# Uttlesford District Council Chalk Streams

## Final Report

**June 2024**

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**Uttlesford District Council**

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## Contract

This report describes work commissioned by Uttlesford District Council on 20 May 2022. Jessica Creber and Richard Pardoe of JBA Consulting carried out this work. It was carried out alongside the Stage 1 Water Cycle Study in June 2022, and a partial update carried out alongside the Stage 2 Water Cycle Study in June 2024.

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## Purpose

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## Acknowledgements

JBA Consulting would like to thank Uttlesford District Council, and Charles Rangely-Wilson of the Catchment Based Approach Shalk Stream Restoration Group for their assistance in preparing this report.

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## Executive summary

JBA Consulting was commissioned by Uttlesford District Council (UDC) to undertake a Water Cycle Study (WCS) for the Uttlesford District. The purpose of the WCS is to form part of a comprehensive and robust evidence base to inform the preparation of the new Local Plan, which will set out a vision and framework for development in the area up to 2041 and will be used to inform decisions on the location of future development.

The north-western part of Uttlesford District is drained by two chalk streams, the River Stort and River Cam, and their tributaries. A chalk stream is broadly defined as a river that derives most of its flow from chalk-fed groundwater. Chalk streams flow from chalk aquifers, stores of underground water that are replenished when it rains. England is home to 85 per cent of the world's chalk streams. These rivers, together with the chalk aquifer from which they spring, are crucial water resources providing millions of people with water as well as supporting unique ecosystems. Businesses and farms also rely on chalk streams as without a reliable water source they would not be able to operate.

Balancing the needs of people and the environment is a challenge and it is getting harder. Population growth, particularly in the south and east of England, means that more and more water is required at a time when climate change is reducing the amount of water that is available.

England's chalk streams are therefore under considerable pressure. The Environment Agency's 'Reasons for Not Achieving Good' database indicates that one of the reasons for some of the watercourses in the district are not meeting 'Good' Water Framework directive (WFD) standards can be related to groundwater and surface water abstractions. Other pressures on chalk streams include pollution from wastewater discharges and agriculture, encroachment by development.

Chalk streams are an important and rare habitat and opportunities should be taken within the Local Plan to define policies to protect these river ecosystems. This report provides an evidence base to identify and characterise the chalk rivers in Uttlesford, and to recommend policies to protect them.

This report makes the following recommendations that can be adopted by Uttlesford District Council to provide greater protection for chalk streams and mitigate the impacts of development during the Local Plan period:

| Measure type | Recommendation |
|---|---|
| Water efficiency | Recommendation 1 – Adopt CaBA strategy recommendation of 90l/p/d throughout Uttlesford<br><br>Recommendation 2 – Require all new non-residential buildings achieve BREEAM "Outstanding" for water throughout Uttlesford |
| Water neutrality | Recommendation 3 – Explore the feasibility of achieving water neutrality in the Stage 2 Water Cycle Study |
| Riparian Buffer Zone | Recommendation 4 – Apply a riparian buffer zone in chalk stream areas to exclude all development within the natural flood plain or 15m of the bank, whichever is larger. A buffer of 10m should be applied to ditches that feed chalk streams.<br><br>Recommendation 5 – Apply a vegetated buffer strip on agricultural land within 15m of a chalk stream and 10m from a ditch feeding a chalk stream. |

| | |
|---|---|
| Cattle fencing | Recommendation 6 – Encourage responsible land management such as cattle fencing through the Nature Recovery Strategy |
| Education | Recommendation 7 – Undertake a public engagement exercise to raise awareness of chalk streams and encourage responsible riparian ownership |
| Sustainable Drainage Systems (SuDS) | Recommendation 8 – Enforce the SuDS hierarchy as defined in the Essex SuDS guidance with a focus on encouraging infiltration SuDS and deep borehole SuDS where appropriate. |
| Neighbouring authority engagement | Recommendation 9 – Continue and strengthen existing partnerships with neighbouring authorities and other stakeholders to define coordinated policies for chalk stream protection |

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## Abbreviations

| | |
|---|---|
| BGS | British Geological Society |
| BNG | Biodiversity Net Gain |
| CaBA | Catchment Based Approach |
| CSO | Combined Sewer Overflow |
| EA | Environment Agency |
| NE | Natural England |
| NFU | National Farmers Union |
| RBD | River Basin District |

| | |
|---|---|
| RBMP | River Basin Management Plan |
| RFD | Reason for Deterioration |
| RNAG | Reasons for Not Achieving Good |
| SAC | Special Area of Conservation |
| SPA | Special Protection Area |
| SSSI | Site of Special Scientific Interest |
| SWMI | Significant Water Management Issue |
| UDC | Uttlesford District Council |
| WCS | Water Cycle Study |
| WFD | Water Framework Directive |
| WINEP | Water Industry National Environment Programme |
| WRMP | Water Resource Management Plan |
| WwTW | Wastewater Treatment Works |

# 1 Introduction

## 1.1 Objectives

JBA Consulting was commissioned by Uttlesford District Council (UDC) to undertake a Water Cycle Study (WCS) for the Uttlesford District. The purpose of the WCS is to form part of a comprehensive and robust evidence base to inform the preparation of the new Local Plan, which will set out a vision and framework for development in the area up to 2041 and will be used to inform decisions on the location of future development.

The north-western part of Uttlesford District is drained by two chalk streams, the River Stort and River Cam, and their tributaries. A chalk stream is broadly defined as a river that derives most of its flow from chalk-fed groundwater. Chalk streams flow from chalk aquifers, stores of underground water that are replenished when it rains. England is home to 85 per cent of the world's chalk streams. These rivers, together with the chalk aquifer from which they spring, are crucial water resources providing millions of people with water as well as supporting unique ecosystems. Businesses and farms also rely on chalk streams as without a reliable water source they would not be able to operate.

During the summer months when temperatures are higher and plants are using water, rainfall is less effective at recharging the aquifer. In many cases, this can cause sections of chalk streams to be dry for much of the year. This natural hydrological variation – which can vary from year to year, is separate to the artificial impact of overabstraction.

Balancing the needs of people and the environment is a challenge and it is getting harder. Population growth, particularly in the south and east of England, means that more and more water is required at a time when climate change is reducing the amount of water that is available.

England's chalk streams are therefore under considerable pressure. The Environment Agency's 'Reasons for Not Achieving Good' database indicates that one of the reasons for some of the watercourses in the district are not meeting 'Good' Water Framework directive (WFD) standards can be related to groundwater and surface water abstractions. Other pressures on chalk streams include pollution from wastewater discharges and agriculture, encroachment by development.

Chalk streams are an important and rare habitat and opportunities should be taken within the Local Plan to define policies to protect these river ecosystems. This report provides an evidence base to identify and characterise the chalk rivers in Uttlesford, and to recommend policies to protect them.

## 1.2 Existing evidence

River Basin Management Plans (RBMP)[1] are required under the Water Framework Directive (WFD) and document the baseline classification of each waterbody in the plan area, the objectives, and a programme of measures to achieve those objectives. Uttlesford straddles both the Anglian River Basin District (RBD) and the Thames RBD. Local Planning Authorities (LPAs) must have regard to the Water Framework Directive as implemented in the Environment Agency's River Basin Management Plans. Within the Anglian RBMP, the need to protect chalk streams is stated.

The Catchment Based Approach (CaBA) chalk stream restoration group consists of Defra, the Environment Agency (EA), Natural England (NE), Ofwat, the water companies, National Farmers Union (NFU) and environmental voluntary groups and many independent members. The group published a Chalk Stream Strategy in 2021[2] which defines the chalk streams in England, the pressures they are under, and proposed a roadmap for their restoration.

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1 Draft River Basin Management Plans: 2021, Environment Agency (2021). Accessed online at: https://www.gov.uk/government/collections/draft-river-basin-management-plans-2021 on: 04/07/2022

2 Chalk Stream Strategy, CaBA (2021). Accessed online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf on: 19/04/2024

The Government's Environmental Improvement Plan 2023 (EIP23)[3] is the first revision of the 25 Year Environment Plan, published under the Environment Act 2021. This contains ten goals aimed at achieving the overall objective of restoring nature. Goal 3: "Clean and Plentiful Water", contains a recognition of the importance of chalk streams and states that "In recognition of this, Defra will continue to work with the Catchment Based Approach to support the implementation of the Chalk Stream Strategy. We will develop plans to outline actions to improve each chalk catchment, including £1 million investment in partnership projects each year".

The CaBA chalk Stream Strategy is therefore a key piece of evidence, supported by Government, and as such will be used to inform this report where possible.

## 1.3 Structure of report

Section 2 of this report provides an overview of what makes chalk streams unique and identifies the chalk streams present within Uttlesford. Section 3 outlines the pressures they are under from over-abstraction, development, agriculture and wastewater discharges. What is currently being done by stakeholders to protect chalk streams is summarised in Section 4 before recommendations to protect the chalk streams in Uttlesford are made in chapter 5.

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[3] Environmental Improvement Plan 2023, HM Government (2023). Accessed at: https://assets.publishing.service.gov.uk/media/64a6d9c1c531eb000c64fffa/environmental-improvement-plan-2023.pdf on: 31/05/2024

# 2 Defining chalk streams in Uttlesford

## 2.1 Chalk stream characteristics

A chalk stream or river is a waterbody which originates from a chalk aquifer. Chalk is permeable and porous, meaning that in a natural chalk catchment, a high proportion of rainfall is soaked up into the rocks to recharge the aquifer. Water is then released slowly to the river via groundwater. A low proportion of flow reaches the chalk stream via surface runoff, resulting in flow that is generally stable.

The ratio between high and low flows is generally less than 10:1 in a chalk stream compared with ratios of 100:1 in clay-dominated catchment where overland flow is the principal flow route[4]. A natural chalk stream may also be at "bank-full" level (the river channel is full) 30% of the year in comparison to only 5% for a river where run-off dominates.

Occasional low flows during dry periods in the summer months are also a feature of many chalk streams with some channels naturally dry for a few weeks per year. Depending on local hydrogeological conditions, some channels may only flow for a few months each year; such channels are referred to as winterbournes. Some upper reaches of chalk streams only flow during exceptionally wet years. These are known as ephemeral streams.

The flow regime also results in a very stable temperate range (typically approximately 10-11 degrees Celsius) and as water filters through the chalk, the result is a low suspended sediment "gin clear" look to the water and clean, gravelly beds which is one of the defining characteristic of chalk streams.

Nutrient levels are typically very low, with total phosphorus levels in the range of 0.01 – 0.03 mg/l in a natural chalk catchment.

Despite deposits of chalk geology being relatively common across Europe, chalk streams are globally rare due to the unique geological characteristics that caused them to form, with a combination of glacial activity and weathering resulting in a band of chalk close to the surface across south and eastern England and north west France. England is therefore home to 85% of the world's Chalk streams.

