WILBRAHAM RIVER

FLOW DEPLETION

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1. INTRODUCTION

David Noble and Associates were engaged by the Wilbraham River Protection Society to further investigate the problems of flow depletion within the Wilbraham River, identify the causes of such problems and recommend a way in which the Society could proceed in seeking improvements in river flow.

2. BACKGROUND

The Wilbraham River is a spring fed stream with flows emerging from the underlying chalk aquifer. This aquifer has for more than a century provided the potable water supply for the city of Cambridge and the surrounding area as the major source exploited by the Cambridge Water Company. Abstraction from the chalk compounded by periods of low rainfall impacts on the groundwater level and hence spring flow, with the result that over periods no natural flow is available to support the Wilbraham River. This condition has a disastrous impact on the ecology of the river and whilst species may temporarily occupy the channel this is quickly vacated once flows are depleted. Evidence of high value species, including water voles, now protected by legislation, and kingfishers, in the adjacent channel systems confirms the potential aquatic habitat value of the Wilbraham River and indeed what existed during less stressed spring flow conditions. Reduced flows in the river system also has an adverse effect on the Wilbraham Fen SSSI.

To compensate for some abstraction by the Cambridge Water Company a scheme was developed to provide a compensatory flow into the river when the natural spring flow was inadequate.

3. RIVER SYSTEM

3.1 Network

The Wilbraham River system comprises sections of what in the majority are man made channels which have been created to serve milling and land drainage needs and combining to produce what is, within a relatively small area, a highly complex network. Whilst the drainage system is well maintained in areas to sustain agricultural land use in others, as with Wilbraham Fen, the formerly drained area is now one of a high water table supporting extensive areas of reed.

There is a distinct high and low level system with water level differences of up to 2 metres, the high level channels being embanked over much of their lengths. The main channels are indicated on the plan APPENDIX 1 .

3.2 Flows

The high level Wilbraham and Fulbourn New Cuts are embanked channels and highly dependent upon springs to provide the base flow. Whilst some rainfall run-off will enter the channels over the upper sections this will be infrequent and therefore unable to make any meaningful contribution to the sustainability of the aquatic environment.

Within fen situations seepage from high level carriers is an endemic feature and over many years this has been a major factor in flow depletion. Flow measurement in January 1994 identified that the flow at Quy Water Bridge of 26 litres/second represented only 10% of that immediately below the confluence of the Little Wilbraham River and Fulbourn New Cut when 245 litres/second was measured.

This substantial loss, seeped through both banks, south westerly into Fulbourn Fen, where it was not welcome, and north easterly into Wilbraham Fen where generally the reverse would apply. Some water was also believed to be accessing the brick culvert passing beneath the river providing drainage to Wilbraham Fen into the lower level system but this was not considered as being significant.

In 1995 the Environment Agency (predecessor) undertook works to reduce the seepage through the banks of the Little Wilbraham River and this was carried out over a length of 650 metres. The work involved installing a 150 mm thick clay lining to the channel over the bed and up the banks to a height of 1 metre, and is believed to have cost in the order of £14,000. The extent of the work is shown on the plan as APPENDIX 2.

The success of the work was closely monitored by the occupier of Island Bungalow, the operation of the septic tank serving which had been seriously impaired due to the continuous and excessive seepage. Since completing the work that problem has been overcome and whilst some seepage has been recently identified this is a local problem and is probably caused through root systems being present in the bank.

3.3 Responsibility

The maintenance of the channels is undertaken by the Environment Agency (main river) the South Cambridgeshire District Council (awarded watercourses) with the remainder being the responsibility of riparian owners. The Agency exercise permissive powers under the Water Resources Act 1991 and as such have no legal responsibility to undertake any maintenance. This contrasts sharply with the role of the District Council who are legally bound to ensure that the condition of their watercourses is compliant with the terms of the award. Riparian owners also have a responsibility under the Land Drainage act 1991 to maintain to a standard which provides for unobstructed flow, legal notices can be served on riparian owners who fail to maintain watercourses in their ownership up to a satisfactory standard.

