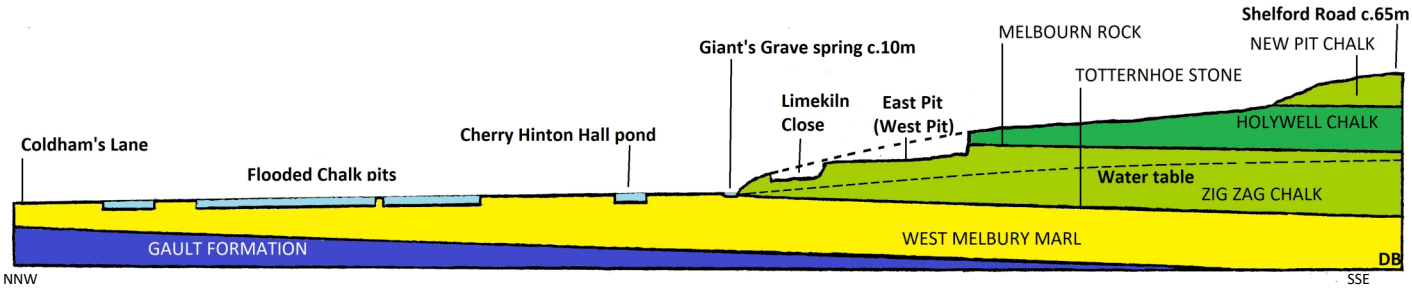
The Cherry Hinton Brook

A. Hydrology and over-abstraction



A schematic cross-section showing the relationships between geological structure, hydrology, and surface morphology in the vicinity of the spring at Giant's Grave in Cherry Hinton. The Cherry Hinton Brook flows from Giant's Grave through the pond in the grounds of Cherry Hinton Hall and alongside the flooded Chalk pits, to beyond Coldham's Lane. The length of the cross-section represents 4kms and its vertical exaggeration is x6.

Pedestrians on Snakey Path are often interested in, and have opinions on, their observations of changes in the amount of water flowing in the Brook. By and large the flow does not vary much because it depends mainly on the nearly-constant resurgence of water from the Chalk spring at Giant's Grave. Many onlookers were struck, however, by the seemingly very low flow during the dry summer of 2022. Broadly speaking, changes in the amount of water flowing in the Brook are due to long-term changes in the level of the water table (see cross-section above) within the Chalk aquifer, south of Giant's Grave, under the floor of East Pit for example. The lower the water table beneath the Pit, the lower the hydraulic gradient within the Zig Zag Chalk. This causes the discharge through the spring, of the ground water beneath the water table, to decrease.

When compared with streams such as the Bourn Brook, which flows over clay, there is little or no risk of flooding. The Cherry Hinton Brook is not flashy. Snakey Path is unlikely ever to be flooded by water issuing from the spring at Giant's Grave.

The Chalk stream

Close to the spring, the Brook has some of the features characteristic of 'Chalk streams' in general. The water is crystal clear with little or no sediment in suspension (observe it at Forest Road for example) but relatively rich in dissolved plant nutrients. It is mildly alkaline with a pH range of approximately 7.4 - 8.5 and has a steady temperature of about 10.2°C.

To a degree these properties are lost or diluted downstream, for example by rain wash of disturbed soil and pollutants. Polluted water even drains directly from the streets of Cherry Hinton into the Brook.

Increase in discharge (leading to an increase in depth of the stream by a few inches) immediately following periods of heavy rain are at least partly due to soil moisture flow.