The CaBA Chalk Stream Strategy groups chalk streams into four types. These are defined in Appendix B. All of the chalk streams in Uttlesford are categorised as A/D, a mix of classic slope-face chalk streams that rise directly from the chalk, and Pleistocene ice-impacted chalk streams that rise from chalk directly impacted by glacial action.

Ditches that feed chalk streams should also be considered when assessing the overall health of a chalk stream, as they form part of the wider riverine habitat. They may offer a route for surface water runoff containing pollutants to enter chalk streams, and also offer opportunities for attenuation of surface water, infiltration to allow recharge of chalk aquifers and filtration of pollutants. The Defra Biodiversity Net Gain calculations require ditches to be scoped in where a site boundary includes a ditch, or intersects the riparian zone of a ditch (5m from the bank top).

## 2.2 Chalk stream ecology

### 2.2.1 Habitat

Chalk streams are naturally slow flowing rivers which were created by multi-phase glaciation 70,000-9,000 BC in the Devensian (last glacial period). The freeze and thaw cycle of glaciation generated large amounts of melted water which carved chalk river channels. Post-glaciation (10,000 years ago), the chalk aquifers fed into these channels, creating the pre-human chalk streams.

Post-human, many chalk streams have been straightened and dredged, creating fragmented habitat and degrading the chalk streams natural meandering courses. Subsequently, the

4 Chalk Stream Restoration Strategy 2021 – Main Report, Catchment Based Approach (2021). Accessed online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf on: 20/06/2022

straightening of the rivers leads to the characteristic gravel of chalk streams being washed away with the increase in flow velocity.

Chalk streams often have an alkaline pH between 7.4-8.7. This is due to the chalk bedrock the source water is filtered through. The stable temperature climate creates a unique habitat that many invertebrates and fish have adapted to. As well as a steady temperature, chalk streams provide a calcium-rich environment which is commonly well oxygenated. Having such specific characteristics makes chalk streams, and many of the species that live in them sensitive to any change.[5]

### 2.2.2 Species

When there is water flow in the rivers, the previously mentioned meanders create varied movement of water distributing gravel and silt creating areas for fish spawning and invertebrates. Brown Trout (*Salmo trutta*) are a common fish species in chalk streams due to their cool temperatures. The Grayling (*Thymallus thymallus*) is typically native to chalk streams and has been reintroduced in chalk streams across the UK with the aim of increasing its overall population numbers. Unlike the Atlantic Salmon, the Brown Trout and Grayling are potadromous, meaning they migrate in freshwater rather than to the sea. This means they are more susceptible to the impacts of physical barriers in rivers. Weir removals and migration channels have been implemented in the Greater Cambridge chalk stream project to help fish migration.

Due to seasonal temperature and rainfall changes, some chalk streams can naturally run dry from summer to early autumn. This commonly occurs at upper river sections. Winterbourne species, specifically winterbourne stoneflies (*Plecoptera*), black flies (*Simuliidae*) and scarce brown sedges (*Trichoptera*) are usually present in chalk streams. These species have adapted throughout their lifecycle to withstand dry stages of the year. With temperature being a harsh selective pressure, it makes these populations unique.

When over-abstraction occurs, these species need to withstand dry periods for longer, which even if they are adapted to these conditions, can interrupt their life cycles if prolonged. Winterbourne plant species can also be affected by abstraction rates such as the Pondwater Crowfoot (*Ranunculus aquatilis*) and Watercress (*Nasturtium officinale*).

Typical of chalk streams are the Water crowfoot, an aquatic plant species and a member of the buttercup *(Ranunculus*) family. The Stream Water-crowfoot (*Ranunculus penicillatus penicilatus*) are common in chalk streams, with the River Water-crowfoot (*Ranunculus fluitans*) more common in larger rivers.

Water-crowfoot species act as a home for Simuliidae larvae which filter diatoms, also known as algae. Water starworts are also common in chalk streams. These species prefer slower flows, with shaded areas and siltier substrate, they are a complicated genus but, as a genus, are easily recognised by their clumped, densely green-leaved growth and yellow anthers.

On the banks of the chalk streams, reeds such as Reed Canary grass (*Phalaris arundinacea*) and Reed Sweet (*Glyceria maxima*) are often present, which act as shade for fish and invertebrate species.

A number of invertebrates are also present in chalk streams. Chalk stream populations are mainly made up of:

- Ephemera (mayflies)
- Plecopteran (stoneflies)
- Trichoptera (caddis fly)
- Coleoptera (beetles)
- molluscs (snails and slugs)

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5 Chalk Stream Strategy, Catchment Based Approach (2021). Accessed online at: https://catchmentbasedapproach.org/wp-content/uploads/2021/10/CaBA-CSRG-Strategy-MAIN-REPORT-FINAL-12.10.21-Low-Res.pdf on: 04/07/2022

- crustaceans (crayfish)
- Hirundea (such as leeches)

Although all of the above groups are present in chalk streams, they can be hard to find due to habitat degradation, and may not be all present at once. Other invertebrates including the white clawed crayfish (*Austropotamobius pallipes*) are found in chalk streams yet not exclusively. A key survival pressure on the White-clawed Crayfish is the presence of American Signal Crayfish (*Pacifastacus leniusculus*) in the waterbody, which out-competes the White-clawed Crayfish for habitat and food and carries crayfish plague (*Aphanomyces astaci*).

## 2.3 Chalk streams in Uttlesford

### 2.3.1 Summary

Natural England recently published (March 2022) a new chalk stream map for England updating previous mapping based on the Priority Habitat map from 2006. This contains a larger number of streams and their tributaries than the previous mapping (which was included in the scoping WCS), and aids the identification of relevant streams within Uttlesford. Missing from this map is Wenden Brook, a tributary to the River Cam. This River was included in the index of chalk streams within the CaBA chalk Stream Strategy and so will be included as a chalk stream in this report.

Uttlesford has several chalk streams, mainly in the north-west of the district, see Figure 2.1. Many of the smaller streams are tributaries of the two larger rivers in Uttlesford: the River Stort and the River Cam.

The Natural England chalk stream mapping took account of superficial geology in its definition of chalk streams, but the intention is for this mapping to be modified by local knowledge. There is an opportunity to engage with local interest groups or river stakeholders to help update this map.

The British Geological Society (BGS) bedrock geology map indicates much of Uttlesford is underlain by chalk geology suggesting that many other streams not included in the Natural England mapping should be classified as chalk streams. However, the superficial geology needs to be taken into account. Much of the chalk bedrock geology is overlain by superficial deposits such as glacial till. In the areas indicated on the mapping as chalk streams, this superficial layer has been eroded to expose the underlying chalk, resulting in direct connectivity between the chalk aquifer, the streams and their valleys, which is why much the River Cam catchment can be said to be a chalk stream. By contrast, the River Pant catchment is largely overlain by superficial deposits and the chalk can be 20-30m below the surface resulting in little connectivity, such that the chalk has minimal influence on the behaviour of the river.

The difference can also be seen in the hydrology of the two rivers. Chalk streams rely mostly on groundwater, and the ratio between high and low flows is low, typically 10:1. If the Q5 (flow that is exceeded 5% of the time – the high flow) and Q95 (flow that is exceeded 95% of the time – the low flow) are compared the River Cam (as recorded at Chesterford) has a ratio of 11:1, whereas the Pant (measured at Copford Hall) has a ratio of 91:1, indicating the Pant is not behaving as a typical chalk stream.

Bedrock and superficial geology maps can be found in Appendix A.

The River Bourne is a tributary of the River Granta (and eventually the River Cam). It is not included in the Natural England mapping, however it is listed in Appendix H of the CaBA chalk Stream Strategy as a chalk stream. The river flows south to north through the village of Ashdon. North of Ashdon the geology mapping does not show any superficial geology overlaying the chalk bedrock suggesting the river may be directly connected to the chalk. South of Ashdon, a superficial layer of Til is present which may prevent this connectivity, so chalk may have less influence on the river. Further investigation may be required into the flow regime of this river (no flow gauges were present to inform this report) in order to define whether the whole or part of the River Bourne should be classified as a chalk stream. This has been marked in Figure 2.1 as a possible chalk stream.

Should the River Bourne not be classified as a true chalk stream along part of its length, it should be noted that it is a tributary to a chalk stream and so development, agriculture and other activities may still have an influence on chalk streams downstream.

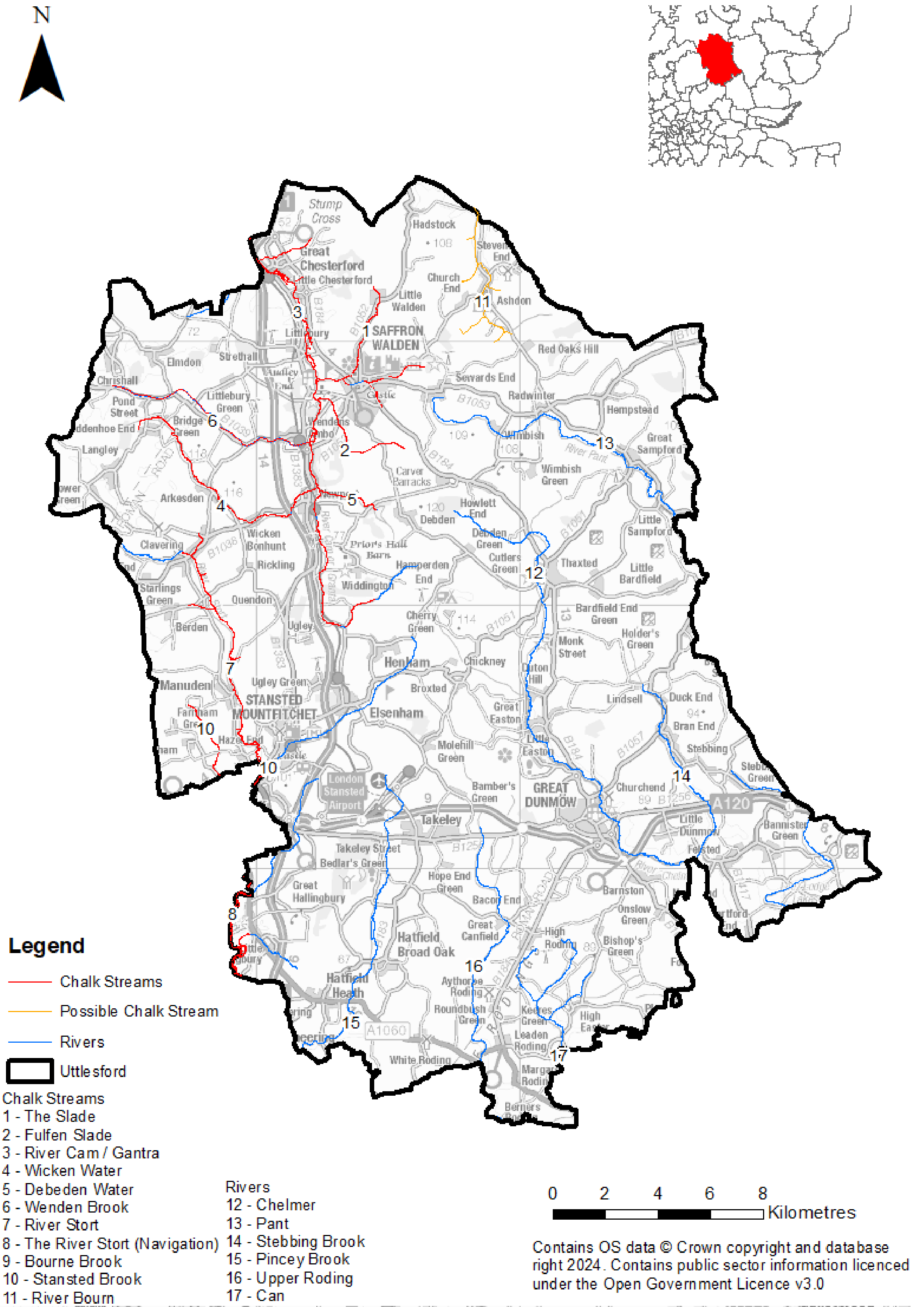



**Figure 2.1 The location of chalk streams in Uttlesford**

### 2.3.2 The Slade

The Slade runs through arable and horticultural land in its headwaters before passing through the town of Saffron Walden. Sections of the river are culverted, and many appear artificially straightened. Through the town the river is heavily constrained by the presence of buildings and gardens limiting the opportunity for future restoration work. West of Saffron Walden there is a Wastewater Treatment Works (WwTW) which discharges to the river.