From Quy Water Bridge to Hawk Mill the Environment Agency carry out annual maintenance work which includes the control of vegetation to both the banks and channel.

The District Council operate a maintenance regime within which watercourses are placed in one of three categories, with two differing only in the frequency of operations and with the third, applying to the less significant watercourses, being maintained on an 'as required' basis with channels kept under surveillance to ensure work is taken at an appropriate time. The watercourses within the Wilbraham River system fall into

Category A - High Priority	- Maintained annually. No's 200 and 202
Category B - Medium Priority	- Maintained every 2 years. No's 310 and 311
Category C - Low Priority	- Maintained not more frequently than every three years. No 421

The responsibility for maintaining the key parts of the river system are shown on the plan APPENDIX 3.

4. ABSTRACTIONS

Since 1981 the Environment Agency's predecessors have considered the augmentation of flows in the Wilbraham River recognising the increasing demands on the aquifer commensurate with the development in the Cambridge area and the general increase in domestic water consumption. Since flow augmentation has been introduced strict control has been exercised and no further abstraction

licences have been granted. Some amendments to licences have been made but these have not provided for any significant increase in the annual quantity.

The augmentation scheme had however been introduced aligned to the Cambridge Water Company's requirements to introduce changes in the way the water source was managed. This proposal led to some relocation of abstraction points but overall quantities, to be taken from the aquifer increased only slightly.

5. LODES - GRANTA GROUNDWATER SCHEME

In the promotion of the flow augmentation scheme the then Anglian Water considered the benefits arising from maintaining flows and consulted widely in an attempt to take on board the full range of interests. Most surprisingly English Nature, whilst expressing concern over Chippenham Fen, did not specifically refer to either Fulbourn or Wilbraham Fen.

The scheme therefore was based upon the desirability of supplementing the spring flows rather than to meet specific needs which had been identified during the investigation and consultation process.

As part of the scheme promotion, which extended over some eight years, a number of boreholes were sunk and tested. Among these was a borehole at Dungate Farm, West Wratting, TL561531 which was licensed in 1989 for a daily flow of 3800 cubic metres and an annual flow of 1,385,000 cubic metres. In tandem consents were issued for 50% of these daily and annual volumes to be discharged to the Wilbraham Temple Spring TL557578 serving the Wilbraham River and to Fulbourn Fen TL534560.

When augmenting the spring flow to the river the licensed quantity is such that a continuous flow of 22 litres/second is possible: in reality the pump, which does not have variable discharge control, delivers between 30 and 50 litres/second. The actual flow rate within this range is determined by the influence on the pumping head of the groundwater level. This flow rate, and indeed the operational management of the borehole, is such that augmentation flow in the river is not continuous with pumping being followed by periods of rest.

The scheme became operable in 1993 since which time augmentation has taken place each year as indicated in Table 1.

	RAINFALL (MM)	* MEAN LEVEL GROUNDWATER (M. AOD)	PUMPED QUANTITY 1,000 CU METRES TEMPLE SPRING
1993	671	12.3	473
1994	499	15.0	47
1995	489	14.8	42
1996	389	13.0	246
1997	505	10.6	245
1998	630	12.5	297

* Estimated from the groundwater level as measured at the Cedar Tree Stud, Wilbraham

TABLE 1

It will be noted that in no year has the available quantity of 693 thousand cu metres been discharged to Wilbraham Temple Spring and indeed over the 6 year period only 32% of the licenced discharge quantity has been used to augment flows.

An integral part of the scheme was the installation of flow measuring flumes on the Little Wilbraham River (New Cut) and the Great Wilbraham River (New Cut). The structures were clearly designed to minimise any impact on upstream water levels, which could adversely affect land drainage, the result being that they both readily 'drown-out' and flow records are not comprehensive or highly accurate.