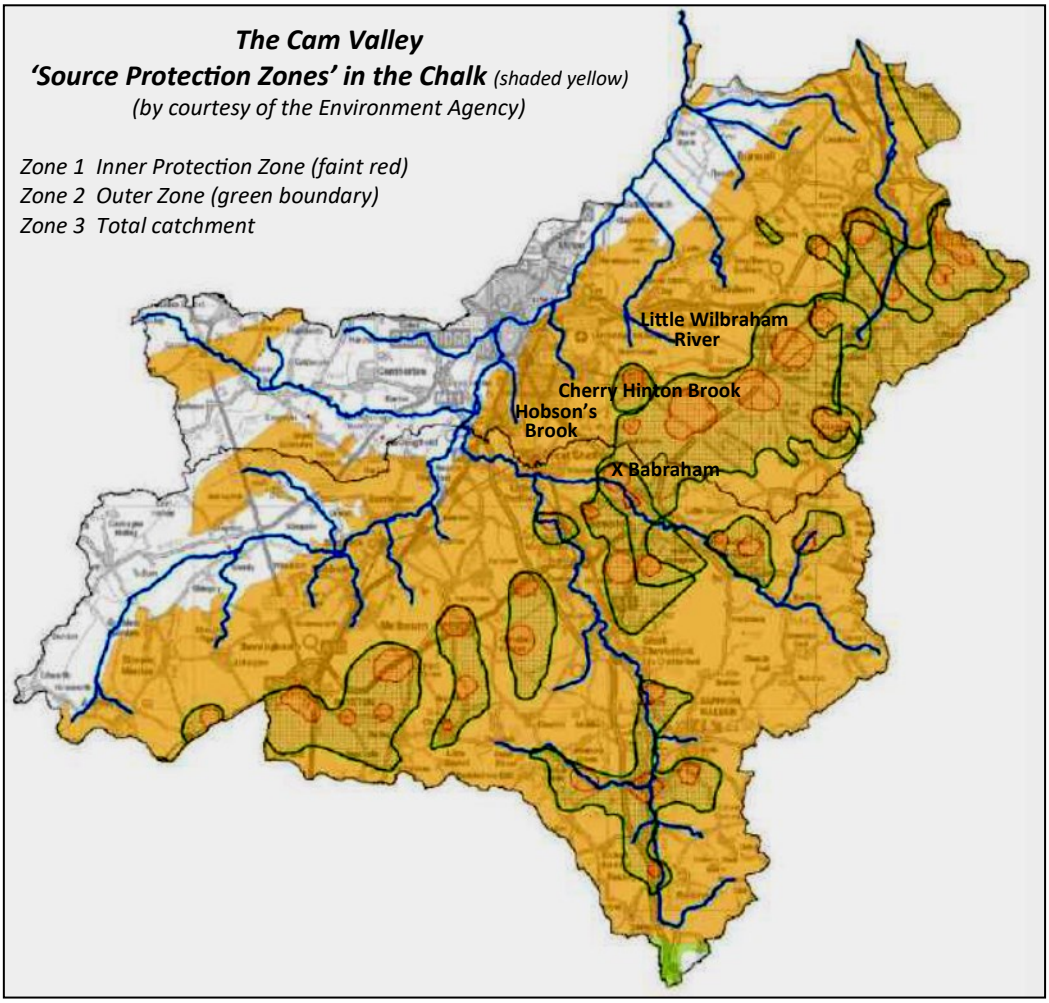
Rain falls onto gardens, lawns, allotments, and school playing field, and seeps into the soil. The moisture infiltrates down through the soil until it reaches (at no great depth) the impermeable West Melbury Marl (clayey) Chalk Formation which underlies the area drained by the Brook, and which is the rock which was quarried from the neighbouring pits now occupied by the Lakes. The soil moisture then seeps slowly, laterally into the channel of the Brook.

There is probably little or no surface flow over the general catchment area of such low relief even though the Chalk Marl is rather impermeable due to its clay content. However, soil moisture in the vicinity of the steep banks of the stream is likely to drain relatively quickly into the channel. This would help explain the slight but rapid increase in depth of the Brook during the wet November following the dry summer of 2022. Local surface runoff on hard surfaces such as tarmac and concrete would also contribute. Meanwhile the height of the water table in the Chalk aquifer makes a delayed and slower response to winter rainfall.

The Brook and the Lakes

There are no raw data available to reveal the relative heights of the two main lakes nor their heights in relation to the Brook. However it can be observed from Snakey Path that the relative heights of the south eastern lake and the Brook do vary, particularly with rainfall.