### 2.3.3 Fulfen Slade

The Fulfen Slade runs through predominantly arable and horticultural land before its confluence with the River Cam to the south of Audley End. Audley End WwTW discharges to the Fulfen Slade close to this confluence.

### 2.3.4 River Cam/ Granta

The main channel of the River Cam runs to the east of the M11 through the settlements of Newport, Wendens Ambo, Littlebury, Little Chesterfield and Great Chesterfield before leaving Uttlesford under the M11. Landuse along the river is a mix of acid, calcareous, and neutral grassland and broadleaved, mixed and yew woodland. Arable and horticulture land is prominent along much of the river.

Six WwTWs discharge into the river (Quendon, Debden (via Debden Water), Newport, Audley End (via the Fulfen Slade), Saffron Walden (via the Slade), and Great Chesterfield.

### 2.3.5 Wicken Water

Wicken Water rises near Duddenhoe End and flows through the settlements of Arkesden and Wicken Bonhunt before joining the Cam through Newport. Arable and horticulture land is mainly present on the banks of Wicken Waters as well as acid, calcareous, and neutral grassland.

### 2.3.6 Debden Water

Debden Water primarily runs through acid, calcareous, and neutral grassland and broadleaved, mixed and yews woodland. Arable and horticultural land is also present with a patch of improved grassland at the head of the river. It joins the River Cam at Newport.

### 2.3.7 Wenden Brook

The Wenden Brook is predominantly surrounded by agricultural land. It is a tributary of the Cam/ Granta running parallel to Wicken Waters. Acid, calcareous and neutral grassland are also present intermittently. The Wenden Brook runs almost parallel to the B1039 running through Littlebury Green.

### 2.3.8 River Stort

The River Stort runs along the north western boundary of the study area. At the head of the river built up areas and gardens are common, with the main course of the river covered by arable and horticultural land. The River Stort also has several WwTW along its banks.

### 2.3.9 The River Stort (Navigation)

Also running along the boundary of the study area, the River Stort (Navigation) which flows through a mosaic of land types including grassland, woodland, and improved pasture. It is a canalised channel running from Bishop Stortford to the confluence with the Lea navigation, and is interlinked with the main Stort channel.

### 2.3.10 Bourne Brook

Acid, neutral, and calcareous grassland is present around Bourne Brook, but arable and horticultural land predominantly outline the brook. Bourne Brook runs through a section of improved grassland close to Farnham Green and Hazel End before leaving the study area and joining the River Stort downstream.

### 2.3.11 Stansted Brook

A small length of Stanstead Brook has been designated as a chalk stream in the NE mapping. This section runs through broadleaved, mixed and yew woodland, but upstream of this (and on a reach not classified as chalk stream) is Stanstead Mountfitchet.

# 3 Pressures on Chalk Streams

## 3.1 Introduction

The health of chalk streams depends on three main factors: water quantity, water quality and physical habitat quality. The following sections will identify the main pressures facing The Rivers Cam and Stort and their tributaries. Many of these factors are also linked, for example a reduction in water quantity can impact water quality.

## 3.2 Water Framework Directive status

The Water Framework Directive (WFD) was first published in December 2000 and transposed into English and Welsh law in December 2003. It introduced a more rigorous concept of what "good status" should mean than the previous environmental quality measures. By 2027 the WFD has committed to all member states waterbodies achieving good status.

Uttlesford's chalk streams, like a large percentage of rivers in the UK, have a "poor" or "moderate" WFD status. Summaries of water framework directive (WFD) catchments in Uttlesford were presented in the Stage 1 Water Cycle Study. These have been reproduced in Appendix D for the chalk stream catchments.

Flow is a Significant Water Management Issue (SWMI) in most chalk stream catchments in Uttlesford. Consequently, many streams are not achieving good status and have flow as a Reason For Deterioration (RFD). Other pressures include sewage discharge and agricultural and rural land management.

## 3.3 Water abstraction

Development and its corresponding rise in population increase demand for water. The whole of the Affinity Water supply area – which includes Uttlesford has been classified by the Environment Agency as being under serious water stress[6]. As the WFD summary of the above shows, most of the chalk stream catchments cite groundwater abstraction as one of the reasons for not achieving good status. The groundwater bodies in Uttlesford are shown in A.3, and their status summarised in the Stage 1 WCS.

Abstraction causes groundwater levels to drop, and as chalk streams are predominantly groundwater fed, river flow will also decrease.

Many chalk streams have periods of naturally low flow during dry weather, and have species specially adapted to these environments. Groundwater abstraction lengthen these periods of low or no flow, and cause them in areas where this is not a natural phenomenon.

The Catchment Based Approach (CaBA) Chalk Stream Strategy summarises the impact on ecology of chronic and unnaturally low flows caused by excessive groundwater abstraction:

- Reduction in current velocity
- Reduction in water depth and the spatial volume of in-channel habitat
- Increase in the residence time of water in the river channel
- Increase in the temperature of water in the channel
- Increase in the concentration of pollutants
- Reduction in oxygen levels
- Increase in sediment deposition
- Reduction or interruption of lateral connectivity between the river and its marginal riparian habitats and floodplain
- Disruption in the passage of migratory fish

6 Water stressed areas – final classification, Environment Agency (2021). Accessed online at: https://www.gov.uk/government/publications/water-stressed-areas-2021-classification on: 20/06/22

Many of these effects interact. For example, Brook Water Crowfoot (*Ranunculus*), a plant that thrives in healthy chalk streams with high flow, has its growth limited when channel flow drops. In turn this reduction in channel flow causes an increase in sedimentation – which also limits the growth of Crowfoot. A feature of Crowfoot is the scour between heads of Crowfoot that acts to flush sediment from the channel making the problem of sedimentation worse.

A reduction in channel flow can also increase water temperature and reduce oxygen content, causing stress and decreased growth rates in invertebrates as well as making them more susceptible to infectious diseases (Mattson et al, 2008). Ground and surface water abstraction also affects macrophytes, and phytobenthos a group of sediment organisms. Both macrophytes and phytobenthos are indicator species for a healthy aquatic environment because of their specific habitat needs.

CaBA carried out a survey of 55 chalk streams assessing groundwater abstraction as a percentage of catchment recharge between 2017 and 2019. In simple terms this is a ratio of how much water is abstracted per year compared with the potential recharge from annual rainfall in the catchment. This metric, although simplistic, provides a quick comparison between rivers. A deficit figure is included in the assessment showing the volume of water that would need to be left in the ground for the catchment to deviate by less than 10% from the modelled natural flow at Q95 (this is the river flow that is exceeded 95% of the time – often called the "low flow" condition).

The River Cam shows a very high ratio of abstraction to recharge (52%) and a deficit of 12.3Ml/d indicating a catchment under significant pressure. The River Stort has a lower ratio (18.5%) but a similar deficit of 11.5Ml/d.

The Water Industry National Environment Programme (WINEP) is a set of actions that the EA have requested all 20 water companies operating in England to complete in a particular Asset Management Period (AMP) as part of their environmental commitments. Actions may include investigations or actual measures, examples could be reductions in abstraction in a particular river to maintain flow to support WFD objectives, or a reduction in phosphate pollution in a catchment through upgrades to a WwTW.

A number of investigations are currently underway within the Cam and Stort catchments as part of the Water Industry National Environment Programme (WINEP).

**Table 3.1 WINEP actions on Groundwater bodies in Uttlesford**

| Waterbody Name | WINEP ID | Unique ID | Scheme Name(s) | Type of scheme / notes |
|---|---|---|---|---|
| Cam and Ely Ouse Chalk | EAN00015, EAN00016, EAN00017, EAN00018, EAN00034 | 7AF100043 | DEBDEN ROAD, SAFFRON WALDEN<br>NEWPORT | Investigation and options appraisal<br>This is an investigation to determine whether increased use of groundwater abstraction will cause deterioration of the status of the groundwater body. If it is shown that increased abstraction causes deterioration of status, then the investigation needs to look at the costs of options to provide alternative sources of public water supply. It is the opinion of EA that increased use |

| Waterbody Name | WINEP ID | Unique ID | Scheme Name(s) | Type of scheme / notes |
|---|---|---|---|---|
| | | | | of the licence beyond maximum peak use between 2005 and 2015 rounded up to nearest 1000 $m^3$ may cause deterioration. |
| Cam and Ely Ouse Chalk | EAN00453 | 7AF200012 | Newport PS nitrate investigation | Investigation<br>To investigate the current inputs of nitrate to groundwater and gain a more detailed understanding of the likely long-term trends in nitrate groundwater concentrations at the abstraction. The concentrations of nitrate at the abstraction show rising trend in nitrate concentrations, which has increased rapidly since 2016, posing a risk of exceeding the drinking water standard in the future. |
| North Essex Chalk | EAN02374<br>EAN00005<br>EAN02375<br>EAN00006 | 7AF100006 | SPRINGWELL SOURCE<br>UTTLESFORD BRIDGE SOURCE<br>WENDEN | Investigation and options appraisal<br>Investigate whether abstraction is causing a failure of the status of North Essex Chalk groundwater body. Ensure No deterioration due to planned abstraction |