At the time of a site inspection on the 14th January 1999, the borehole discharge to the Temple Spring was taking place with little or no natural spring flow being apparent. From information provided it would appear that at this time the groundwater level was in the order of 14.0m AOD at the Cedar Tree Stud, Wilbraham. Flow was observed through the grounds of Wilbraham Temple and in the New Cut at Little Wilbraham to the south of the Rectory. At the point where the low level channel crosses beneath the New Cut there was no flow in the latter, with the flow at Hawk Mill being exclusively that in the former channel.

Comment

The development and testing of the boreholes took place in the mid to late eighties at a time of buoyant aquifer conditions and a degree of optimism would have

prevailed which would not have been the case some three or four years later. The Environment Agency confirmed that the earlier drought conditions in 1976 had not been considered when developing the scheme as data, particularly on river flows, was not available.

In the determination of the flow to augment the river, and the 50% apportionment to Temple Spring, there was little science applied and with no account taken, most surprisingly, certainly in hindsight, of the seepage of water from the Wilbraham River vertically due to the aquifer drawdown and horizontally as a result of a surrounding lower water table controlled by the land drainage channels.

6. THE PROBLEM

The abstractions by the Cambridge Water Company from the chalk aquifer have taken place over many years and whilst licensed quantities may not have changed significantly the operation of the sources will have done. Information has been made available of the quantities abstracted from boreholes in the area but the complex nature of the licences is such that any direct interpretation is difficult. From analysis it would however appear that since 1990, whilst varying annually, there is no discernible upward or downward trend but of note is the fact that over that period only about 78% of licenced authorities have been abstracted.

In years where average or above average rainfall occurs the replenishment of the aquifer can be sufficient to sustain flow conditions, although there has been and will be a tendency for spring flows to reduce during the summer with the coincidence of higher abstraction and lower replenishment rates.

Since 1980 the variations in rainfall, and hence aquifer recharge, have been highly variable the latter from a maximum level of 17.0m AOD in 1988 to a minimum of 9.0m AOD in 1992. The groundwater levels are plotted as APPENDIX 4. The relationship between rainfall and groundwater level is more direct than is often the case, confirming the responsive nature of the aquifer as indicated in the rainfall/groundwater level comparison in APPENDIX 5.

It is clear from the available evidence, that the augmenting borehole flows under the Lodes Granta Groundwater Scheme have been incapable of supporting a river flow throughout the length of the Wilbraham River downstream to Quy Mill under the conditions which have prevailed in recent years

The management of the system which leads to intermittent flow is far from ideal and the inability of the channel to retain flow results in the augmentation water providing limited benefit.

It is confirmed that the operation of the augmentation scheme has not compensated for the lack of spring flow and the inability of the channel to retain water which was introduced from the borehole has not been fully addressed.

Against the evidence of the operational experience it can be reasonably concluded that the promotion of the Lodes Granta Groundwater Scheme was over-optimistic and has failed to deliver the publicised objectives.

7. THE WAY FORWARD

The Agency, in addressing the issue at the present time, as opposed to 18 years ago, would adopt a very different approach. I believe in 1981 it would be seen very much as a public relations exercise to convince doubters that provision had been made to overcome the accusations of over-abstraction. It is somewhat surprising that the Cambridge Water Company did not contribute towards the capital costs of the scheme which in effect were borne by all the abstractors in the Anglian Region. Whilst it is unrealistic to consider turning back the clock, and having a fresh start approach there are however a number of matters for consideration among which would be:-

- It is so unlikely that there will be reductions in abstraction from the aquifer, and indeed within the licences there is scope for increases, this can be discounted as an option to aid a solution.

- In parallel with any beneficial changes to the augmentation flow it is imperative that actions be taken to significantly reduce the channel seepage in order to effectively transfer flows through the system to Quy Mill. As witnessed in January 1999 losses are substantial below Little Wilbraham and consideration must be given to undertaking further channel lining. The extent of channel lining required is not known but based upon previous expenditure this is likely to cost in the order of £22 per metre length of channel.