Near lamp post 14 on Snakey Path there is an overspill pipe which allows water from the lake to drain into the Brook. Other than this there is no information about the hydrological processes operating between these two water bodies. However, water, that is unlikely to be unpolluted, drains into the lake from the industrial estate north of the railway line.



Stream discharge in the longer term

Variations in discharge in the longer term are a different matter. There is no direct evidence for the size of the discharge of the Cherry Hinton Brook, say 100 years ago, making quantification impossible. Unlike the Hobson's Brook and the Little Wilbraham River, in more recent times, it does not have a gauging station; so there is no historical record.

However, it may be possible for someone to vouch that the Cherry Hinton Brook did or did not dry up in the exceptionally dry summer of 1976. This would afford an absolute comparison with the flow of Hobson's Brook from Nine Wells, near Addenbrooke's. Here the springs did dry up and they lost their SSSI status as the result of the extermination of flatworms (*Crenobia alpina*) and cased-caddisflies (*Agapetus fuscipes*). In the summer 'drought' of 2022 the flow of the Cherry Hinton Brook more or less fizzled out by Coldhams Lane. The reason for this is not obvious. It presumably seeped unseen through disturbed surface material in this historical zone of drastic human interference, construction work of various kinds.

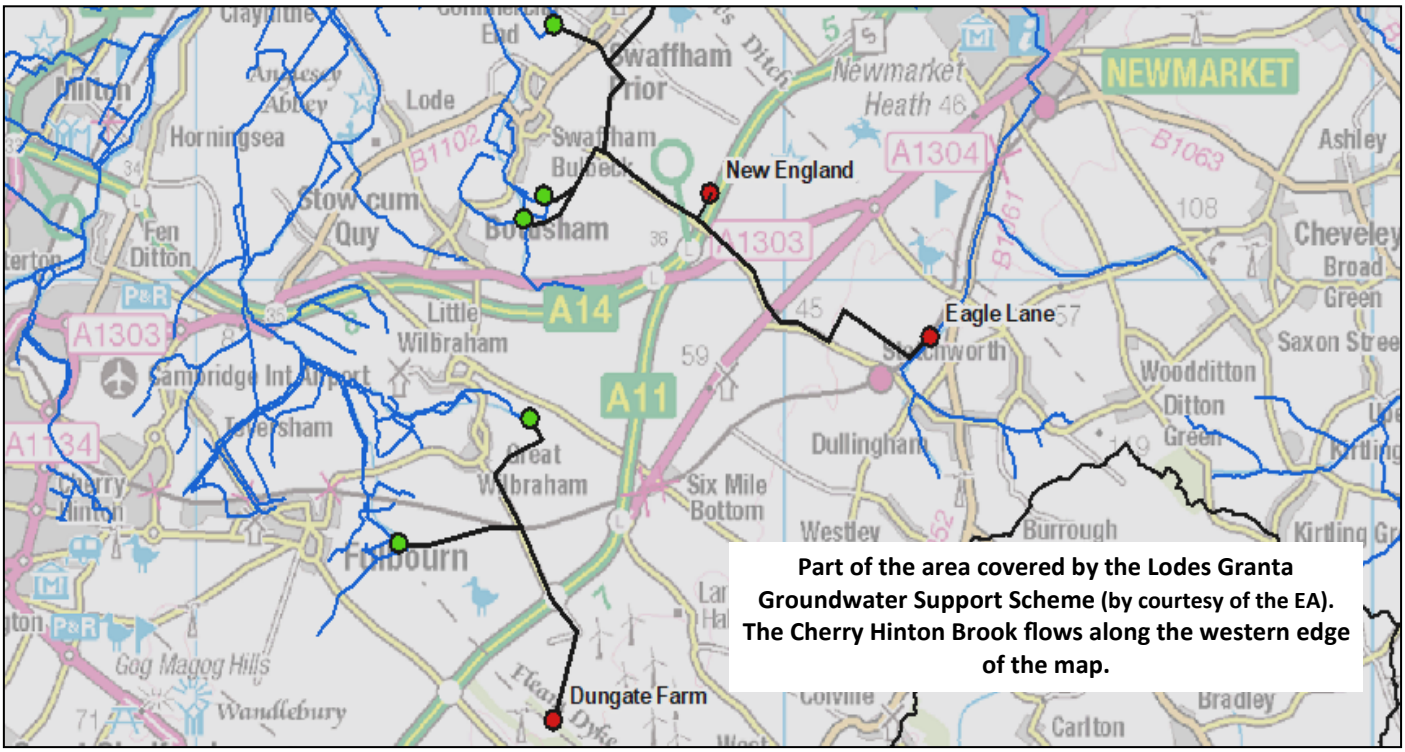
The Brook and the Cambridge Water Co.