**Table 3.2 WINEP actions on chalk surface waterbodies in Uttlesford**

| Waterbody Name | WINEP ID | Unique ID | Scheme Name(s) | Type of scheme / notes |
|---|---|---|---|---|
| Cam (US Newport) | EAN00013<br>EAN00035 | 7AF100033 | NEWPORT | Sustainability Change<br>This is an implementation scheme to prevent deterioration of flows in these rivers. EA will seek to cap abstraction licences based on maximum peak use between 2005 and 2015 rounded up to nearest 1000 $m^3$. |

| Waterbody Name | WINEP ID | Unique ID | Scheme Name(s) | Type of scheme / notes |
|---|---|---|---|---|
| Wicken Water | EAN00028<br>EAN00010<br>EAN00014 | 7AF100033 | UTTLESFORD BRIDGE SOURCE<br>WENDEN<br>NEWPORT | Sustainability Change<br>This is an implementation scheme to prevent deterioration of flows in these rivers. EA will seek to cap abstraction licences based on maximum peak use between 2005 and 2015 rounded up to nearest 1000 $m^3$. |
| Wendon Brook | EAN00024<br>EAN00030<br>EAN00012 | 7AF100033 | DEBDEN ROAD, SAFFRON WALDEN<br>UTTLESFORD BRIDGE SOURCE<br>WENDEN | Sustainability Change<br>This is an implementation scheme to prevent deterioration of flows in these rivers. EA will seek to cap abstraction licences based on maximum peak use between 2005 and 2015 rounded up to nearest 1000 $m^3$. |
| Cam (Newport to Audley End) | EAN00026<br>EAN00029<br>EAN02413<br>EAN00011<br>EAN00019 | 7AF100034 | SPRINGWELL SOURCE<br>UTTLESFORD BRIDGE SOURCE<br>UTTLESFORD BRIDGE SOURCE<br>WENDEN<br>DEBDEN ROAD, SAFFRON WALDEN | Sustainability Change<br>This Scheme for flow improvement for River Cam has three aspects. 1. EA to seek to cap the licence to prevent deterioration based on maximum peak use 2005 to 2015 rounded to nearest 1000 m3. 2. Carry out river restoration works (Options 19, 20 and 21 from options appraisal). 3. Change the flow trigger condition on Uttlesford/Springwell licence from 12.72 Ml/d to 15.64 Ml/d. |
| Cam (Audley End to Stapleford) | EAN00023<br>EAN00385<br>EAN00036<br>EAN00025<br>EAN00027<br>EAN02412<br>EAN00037 | 7AF100034 | DEBDEN ROAD, SAFFRON WALDEN<br>RIVER RESTORATION: IMPLEMENTATION SCHEME<br>NEWPORT | Sustainability Change<br>This Scheme for flow improvement for River Cam has three aspects. 1. EA to seek to cap the licence to prevent deterioration based on maximum peak use 2005 to 2015 rounded to nearest 1000 $m^3$. 2. |

| Waterbody Name | WINEP ID | Unique ID | Scheme Name(s) | Type of scheme / notes |
|---|---|---|---|---|
| | | | SPRINGWELL SOURCE<br>UTTLESFORD BRIDGE SOURCE<br>UTTLESFORD BRIDGE SOURCE<br>WENDEN | Carry out river restoration works (Options 19, 20 and 21 from options appraisal). 3. Change the flow trigger condition on Uttlesford/Springwell licence from 12.72 Ml/d to 15.64 Ml/d. |
| Stort and Bourne Brook | HNL00026<br>HNL00023<br>HNL00028<br>HNL00022 | 7AF100075 | NORTH STORTFORD PUMPING STATION<br>STANSTED MOUNTFITCHET PUMPING STATION<br>STANSTED PUMPING STATION<br>THE CAUSEWAY BISHOPS STORTFORD | Investigation and Options Appraisal<br>WFD Flow investigation – no details given |
| Stort (at Clavering) | HNL00025<br>HNL00030 | 7AF100078 | STANSTED MOUNTFITCHET PUMPING STATION<br>STANSTED PUMPING STATION | Investigation and Options Appraisal<br>WFD Flow investigation – no details given |

## 3.4 Agriculture and industry

Natural chalk streams are characterised by their "gin-clear" waters and low nutrient concentrations. Run-off from agricultural land and effluent from industry can cause a reduction in water quality – exacerbated where flows are already lower due to abstraction resulting in less dilution of pollutants. Due to chalk streams needing "soggy" flood plains agriculture has over time, had a negative effect on chalk streams by disconnecting the river from its natural flood plain, and draining flood plains to increase agricultural productivity.

The Natural England Living Habitats Map was used to show the main landcover types in Uttlesford. As seen in figures Figure 3.1 to Figure 3.4, acid, calcareous and neutral grassland and arable and horticultural land predominantly cover Uttlesford. Agricultural runoff is a large risk to chalk stream health because of their environmental sensitivity. Fertilisers and poor field management commonly lead to runoff containing phosphate and ammonia polluting watercourses.

It should be noted that the Natural England Living Habitats Map shows a snapshot in time and may change as farmers change land use.