- The operation of the Dungate Farm borehole should be reviewed, particularly considering the need to utilise fully the water available during periods when spring flows cease or are substantially reduced.

- The rigidity of the borehole licence and the apportionment of 50% to the Fulbourn Fen and Temple Spring is surprising and should be relaxed. A more need driven management would ensure better use of the available water to the potential benefit of Fulbourn Fen and the River alike.

- When augmentation takes place a continuous flow is highly preferable, as confirmed by the Principal Wetland Ecologist of English Nature, and the management of the borehole should facilitate this. Such a change will most likely require a new pump in the borehole and associated control arrangements, a means of varying flow rates would be advantageous.

- The terms of the abstraction licence for the Dungate Farm borehole should be reviewed within the context of the overall Lodes Granta Groundwater Scheme to identify whether any changes (increases) in the abstraction rate are possible.

- Within possible options consider the feasibility, and indeed desirability, of abandoning a section of the New Cut between Little Wilbraham and Hawk Mill diverting flows into the low level system. This could only be considered as the preferred option if augmented flow changes and seepage reduction were unable to create satisfactory conditions.

- Appropriate maintenance of the channels is a pre-requisite in ensuring that water levels are adequately controlled. Equally the management will sustain the habitat interest as long as this is effected in an environmentally sensitive way. The Environment agency's annual programme should continue, timed to accord with the habitat interest, but care must be taken over the existing and any future channel lined sections to ensure the clay to bed and banks is not disturbed. This is particularly important when external contractors are used.

The District Councils maintenance has hitherto concentrated on flailing the bank sides of the channels as a routine operation, and de-silting when accumulations

necessitate this. A recent review of watercourse management has been undertaken and it is possible that some changes in present practice may be introduced. To retain capacities and the ecological features of the channel it is essential that an appropriate level of maintenance is undertaken and indeed it is necessary to do so in compliance with the requirements of the awards.

If any improvement is to be made to the flow conditions during the drier periods the success will be totally dependent upon persuading the Environment Agency of the environmental benefits to justify the necessary expenditure. Whilst costs will be a significant consideration they may not be a problem if the strength of the case is such that it is seen as a high priority which will then release the necessary resources to develop and implement a solution. The Agency did not consider that external funding would be essential if improvements are to be effected.

Unlike the promotion of the Lodes Granta Groundwater Scheme the case must be needs driven which will require a clear statement of objectives in terms of amenity, channel ecology and adjacent land use interest. Within the latter Wilbraham Fen would be included and identifying benefits to the SSSI arising from any improvements would be a major plus.

The Agency, whilst not necessarily seeing the solution as one hindered by lack of funds, should be persuaded to involve the Cambridge Water Company in a partnership approach, the Company have environmental responsibilities and could gain beneficial public relations from participation. An initial approach to them has brought an encouraging response. See APPENDIX 6.