So, changes in the discharge of water from Giant's Grave, over decades, depend on changes in the height of the water table, but also on the pattern of movement of the ground water below the water table. This latter is complex and unexpected where influenced by the extraction of water from the aquifer, through bore holes, by the Cambridge Water Company. This is illustrated in the above map of the Chalk outcrop (shown in yellow) which portrays so-called 'Source Protection Zones' in relation to the Cherry Hinton Brook and its neighbouring streams.

Boreholes are located within the areas shaded faintly in red. Though compiled in order to analyse the risk of water contamination, the map in fact shows the pattern of flow of ground water through the permeable Chalk towards the boreholes. Zone 1 is defined as the area within which the travel time of ground water through the Chalk to a borehole is 50 days or fewer. For Zone 2 the travel time is 400 days or fewer.

The proximity of rapid-seeping groundwater so close to the Little Wilbraham River does nothing to discourage the understanding that over-abstraction has been directly responsible for the sad history of that stream. It so happens that the Cherry Hinton Brook itself is, also, not so very far from the same zone.

Remarkable and salutary was Cambridge Water's own 2009 Asset Management Plan (AMP4) report conclusion that pumping in the summer months at Babraham pumping station, some 8kms away from



Part of the area covered by the Lodes Granta Groundwater Support Scheme (by courtesy of the EA). The Cherry Hinton Brook flows along the western edge of the map.

the springs at Nine Wells, had a direct and profoundly adverse affect on the flow rates of those springs. This frank declaration made Cambridge Water's other claim, that such pumping had no comparable affect on the flow at Giant's Grave, tentatively plausible at the time.

In any case, by then, it was a truth almost universally acknowledged that, on balance, the total rate at which water is lost from the Chalk aquifer through pumping and through natural springs is greater than the rate at which it is being replenished by rainfall. Groundwater is being depleted due to our rapaciousness. The water table has been falling for decades due to over-abstraction, and tributaries on the south side of the Cam Valley have been suffering.

Extraordinary augmentation

Evidence for the wide acceptance of such a belief comes from an unexpected quarter. It comes in the shape of the extraordinary Lodes Granta and Rhee Groundwater Support (ie augmentation) Schemes developed by the Environment Agency and Cambridge Water since the 1990s (see map above).

The map shows two of the five (summer) stream augmentation schemes east and north of Cambridge. For example, water pumped up from the borehole at Dungate Farm is fed by pipes into the Little Wilbraham River at two discharge points (shown in green). Just to the west, the Cherry Hinton Brook is, of course, without augmentation. A little further west, off the map, are the springs at Nine Wells. Their augmentation by water piped from Babraham began as recently as 2021. Eight more of the Rhee Groundwater Support schemes lie south and west of Cambridge stretching beyond Royston to Ashwell.

A moment's thought will reveal that water being pumped from the aquifer in this way, for the short-term benefit of the streams, is in itself making a major contribution to the long-term, inexorable lowering of the water table. This exacerbates the underlying problem. Is there a trace of irony in the name 'Groundwater Support Scheme'? In reality the groundwater is being whittled away. Peter is being robbed to pay Paul. Chalk stream ecologists view augmentation, at best, as a necessary evil.