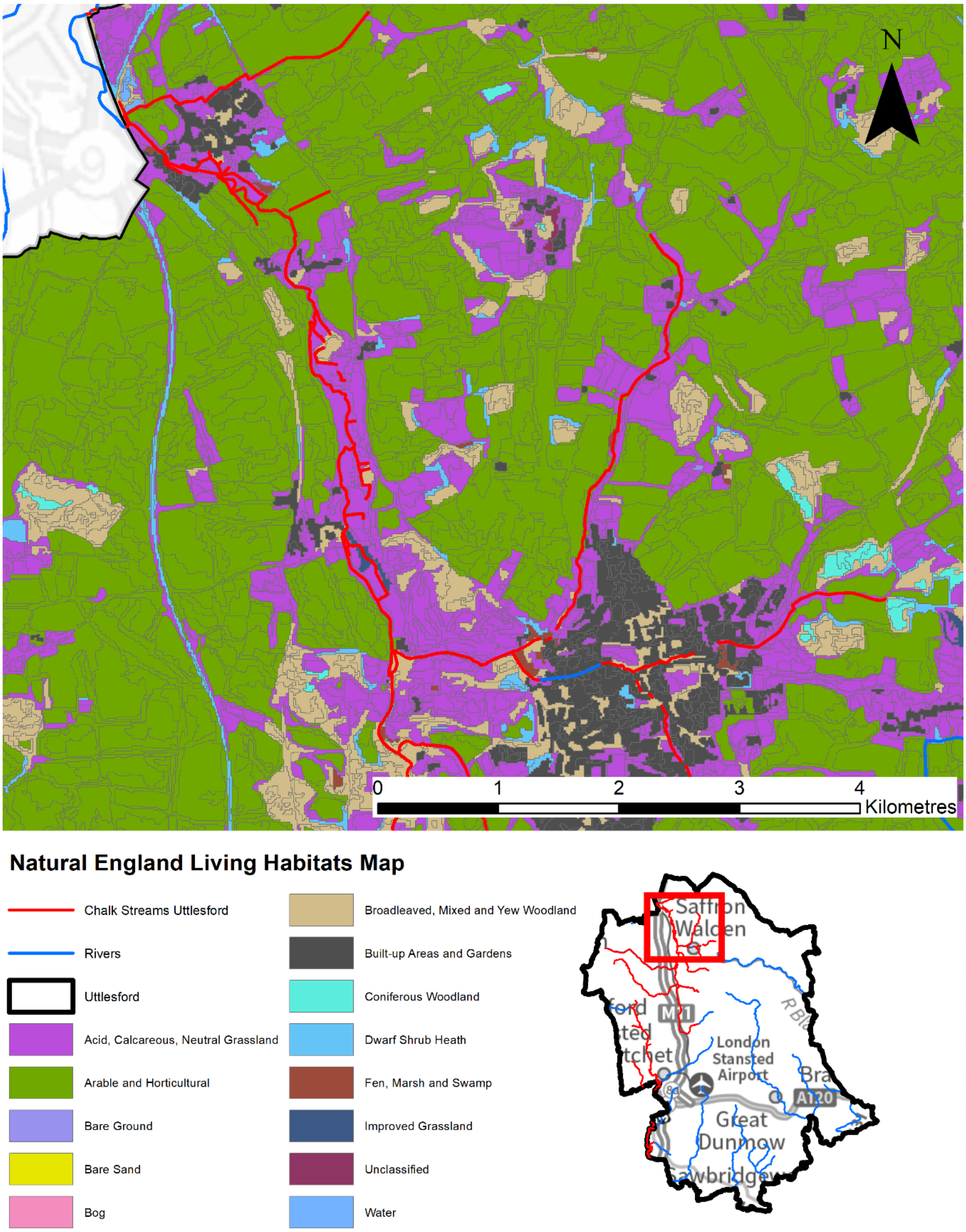





**Figure 3.1 Landcover in Uttlesford Part 1**

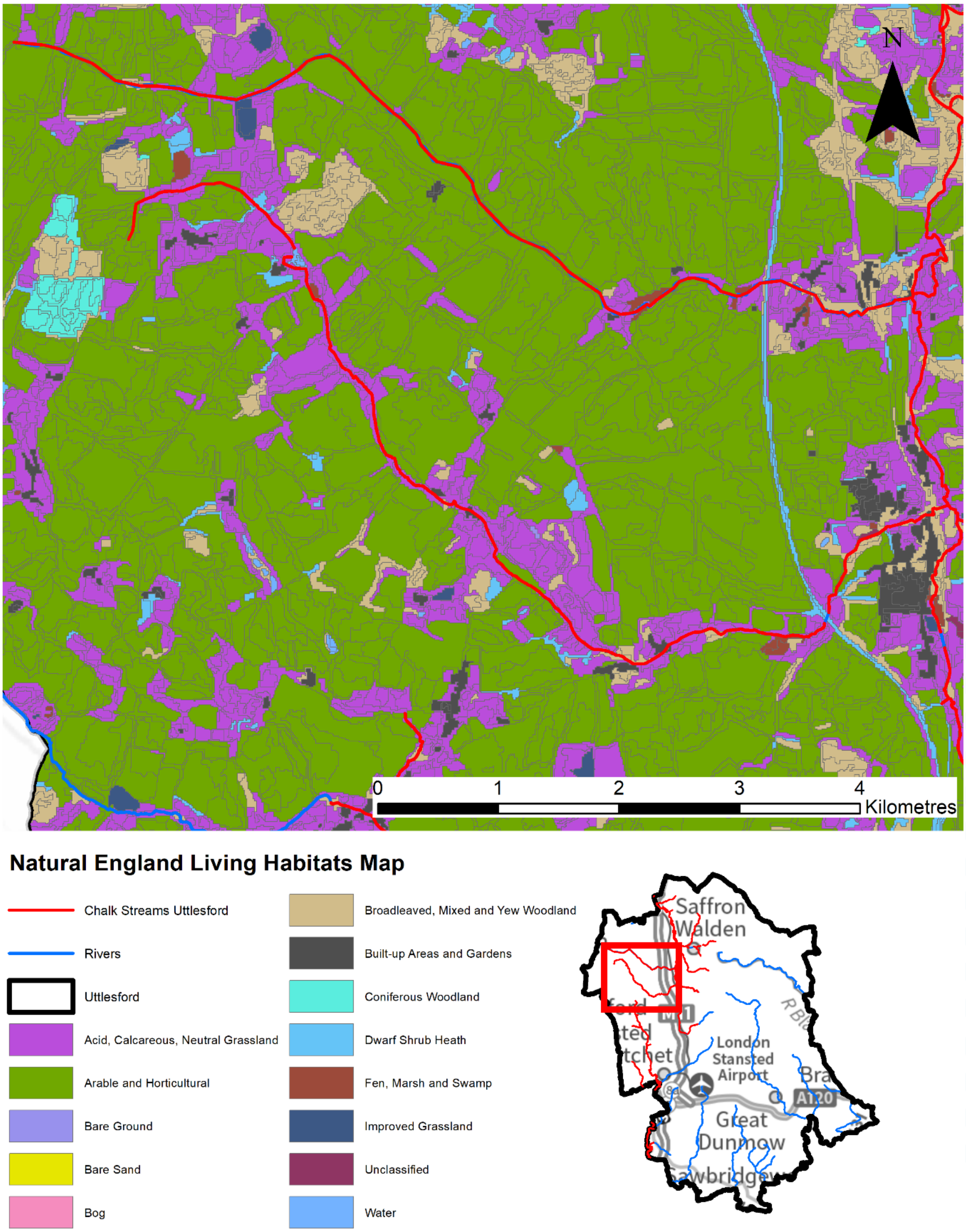





**Figure 3.2 Landcover in Uttlesford Part 2**

JBA consulting

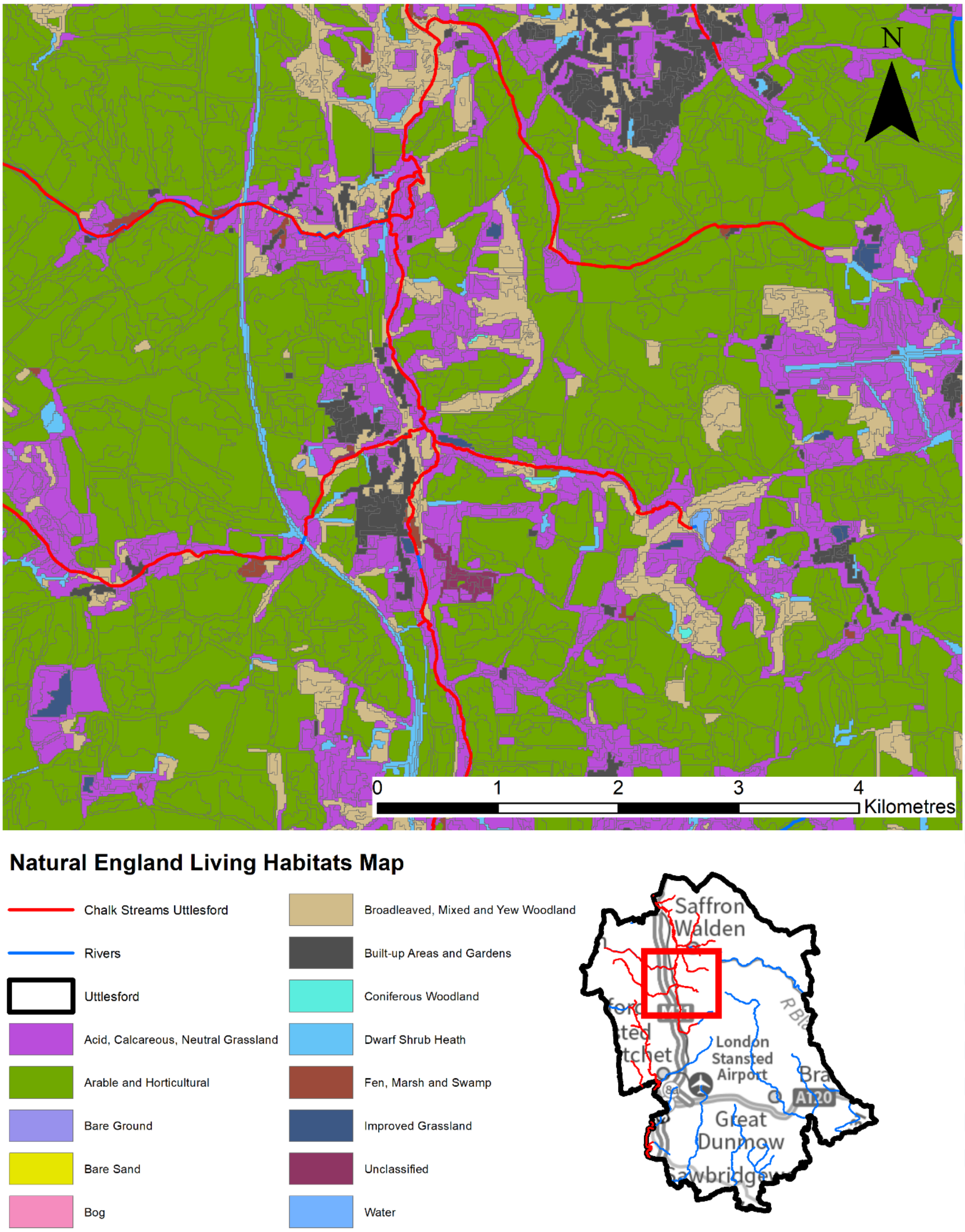





**Figure 3.3 Landcover of Uttlesford Part 3**

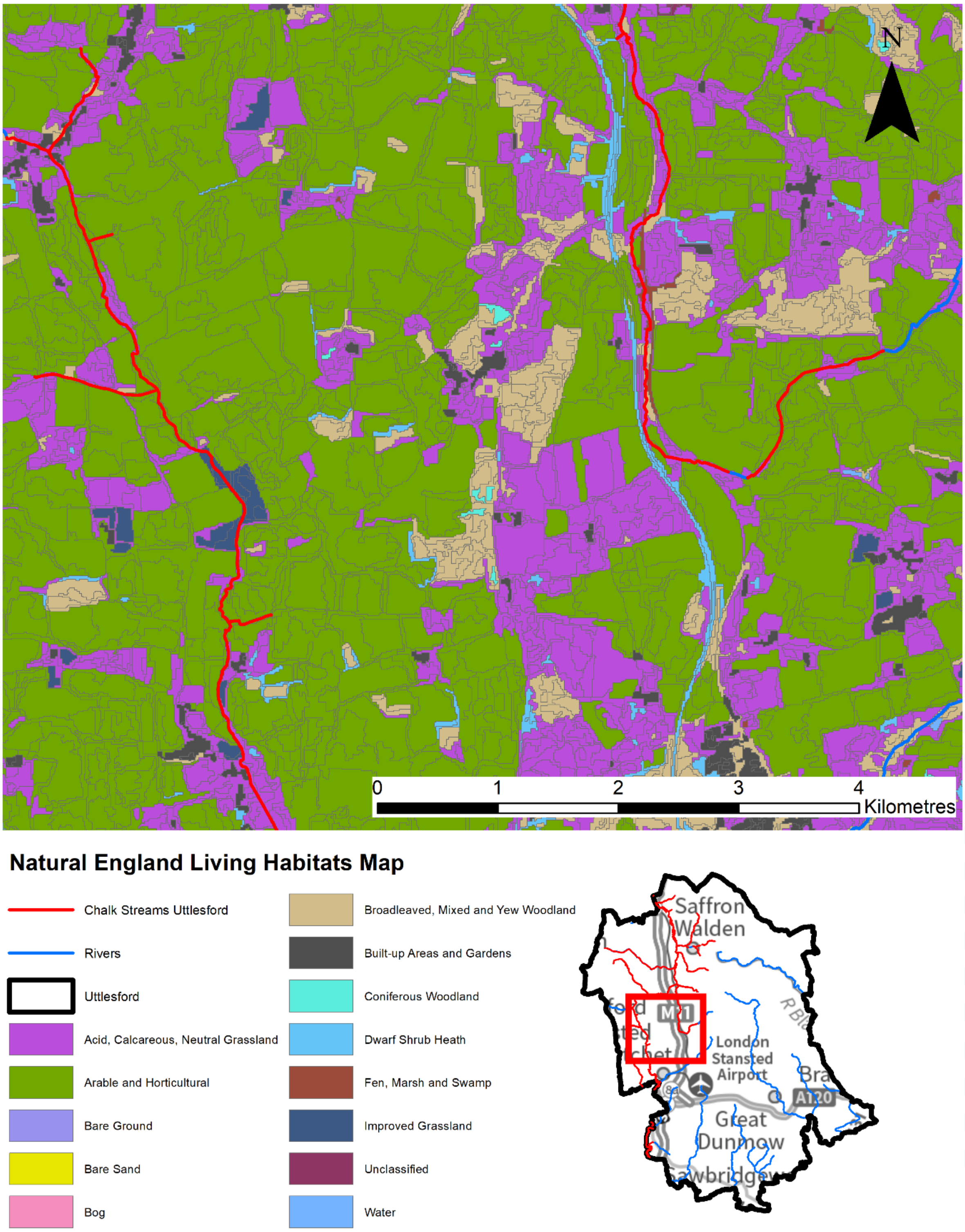
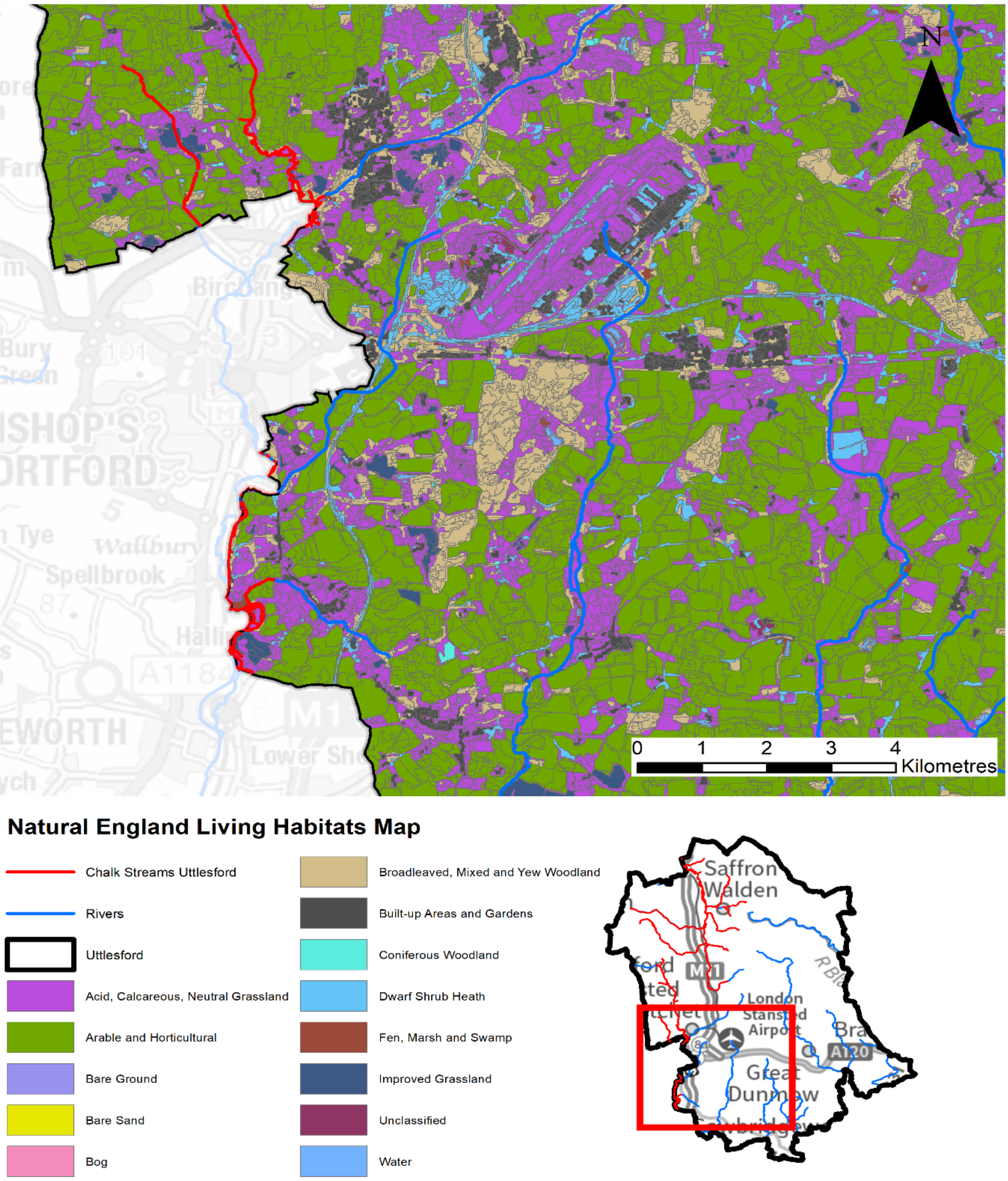