8. RECOMMENDATION

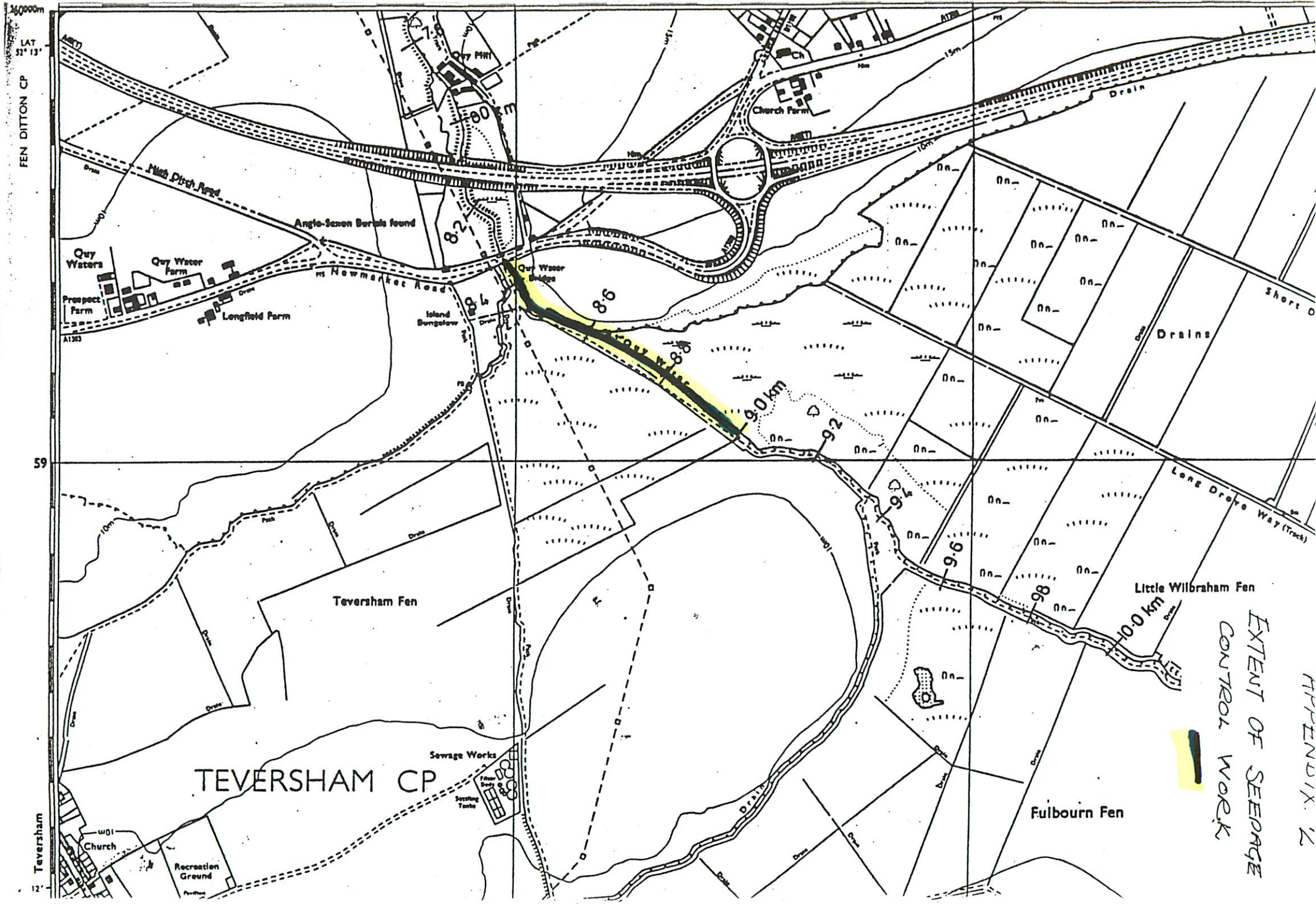
The Environment Agency have the powers to amend both the abstraction licence and discharge consents associated with the Dungate Farm borehole, subject to following the statutory procedures and are able to carry out any works deemed necessary to the channels.

Persuading the Agency to promote such measures will be dependent upon the compilation of a needs driven case in which the flow depletion is clearly identified as adversely impacting upon the ecological and other interests and that removing or reducing this impact is confirmed as providing benefits commensurate with associated costs.

Fundamental in the promotion of improvements would be the development of a water level management plan for the river which would be compatible with that for the Wilbrahm Fen SSSI and in which the channel maintenance regime would form an integral part.

Further dialogue with the Environment Agency is the obvious way for the Society to move forward using this report as a discussion document. Within exchanges it would be most beneficial for the Society to identify other interests which would support the improvements sought. The generation of this local interest will go far in persuading the Agency of the need for the improvements, and this support could be canvassed from, among others, English Nature, Cambridgeshire Wildlife Trust, and the Cambridge Green Belt Project.

