from part of the reed beds to lower the land surface and the clearing of scrub (Fig 33). By the re-introduction of grazing, the harvesting of good quality reeds and the encouragement of a wide range of flora and fauna, the scheme when fully developed should

provide an exemplary symbiosis of land use and nature conservation. Less management in recent years has led to the invasion of some of the wet grassland by scrub. Discussions are currently taking place on how further restoration and maintenance of the SSSI is to be funded in the present financial climate⁴³



Figure 33. Former fields, now reed beds in the SSSI in Wilbraham Fen. The watercourse is the Parish Ditch between Little Wilbraham and Stow cum Quy



Figure 34. Little Wilbraham Fen., looking north from the Long Drove, winter 1999. The ditches and public drains have been restored and the land to the left cleared of scrub.

COMMENT

The drainage system devised by the Parliamentary Commissioners left a legacy of responsibility for maintenance that was not fully met due to two main causes: the failure to replace, by legislation, an outmoded system of management and the depressed state of agriculture beginning in the 1870's and lasting, with short intermissions, for more than 80 years. The consequences of dereliction, to some extent mitigated by water abstraction, were such that much of the land drained early in the 19th century was lost to cultivation. The programme of restoration has, in the last 50 years, reclaimed much but not all of this land for agriculture. A knowledge of the sequential adaptation of the natural watercourses, first to provide power for the watermills and later to claim the fen for arable cultivation, makes the present pattern of drainage comprehensible.

How well then does a drainage system devised for the conditions of 200 years ago meet, with modification, the needs of today. The flow in the main streams has been much reduced by water abstraction and in most years the springs run dry. But there is no economic need for water power: the mills, other than Lode Mill, have long been out of use. With a lowered water table some ditches and drains are now redundant, in other areas the land is, in Vancouver's words, *"incapable of being drained by the present means adopted for that purpose"*. In the western part of Little Wilbraham Fen wastage of the peat has lowered the surface of the land to near the winter water table. Because of this the drainage system has become ineffective and some

200 acres have been lost to farming. Similar but less striking

changes have occurred in the parish of Fulbourn in the region of the long-demolished water mill where the land is managed as a wet meadow nature reserve and an area to the west of the springhead just north of the railway in the parish of Great Wilbraham. The system meets the needs of cereal farming where the fields overlies gravel deposits and elsewhere drainage for the most part remains effective. But a new factor - nature conservation - has entered the equation with aquatic needs that have yet to be fully addressed: the regular maintenance of both bed and banks or the raised watercourse to sustain and avoid flooding of adjacent arable land and modulation of the water table in the reed beds and other wetlands no longer under cultivation.

The continuing effectiveness of a drainage system devised in very different circumstances more than 200 years ago depends upon a balance being maintained between the needs of water abstraction, irrigation, drainage and, now, nature conservation: a balance that can through lack of understanding be readily upset.

ENVOI

Better informed, our traveller returns to his roadside vantage point with heightened interest. The landscape is unchanged but his perception of it is now much altered. The reed beds and encroaching scrub that formerly he thought were in residual primeval fen he now recognises for what they really are: the invaders of hard-won fields reverting to their natural state through the unforeseen effects of the very process that created them. The meandering watercourse that seemed at first to drain the area he now knows served as an embanked conduit to provide a head of water to power Quy Mill. There is no local answer to the dereliction of this land: the cause and cure are to be found elsewhere, beyond the basin. Without descending from his vantage point he can now better appreciate how the relationship between contour and watercourse, drain and ditch, ditch and water table have dictated the past and present use of the adjoining land. The reed beds now standing in the fields so recently reclaimed in Fisher's Fen are evidence that this relationship can be unwittingly disturbed and of the transience of a landscape that owes so much to man. These and related matters will exercise his mind when next our traveller pauses to view the landscape from the interchange at Quy.

APPENDIX

Extract from Inclosures Act. Great Wilbraham. 1797. as amended 1801.

'And we the said Commissioners do hereby certify and declare that the public works for the Parish of Great Wilbraham and which are to be kept and maintained by and out of the moneys arising from the annual rent of the allotment to the Churchwardens and Overseers of the Parish of Great Wilbraham and their successors and to the Surveyors of the said parish of Great
bridges over the
Wilbraham and their successors, are the / River and Water courses dividing the parishes of Great Wilbraham and Fulbourn
x x x x x x (the said River and Watercourse above x x x x x x
x
x x x x a certain Mill called Hawkes Mill which are in the
Parish of Great Wilbraham aforesaid x x x x wholly
and the said James Hicks
belonging to the proprietors of Hawkes Mill / and their tenants
to scour out and maintain and keep in good Condition
in the same manner as before the passing of this Act)

/ the drains x x x conveying Water arising from the Springs to the Tunnell which is laid under the River near to a piece of Ground called Cringles And also the said Tunnell..."