**Figure 3.4 Landcover of Uttlesford Part 4**






## Figure 3.5 Landcover of Uttlesford Part 5

High phosphate levels are prevalent in Uttlesford, this can lead to eutrophication and subsequently algal blooms and a reduction of dissolved oxygen within the watercourse. Not only can this be detrimental to invertebrates but can also have damaging effects on plant and fish populations.

Ammonia is another common agricultural pollutant. Ammonia pollution is commonly linked to agricultural runoff which has negative effects on macrophyte populations (large aquatic plants). Ammonia, in high amounts, is toxic to aquatic life decreasing biodiversity levels.

### 3.4.1 Cattle Grazing

Another risk to chalk streams from agriculture is cattle grazing. Factors such as reduced water depth and reduced shade can occur from cattle grazing subsequently having effects on trout spawning and increased turbidity. Ungrazed sites typically have higher levels of macroinvertebrate species than grazed sites[7]. This can be because of the increase in sediment from eroded river banks occurring from cattle drinking from the rivers. As seen in Figure 3.1 to Figure 3.3 arable and horticultural land mainly cover Uttlesford, consequently, cattle grazing may not be a significant catchment-wide issue, although local problems may occur.

Cattle trails, the pathways cattle use to walk to and from the bankside, can act as channels for surface water thus increasing levels of ammonia and phosphate runoff into rivers.

### 3.4.2 Sediment from agriculture

Soil erosion can have a significant impact on water quality and sediment accumulation in watercourses[8] with 76% of the sediment load in UK rivers resulting from erosion of agricultural land[9]. The soil erosion rate on arable land is typically double that of pasture, but is highly dependent on the topography and land management practices.

## 3.5 Development and urbanisation

### 3.5.1 Runoff from developed sites

Within developed sites, pollutants from gardens and vehicles can be carried by rainwater either directly overland into watercourses, or via surface water drains. The speed and volume of runoff is higher than those on undeveloped sites due to the higher proportion of impermeable surfaces.

Pollutants present in runoff from roads could include metals such as Cadmium, Zinc and Copper (from vehicles), particulates from tyres and exhausts, oil, washer fluids etc. Other pollutants present in runoff from developed sites could include fertilizers / pesticides from gardens.

Sediment and other pollutants can disrupt the natural ecology of chalk streams making developed sites drainage systems and wastewater management a prominent factor in Uttlesford's chalk streams health.

### 3.5.2 Construction runoff

Runoff and sediment from construction sites is also a risk to chalk streams that need to be managed. Runoff from construction sites may include, but is not limited to, oil, pesticides and soil/ sediment, all of which can damage a habitat. Runoff is influenced by various factors such as climate and topography, as well as soil type.

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7 Harrison, S. S. C. and Harris, I. T. (2002) The effects of bankside management on chalk stream invertebrate communities. Freshwater Biology, 47, 2233-2245.
8 Can control of erosion mitigate water pollution by sediments?, Rickson, R.J. (2014), Science of the Total Environment [online]. 468–469 pp. 1187–1197
9 The potential impact of projected change in farming by 2015 on the importance of the agricultural sector as a sediment source in England and Wales, Collins, A.L., et al. (2009). Catena [online]. 79 pp. 243–250.

## 3.6 Riparian squeeze

Natural rivers are rarely fixed in the landscape and natural hydromorphological processes cause them to move and meander over time. These natural processes are interrupted when rivers are straightened or diverted to accommodate agriculture or development, or left perched when drainage ditches are used to drain adjacent land. This can be particularly significant in chalk streams, where the floodplain is a zone of high groundwater level which regulates the interaction of water between the chalk aquifer and the stream.

Development right up to the river bank can also pin the banks in place preventing future movement, often leaving a canalised stream with an artificial flow and a degraded habitat. Figure 3.6 shows an example of where the natural flood plain may have been encroached upon by development (this is not suggesting that this development is at increased flood risk).

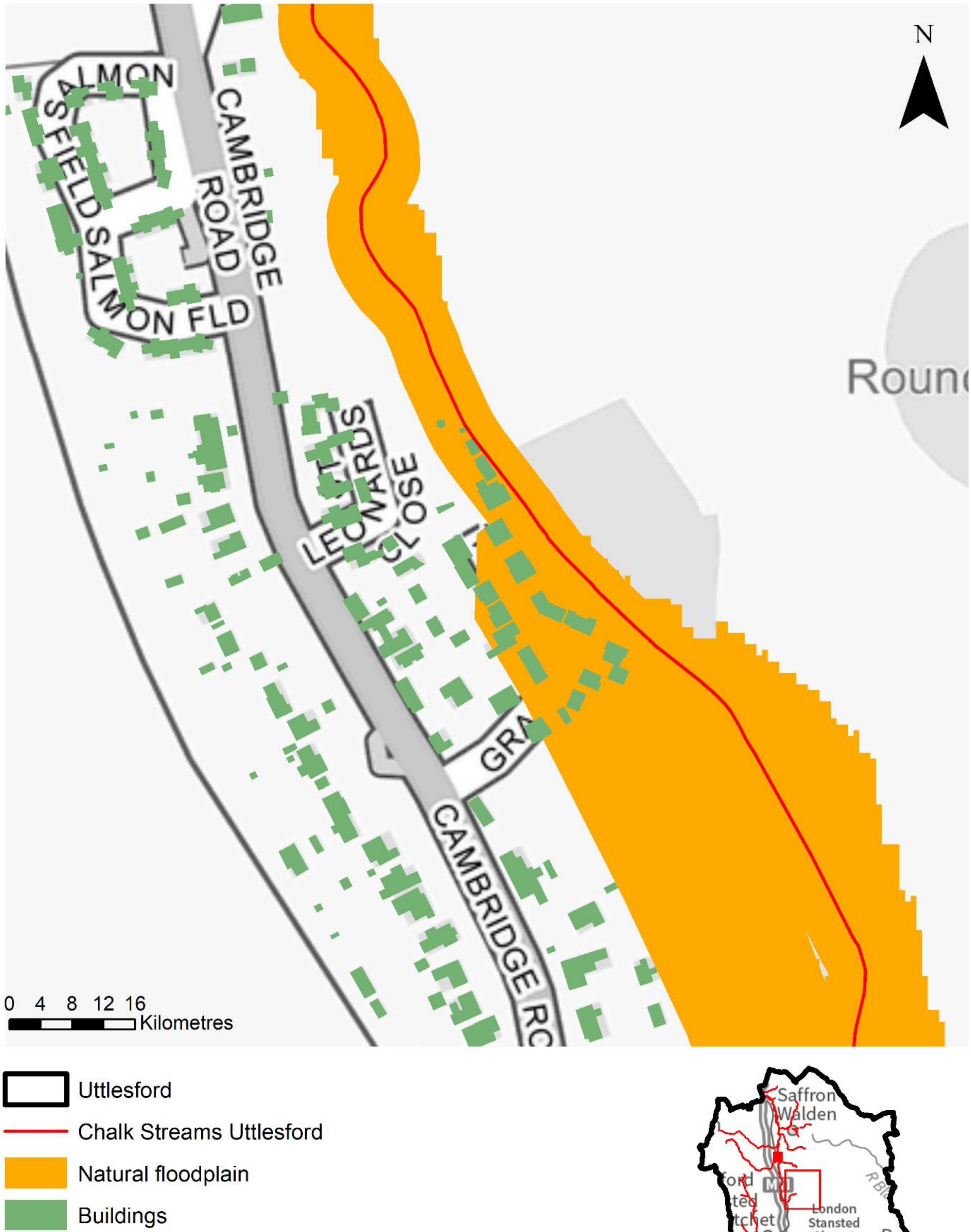




**Figure 3.6 Building encroachment on chalk streams and floodplains**

## 3.7 Discharges from Wastewater Treatment Works

With a growing population and increased abstraction, it follows that the volume of treated wastewater being discharged to the environment is also increased. Although an environmental permit is applied to discharges of wastewater, defining the level of treatment required and the maximum concentration of certain pollutants, increases in wastewater discharge that aren't accompanied by a tightening of the environmental permit and / or improvements in treatment technology are still a threat to the sensitive environments in chalk streams. If a WwTW is within its existing permit (either for volume of effluent, or concentration of pollutants), growth can be accommodated without any changes being made. This can lead to a small deterioration in water quality that may not be considered to be significant (less than 10% deterioration and no change in WFD class), but still increases the pressure on what is a sensitive habitat.

Wastewater discharges are a source of phosphate and ammonia pollution in Uttlesford chalk streams. As mentioned previously, high phosphate and ammonia levels can have harmful effects on the surrounding environment. 82% (9/11) of Uttlesford catchments have high phosphate levels under the WFD classification. This is due to a combination of wastewater discharges and agricultural runoff. See Figure 3.7 for the locations of WwTWs in Uttlesford.

Anglian Water and Thames Water are the sewerage undertakers for Uttlesford, and manage the wastewater treatment works (WwTW) and storm overflows in the study area. The Stage 1 and 2 WCS reports contain details of all of the WwTWs present in the study area.