Whilst the aquatic habitat would be high on the list of potential benefits, the case should be broader based taking account of amenity, historical and other issues.


APPENDIX 2
EXTENT OF SEEPAGE CONTROL WORK
FEN DITTON CP
TEVERSHAM CP
Teversham
Teversham Fen
Fulbourn Fen
Little Wilbraham Fen
Drains
Long Drove Way (Track)
Short D
Drain
Quy Mill
Church Farm
Ch
Hill Ditch Road
Anglo-Saxon Burials found
Quy Waters
Quy Water Farm
Prospect Farm
Longfield Farm
Newmarket Road
Island Bungalow
Quy Water Bridge
Quy Water
Sewage Works
Church
Recreation Ground
7.0
7.2
7.4
7.6
7.8
8.0 km
8.2
8.4
8.6
8.8
9.0 km
9.2
9.4
9.6
9.8
10.0 km
59
LAT 52° 13'
360000m

CAMBRIDGE
WATER
COMPANY

Our Ref. SBK/SJC P 1.01
Your Ref. DS/SAA/98/162

14th April, 1999.

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15 APR 1999

Dear David,

Wilbraham River

Thank you for your letter of 22nd March which Robert Burgin has passed to me. I apologise for not replying sooner but the demands of the OFWAT price review has kept me fully occupied until now.

The Company's business plan includes for environmental studies into the lack of flow in the River Granta to be confirmed with the Environment Agency and it is possible that the Wilbraham River could be investigated within the scope of these studies. The scope and budget will depend upon the settlement we reach with OFWAT as a result of their price review.

I can therefore confirm that the Company is interested in your project in principle but we will need the agreement of both OFWAT and the Environment Agency before committing resources.

Yours sincerely,

Stephen B. Kay
Engineering Director and Regulation Manager.

Copy: MDE

Directors: M.P. HALSTEAD, M.A., Ph.D., F.C.C.A., Chairman; N. HEFFER, M.A., F.C.A., Deputy Chairman;
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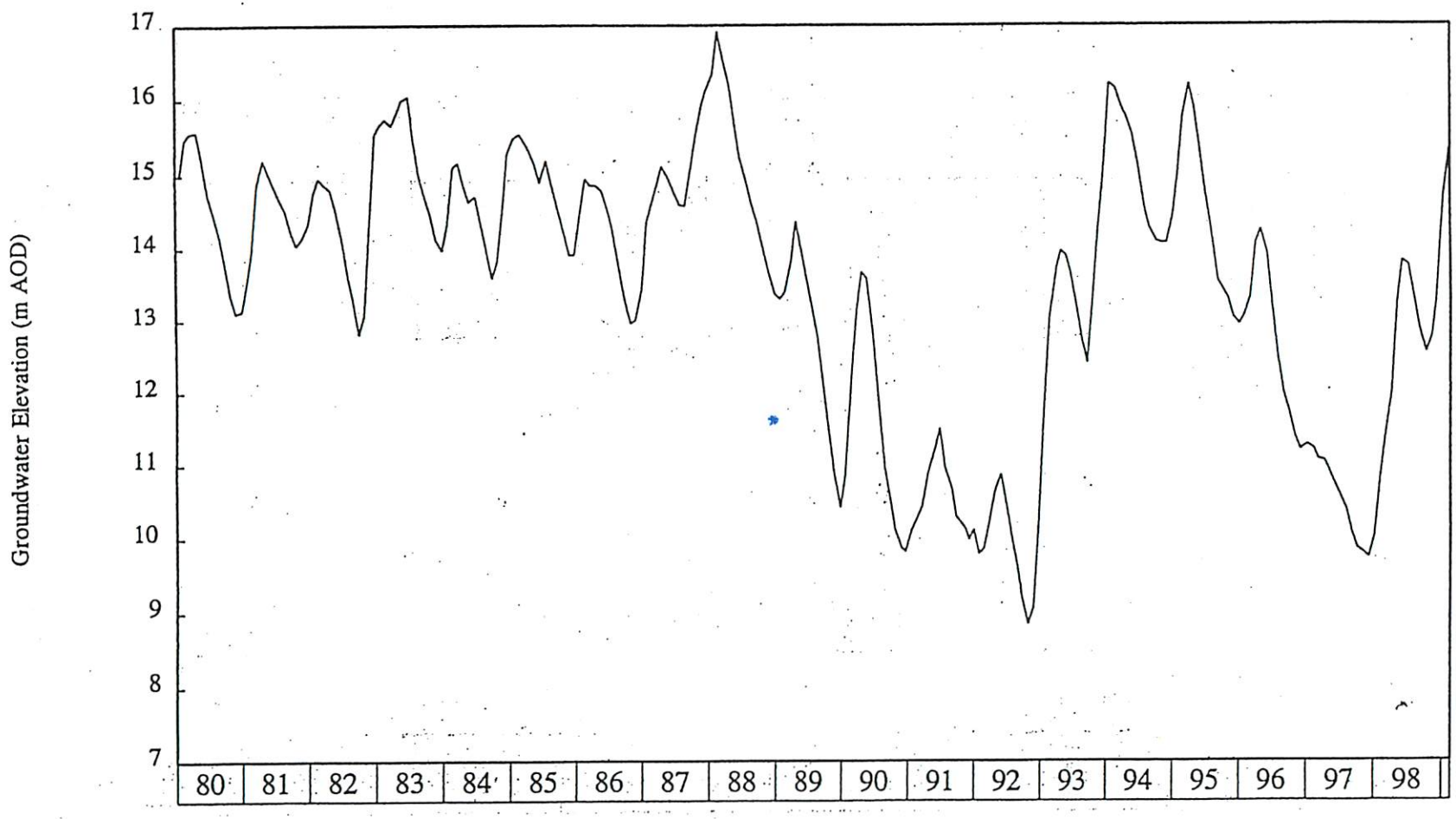
TL55/005