The Brook is indeed suffering

In a radical change of outlook, both Cambridge Water and the Environment Agency (EA) now accept that over-abstraction is having an "actual impact on the headwaters of the Cherry Hinton Brook". The EA's publication in 2020 of their Water Industry National Environment Programme (WINEP) expressed the intention to reduce the licensed abstraction rate at Fleam Dyke (see map above) by 3.5%.

However it is known that actual (excessive) abstraction rates are often lower than the EA's original excessively generous rates offered. Another moment's thought will suggest that the average discharge of the Cherry Hinton Brook is not going to increase visibly any time soon. Anglian Water's planned Fens Reservoir is a step in the right direction but the earliest it will come on tap is 2035.

B. A much-abused suburban Chalk stream

The historical record of abuse can be traced with the help of the sketch map (not to scale) on the next page.

Between Giant's Grave and the 19th century Cherry Hinton Hall's ornamental ponds the Brook is mainly tightly confined between private residential plots with no public access. Already the spring water issuing from the Chalk aquifer has been polluted by the very high and prevalent nitrate levels due to past fertiliser use. This pollution will persist for decades to come. Apart from any pollution, which may be caused by the high concentration of ducks and other waterfowl in the main ornamental pond with a through-current, the pond is notable for preventing fish migration due to the small waterfall at its outlet.

Between this outlet and Daws Lane there is buried evidence of an unknown number of earlier small water mills dating back over an unknown number of centuries. At present there is no visible trace of them. Old maps show a network of channels hereabouts, presumably fed by the distributary, possibly including a medieval moat. In any case it seems that a leat on the south edge of Daws Lane conducted water to Sidney Farm which used to be located beside what is now Sidney Farm Road. It is said that until the 1960s a local farmer blocked the brick bridge leading to the allotments and poured arsenic into the resulting pond in order to dip his sheep. The bank of the channel is gently sloping for access at this point.

Along with most of the River Cam's tributaries the Cherry Hinton Brook suffered canalisation. This was a process, supposedly to reduce the risk of flooding which fell out of fashion by about the 1980s. The result is illustrated in the photo below which was taken along Snakey Path where the stream skirts the three Cherry Hinton Lakes. Typically, the channel was

straightened and deepened and the sides of the channel were steepened with the result that the channel was widened. So, every last vestige of the original Chalk stream channel was destroyed.

In recent years much effort has been put into 'channel restoration' along Daws Lane (photo above, 2021) and Snakey Path by shovelling in many tons of flint gravel. However it does raise the question, 'What is being restored?' The beds of Chalk stream channels elsewhere in England typically consist of flint gravel but judging by the spoil levée in the photo (below, left) there was no gravel here. Presumably the bed of this

channel was cut directly in the West Melbury Marl which, it so happens, contains no flint to have provided a residual gravel. Anyway, the channel bed is now covered mainly by a thick layer of silt which is totally unsuited to a thriving Chalk water ecosystem.

One of the Lakes is just visible in the photo on the left. These flooded quarries are, in themselves, an abuse of landscape on a heavy industrial scale, having provided clayey Chalk for the adjacent cement works (see photo above) which served the citizenry's demands at the time. The works were demolished in 1988 but are shown in the 1981 photo above taken from near the Daws Lane allotments with the overgrown Brook channel in the foreground. In 1950s, within living memory, waste from the works was discharged into

the Brook causing it to flow sludgy grey.