It is important that should either new or upgraded infrastructure be required to accommodate growth, that delivery of this is aligned with the delivery of new development to minimise the impact of additional treated effluent. Consideration should be given to how improvements at WwTWs that discharge to chalk stream catchments can contribute to improvements in water quality.

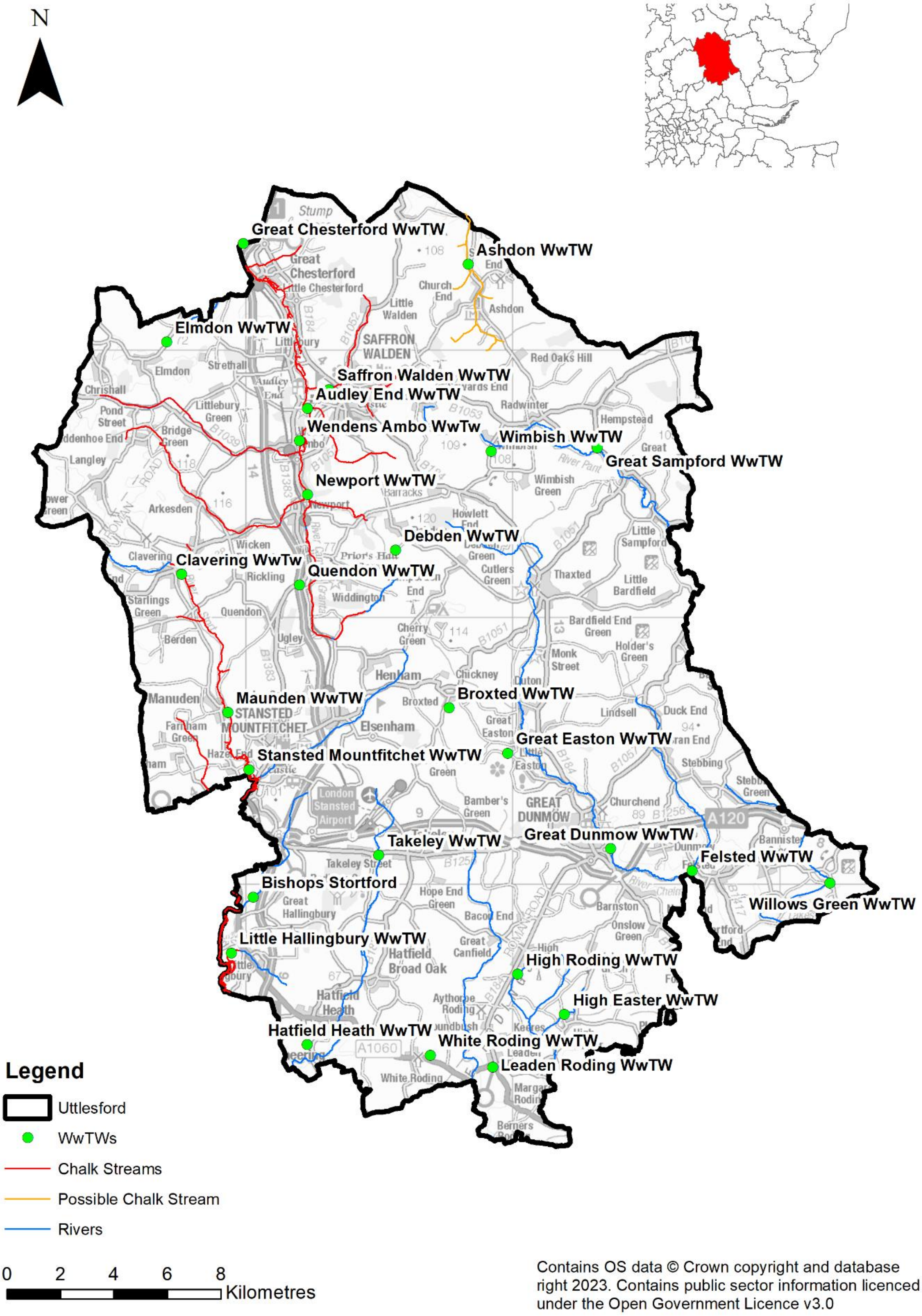




**Figure 3.7 WwTW in Uttlesford**

## 3.8 Storm overflows

Storm overflows are an essential component in combined sewer networks, reducing the risk of sewer flooding during intense rainfall – however when they operate frequently, they can cause environmental damage.  They occur on combined sewer systems where the sewer takes both foul flow (sewage from homes and offices) and rainwater runoff. In normal conditions all of this flow passes through the sewer network and is treated at a wastewater treatment works. In periods of exceptional rainfall, the capacity in a combined sewer may be used up by the additional flow from rooftops and storm drains. Once the capacity is exceeded, wastewater would back up into homes, businesses and on to roads. A storm overflow acts as a relief valve, preventing this from happening.  As well as being present on the sewerage network, they also exist on storm tanks at WwTW.

Storm overflows become problematic when they are operating in moderate or light rainfall – possibly in breach of their permit.  This can occur when the area of impermeable surfaces connected to the sewerage system has increased as a result of development and urban creep, and as a result of infiltration of soil and ground water into sewers and private drains through the fabric of the pipes and chambers.

There are seven network storm overflows and three WwTW storm tank overflows in Uttlesford’s chalk stream catchments, see Figure 3.8.  Many of the WwTWs present in chalk stream catchments do not appear in the Event Duration Monitoring (EDM) data, but are likely to have a storm tank overflow.

Unlike treated wastewater effluent discharges, storm overflows are only subject to screening to remove gross solids, meaning raw, diluted sewage is discharged into watercourses. Subsequently, storm overflows can impact water quality in chalk streams.

**Table 3.3 Storm overflow operation in Chalk stream catchments**

| Storm Overflow | Storm Overflow Number | Receiving watercourse | No. of operations in 2021 | Duration of operation in 2021 (hours) | No. of operations in 2022 | Duration of operation in 2022 (hours) | No. of operations in 2023 | Duration of operation in 2023 (hours) |
|---|---|---|---|---|---|---|---|---|
| Castle Street/ High Street | 4 | River Slade | 46 | 69.75 | 28 | 14.5 | 17 | 6 |
| Little Chesterford | 8 | Cam (Audley End to Stapleford) | 0 | 0 | 0 | 0 | 3 | 5.25 |
| Little Hallingbury (WwTW) | 25 | Little Hallingbury Brook | 59 | 969.55 | 31 | 404.9 | 61 | 846.75 |
| Saffron Walden WRC (storm tank overflow) | 26 | River Slade | 7 | 7 | 8 | 6.75 | 1 | 0.5 |
| Saffron Walden WRC (network overflow) | 10 | River Slade | 13 | 19.25 | 17 | 13 | 26 | 15.5 |
| Saffron Walden-George Abbey OV | 11 | River Slade | 0 | 0 | 0 | 0 | 4 | 1.5 |

| Storm Overflow | Storm Overflow Number | Receiving watercourse | No. of operations in 2021 | Duration of operation in 2021 (hours) | No. of operations in 2022 | Duration of operation in 2022 (hours) | No. of operations in 2023 | Duration of operation in 2023 (hours) |
|---|---|---|---|---|---|---|---|---|
| SO Gasworks Crossroads | 12 | River Slade | 0 | 0 | 0 | 0 | 0 | 0 |
| Stansted Mountfitchet WwTW | 27 | Stort and Bourne Brook | 30 | 383.07 | 17 | 146.47 | 35 | 325.25 |
| Thaxted Road. Victoria Avenue CSO | 16 | River Slade | 1 | 1 | 0 | 0 | 2 | 0.5 |
| Wicken Bonhunt PS | 18 | Wicken Water | 0 | 0 | 0 | 0 | 2 | 9.75 |

The Environment Agency's Storm Overflow Assessment Framework (SOAF)[10] requires that water companies undertake investigations where an overflow spills more than 60 times per year in one year, 50 times per year over two years or 40 times per year over three or more years.

10 Storm Overflow Assessment Framework, Environment Agency (2018). Accessed online at: https://www.water.org.uk/wp-content/uploads/2018/12/SOAF.pdf on: 01/07/2022

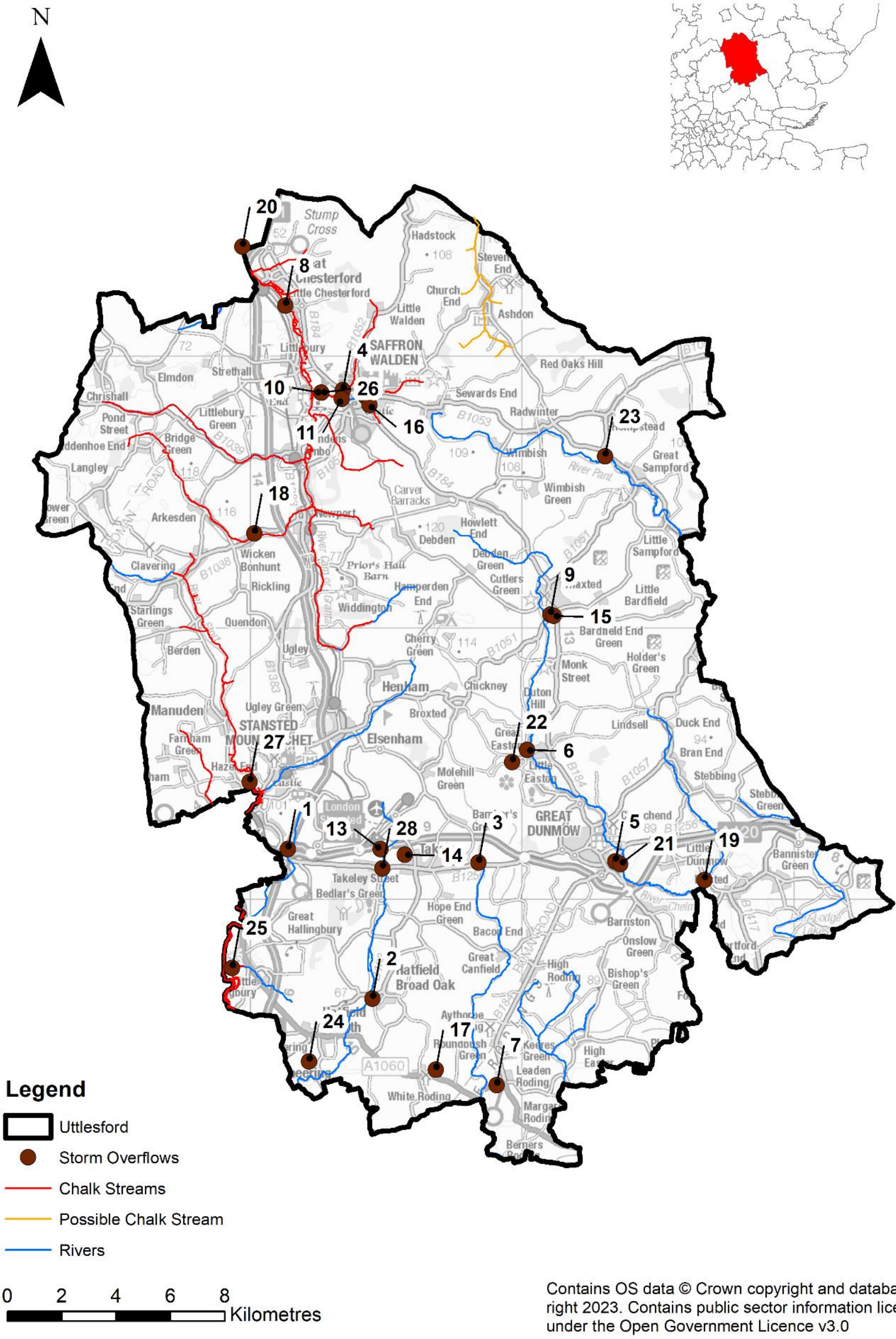




**Figure 3.8 Uttlesford storm overflows in relation to chalk streams**

# 4 Current mitigation measures and initiatives

## 4.1 Introduction

Various organisations have been involved in or made recommendations for the protection of chalk streams. These include the Environment Agency and water companies through their statutory obligations, and other stakeholders such as Catchment Based Approach Chalk Stream Restoration Group who have published a Chalk Stream Strategy, and the Angling Trust who published a charter for Chalk Streams in 2013. Since 2013, community groups have carried out work on chalk streams including those in Greater Cambridge who conducted an audit of the chalk streams in the Upper Cam catchment (downstream of Uttlesford).