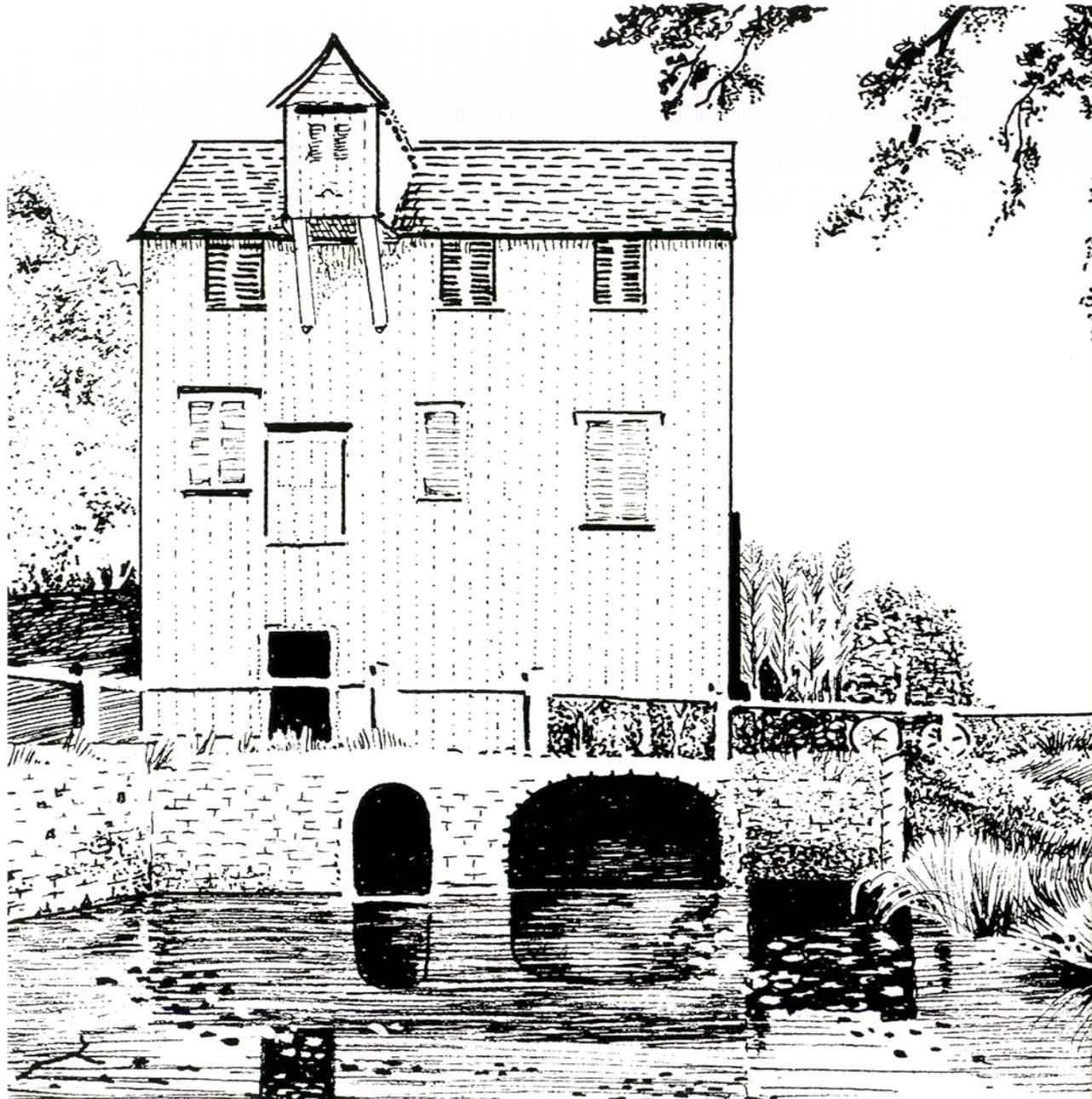
Note: The changes made in 1801 to this section of the Act introduced an unforeseen ambiguity into the Commissioners' assignment of responsibilities for the maintenance and river above Hawk Mill. When this was tested in the courts in 1941 (White and Others v. Rural District Council of Chesterton) Mr. Justice Atkinson declared, *inter alia*, that it was the Council's duty to 'maintain in good condition the Great Wilbraham River and the Banks thereof from its source downstream to its junction with the Little Wilbraham New Cut ...'. This judgement was overturned by the Court of Appeal which ruled that the Council's duty was confined to maintenance of the "Bridges over the River and Watercourses dividing the parishes of Great Wilbraham and Fulbourn...". The riparian owners or occupiers were responsible for maintaining the river from its source down to the junction with Little Wilbraham New Cut and the owners or occupiers of Hawk Mill for maintaining the Mill Race.

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Lode Mill