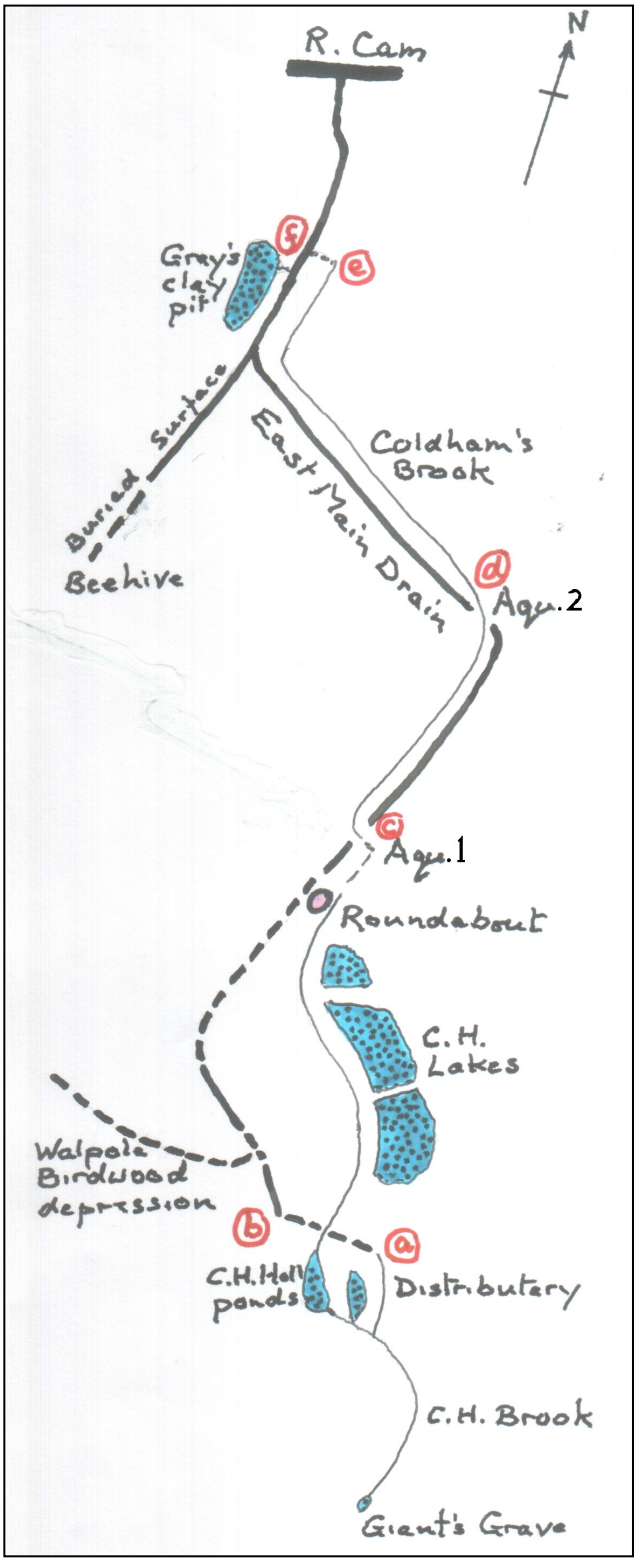
For decades the stream channel has been a convenient and favoured dumping ground for the detritus of suburban civilisation: metal cans and bottles, clothes, bicycles, supermarket trolleys, garden furniture, car tyres and wheels, not to mention stolen portable safes and miscellaneous plastic and metal objects of all kinds. If all of these had not been painstakingly removed over the years the channel would now surely appear as a long narrow strip of landfill. Inexplicable is the flaw in the psyche of some dog-owners which allows them to wrap dog-mess in plastic and toss it somewhere in sight but out of reach, over a fence, or dangling from a bush.

Attempts by Peterhouse to keep out frolicking summer trespassers from the Lakes have resulted in unsuitable, totally ineffective, ugly fencing, steel pillars, and a graffiti-covered, damaged, plate-steel, useless barrier.

It is astonishing that such a maltreated stream should form the axis of a green corridor of such ecological richness and diversity, crowned, for example, by water voles, little egrets, herons, and kingfishers.

Yet, after all the abuse above, the level of desecration reaches new heights (or depths) once the Brook has passed Sainsbury's. The roundabout and its new road layout were pushed through in the 1960s for our convenience. After flowing under Coldhams Lane the Cherry Hinton Brook disappears into 100m of miserable tunnel. The natural alignment and channel of the Brook between the roundabout and (c) on the map were completely destroyed. The tunnel and right-angled bend must have seemed a good engineering solution at the time. The Brook reappears in a short man-made ditch on the opposite side of Barnwell Road. Hereafter it is known as Coldhams Brook being represented in the sketch map on the right by the thin black line between (c) and (e).