Environment Agency
Anglian Region

Site ID : TL55/005
Grid Reference: TL 5660 5770
Site Name :
NR ~~CHERRY~~ CEDAR TREE STUD, WILBRAHAM

Legend

APPENDIX A

APPENDIX 5

RELATIONSHIP - RAINFALL/GROUNDWATER LEVEL

YEAR	RAINFALL (MM)	GROUNDWATER LEVEL (EST) M. AOD (CEDAR TREE STUD)
1981	478	14.4
1982	644	14.0
1983	531	15.0
1984	595	14.4
1985	512	14.5
1986	578	14.3
1987	627	15.0
1988	587	15.5
1989	509	12.8
1990	417	11.8
1991	441	10.5
1992	610	9.9
1993	671	12.3
1994	499	15.0
1995	489	14.8
1996	389	13.0
1997	505	10.6
1998	630	12.5
AVERAGE	540	13.4

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WILBRAHAM RIVER PROTECTION SOCIETY

President
The Right Hon. the Lord Fairhaven JP DL
Vice-Presidents
JGP Crowden Esq JP,
James Paice Esq MP

5 March 2002

SOUTH CAMBRIDGESHIRE
PLANNING DEPARTMENT
- 7 MAR 2002
File Ref:.....
Letter No:.....

Mr Rob Mungovan
Ecology Officer
Planning Department
South Cambridgeshire District Council
9-11 Hills Road
Cambridge
CB2 1PB

Dear Mr Mungovan

Thank you so much for your letter of 27 February 2002 expressing interest in the objectives of the Society and for your offer of assistance in developing a co-ordinated maintainance programme. I enclose, as requested, a photocopy of the the report that we commissioned from David Noble.

We would be interested in taking up your offer to advise us on the development of enhancement schemes for the watercourse and the aquatic environment. When you have read the report please get in touch so that we may arrange a mutually convenient date and time to meet.

Yours sincerely

T D Hawkins

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