The East Cambridge Main Drain is represented by the thick black line, continuous where visible at the surface, dashed where buried. Built for our benefit, to reduce the chance of flooding, it rings the death knell for Coldhams Brook. In a nutshell it 'captures' or absorbs the Brook so that the latter loses its identity by filtering down into the polluted water of the Drain. It is possible to smell the pollution which varies in intensity from day to day. Together the two water bodies enter the Cam as one. There is no possibility of fish migrating from the Cam upstream to Cherry Hinton.



A schematic map (not to scale) of the drainage pattern of east Cambridge. The distance, as the crow flies, from Giant's Grave to the Cam is c.2½ miles.

The story begins in the grounds of Cherry Hinton Hall where an underground pipe conducts water from the north (downstream) end of the distributary (a) (see map above) under the Brook to the East Main Drain where it can be seen as the open ditch starting in Daws Lane at one of the entrances to the Hall grounds at (b). Here water can always be seen emerging from underground and flowing northwards along the ditch. The discharge of the Cherry Hinton Brook is

permanently reduced by the amount of water diverted into the Drain. The altitude of the East Main Drain at (b) is lower than that of the underground pipe where it is immediately under the channel of the Brook between (a) and (b).

Where the two watercourses meet at (c) beyond the Sainsbury's roundabout this altitude difference has been maintained or increased. Coldhams Brook therefore has to cross the Drain by a (covered) aqueduct (Aqu.1). Between (c) and (d) the two water courses are approximately parallel with the Drain always at a lower level than the Brook. Throughout this length, along the edge of Coldhams Common, the water of the Brook seeps down through its bed and through swallow holes into the Drain. The main swallow hole is near (d) and is repaired periodically by the City of Cambridge Drainage Department. It seems that expensive waterproofing of the channel will be required in perpetuity in order to maintain this unsatisfactory state of affairs.

Any water still flowing in the Brook re-crosses the Drain by the second covered aqueduct (Aqu.2) at (d), near Galfrid Road. This flow is usually extremely small and the clearly-defined channel of the Brook from (d) to (e) holds usually, at best, a series of puddles.

Incidentally, with reference to the geological section on page 1, where the water in East Main Drain has reached (f) the West Melbury Marl has feathered out due to the general dip (downwards) from left to right. So the Gault Formation reaches the surface. Clay from the Gault used to be extracted from Gray's clay pit.

The photo above right shows where, in effect, the Cherry Hinton Brook terminates, nearby at (e).

The channel of Coldhams Brook also therefore ends here, ignominiously, without quite reaching the Newmarket Road. In the 16th century the Brook continued in its alignment, crossed the road and supplied a paper mill (a precursor of CUP) with water. If the flowing water of the Brook should ever reach (e) nowadays it would have to enter the pipe in the photo (shown as dashed line ef on map) and to flow down the slope into the East Main Drain flowing from left to right in the shallow valley near the top of the photo. There is no escape. Coldhams Brook and the Cherry Hinton Brook cannot reach the River Cam undefiled. All of their combined waters enter the East Main Drain sooner or later.

However, it has been suggested that the Cherry Hinton Brook could be diverted down into East Drain at (c). This arrangement, with a suitably engineered fish pass, would in theory connect the Cherry Hinton Brook with the River Cam and would enable fish such as brown trout to migrate upstream from the Cam, albeit through polluted water, to beyond (c), assuming that fish could, and would wish to, negotiate the tunnel up to Coldhams Lane. Using a buzz word of the time this would 'interconnect' two different ecosystems.

However, Coldhams Brook itself between (c) and (d), the backbone of Barnwell West Local Nature Reserve, would then dry out completely and eliminate the water whorl-grass (*Catabrosa aquatica*) which was observed here in the past, together with other valuable wildlife. The whorl-grass is one of the rarest plants in Cambridgeshire, perhaps found now only in this locality, but common in the rest of the British Isles and non-tropical areas of the northern and southern hemispheres. Stretches of recently 'restored channel', laboriously fashioned, would be abandoned, but interest, and life, would transfer to the lower channel.

David Brooks 1 January 2023