The following section summarises the work that is already underway and the recommendations that have been made in recent reports.

The legal status of chalk streams and the relevant environmental legislation is also discussed.

## 4.2 Environmental Legislation

There is no specific legal protection for chalk streams in the UK. Environmental legislation provides legal protection to designated species and habitats through a number of different means such as the Conservation of Habitats and Species Regulations 2017 (As amended), which defines Special Areas of Conservation (SAC) and Special Protection Areas (SPA), and the Wildlife and countryside Act 1981 which designates Sites of Special Scientific Interest (SSSI). There are three SSSIs in chalk stream catchments in Uttlesford, and no SACs or SPAs. The three SSSIs are summarised in Appendix C below, however all three are designated for habitat adjacent to the river, and not for the chalk streams themselves.

The Natural Environment and Rural Communities Act 2006 (commonly referred to the as the NERC Act), was intended to implement key aspects of the Government's Rural Strategy published in 2004 and established Natural England as a new independent body responsible for conserving, enhancing and managing England's natural environment.

Section 40 of the NERC Act places a duty to conserve biodiversity on public authorities, including Local Planning Authorities and water companies. "The public authority must, in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity."[11]

Section 41 requires the Secretary of State to publish and maintain a list of species and types of habitat which in the Secretary of State's opinion (in consultation with Natural England) are of "principal importance for the purpose of conserving biodiversity." Chalk streams are not specifically mentioned in this list and fall within the general classification of "rivers".

The lack of a formal statutory driver for chalk stream enhancement and protection has held back the restoration of chalk streams and is a key recommendation of the Catchment Based Approach Chalk Stream Strategy.

## 4.3 Environment Agency

The Environment Agency has been working to limit the damage dry weather can cause and to ensure that water supplies are sustainable for the future. This includes taking immediate action to restrict the amount of water taken, developing long-term plans to reduce reliance on chalk streams, working with partners on projects to improve water quality and stepping in to limit damage to wildlife and the environment when river levels are too low.

They have also been working to make sure that water abstractions are sustainable. The Environment Agency regulate water abstraction through their licensing system. By reviewing licences and reducing the amount of water people can take the Environment

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11 Natural Environment and Rural Communities Act 2006, HM Government (2006). Accessed online at: http://www.legislation.gov.uk/ukpga/2006/16/section/40 on: 24/01/2022

Agency have returned 16 billion litres of water back to chalk aquifers and streams since 2008 and removed the risk of another 14.9 billion litres being taken[12].

The Environment Agency have also been working with water companies to find long term solutions for water supply by finding alternative water supply sources and reducing demand such as new reservoirs and pipes to transfer water from other parts of the country.

## 4.4 Affinity Water

Affinity Water (AfW) provide the water supply to Uttlesford and to neighbouring areas to the south and west. They divide their supply area into eight water resource zones - which are defined by the EA as areas in which the management of supply and demand is largely self-contained and where the supply infrastructure is linked such that customers within the zone experience the same risk of supply failure. Uttlesford is covered by the Stort WRZ which sits in their Central region (consisting of six adjacent WRZs).

Within a WRZ a customer may receive their water from anywhere within the zone, or from water transferred from other zones, and not necessarily from the nearest source. For this reason, it is not possible to say that an individual development site will increase abstraction from a particular water source. It is for the water company to balance the water sources they have to provide a sufficient supply for the WRZ, while meeting their environmental obligations and staying within their abstraction licences.

Water Resource Management Plans (WRMPs) are 50-year strategies that water companies are required to prepare, with full updates every five years. They define the expected demand for water and how this demand will be met from their supply. Affinity Water have published their revised draft Water Resources Management Plan 2024 (rdWRMP24) with a final version expected later in 2024.

Within the rdWRMP24 they outline their role in achieving sustainable abstraction:

*"Flows in the Chalk rivers in our area are dictated primarily by the amount of seasonal rainfall that we get, and, in particular, the amount that percolates through to and recharges the Chalk aquifer. This 'recharge' is released from aquifer storage through the bed of the streams over time and provides differing levels of baseflow that are related to how much aquifer recharge there has been. Hence flows reduce or even disappear naturally in some reaches, as a result of dry weather or drought.*

*However, in some catchments we also currently abstract from those Chalk aquifers via our boreholes. This affects groundwater levels and, in some cases, can affect the low flows within the streams and rivers. Where this has a detrimental impact on the health of the stream, as described through the ecology, quality or geomorphology of the river, then we regard that the abstraction is unsustainable and we need to reduce or even cease the abstraction to help restore that steam or river to a healthy condition. The definition of 'unsustainable' will require further exploration and definition with stakeholders through AMP8 (2025-2030), as described in our Monitoring Plan …. For this plan we have used the requirements of existing legislation (the Water Framework Directive) and guidance from our regulators, along with testing of parameters that underpin that guidance to evaluate ranges of abstraction reduction need."*

Sustainability reductions are planned reductions in the amount of water than is abstracted from the environment, in particular from the chalk aquifers. Affinity Water have a programme of sustainability reductions planned in response to Environment Agency requirements. In order to achieve these, alternative sources of water (or reduced demand) is needed.

Additional to sustainability reductions, AfW have included catchment and nature-based solutions which complement the proposed reductions in abstraction and will provide

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12 Protecting our precious chalk streams, Environment Agency (2019) Accessed online at: https://environmentagency.blog.gov.uk/2019/10/02/protecting-our-precious-chalk-streams/ on: 24/01/2022

additional environmental resilience in the Chalk catchments. These types of solutions also contribute towards natural capital and biodiversity net gain.

The EA define different changes to abstraction licences for water companies based on the current WFD status of waterbodies, and the expected growth in groundwater abstraction. Most of the waterbodies within AfW's supply area are not in good WFD status, with the reasons for not achieving good status including "flow, not supporting good status" (which is affected by abstraction). As there is no planned growth in abstraction, their licences have been capped at the maximum peak abstraction value. They intend to implement this by using a six-year rolling licence cap on their sources, set to the "recent actual" values (mean abstraction from the period 2010 to 2016), with an allowance to abstract up to the maximum peak abstraction within the rolling period in any one year. They note that the criteria for capping licences will become more stringent in the future and there is the potential for licences to be capped at the recent actual (mean abstraction for the period 2010 to 2016) rather than the maximum peak abstraction.

Alongside this, AfW have confirmed that they are committed to "progressively ending unsustainable abstractions" where this is identified. Where there are known potential impacts then sources are schedules for reduction in AMP8 (2025-2030). Their abstraction reduction strategy is intended to provide a balance between the pace at which they end unsustainable abstraction and affordability. An adaptive strategy, on a catchment-by-catchment basis, will allow the impact of the programme to be assessed, and the risks of groundwater emergence to be managed as groundwater levels recover.

Alongside the Stage 1 WCS, AfW confirmed that they cannot guarantee at this stage there won't be a requirement for a new source or new infrastructure. It would however be their responsibility to ensure that no adverse environmental impacts would arise from any new infrastructure or source of water.

## 4.5 Chalk stream strategy

Catchment Based Approach (CaBA) and the Chalk Stream Restoration Group (CSRG) have published a Chalk Stream Strategy Report (2021[13]) with the goal to enhance chalk streams across the UK. CaBA recommend an approach that addresses all three facets of the health chalk streams – flow, water quality and habitat. Recommendations and actions are laid out in their strategy report.

Their recommendations include:

- A national time-bound commitment to meet targets on chalk stream health which is feasible and beneficial.
- Decrease nutrient run off into chalk streams
- Abstraction limits where flows are reduced by no more than 10%
- A review on waterbody boundaries and assessment methods to ensure water quality measures are accurate.
- Prioritisation of chalk stream head waters
- Using A Nature Recovery Network (NRN) and Environmental Land Management (ELM) schemes to increase biodiversity in chalk catchments
- A national network to implement restoration strategies in catchment areas
- Cost-benefit analysis/ economic appraisal review

Within the report CaBA also suggest there should be a "development and planning rules for chalk streams" section of the National Planning Policy Framework, that mirrors their own

13 CaBA CSRG Strategy MAIN REPORT FINAL 12.10.21 (catchmentbasedapproach.org)

advice on "farming rules for chalk streams". A list of similar recommendations has been produced for new developments[14]:

- LPAs should take account of implications for water resources and sewerage systems of major housing developments in the Local Plan.
- Developers should make water company developer contributions to help cover the costs of negative impacts on water resources from developments.
- CaBA suggest no work to be done within 25m of gateways to decrease run off channels on agricultural land and a 10m buffer from chalk streams on arable land. This can be repurposed in a new development setting with "no development" chalk stream buffer zones implemented.
- SuDs on all new development in chalk catchments
- Highest standard of water efficiency possible, including the possibility of water neutrality, for new developments in chalk stream catchments (90 l/p/d)
- Chalk streams and their associated habitats should be featured strongly in Local Nature Recovery Strategies and Biodiversity Net Gain.

Although not all of the above points are within the power of the LPA to change, it gives a concise overview of recommendations that could benefit chalk stream health and protection.

## 4.6 Angling Trust

In 2013 The Angling Trust put forward a Charter for Chalk Streams[15]. This included a list of recommendations such as compulsory water metering and education, as well as immediate start pilot schemes to restore channel morphology and connectivity.

## 4.7 Greater Cambridge Chalk Stream Project

Greater Cambridge is home to several chalk streams predominantly to the southwest of the city. Over the last 10 years Cambridge residents have been campaigning and carrying out practical conservation efforts to try and regenerate the chalk streams within their district. This Greater Cambridge Chalk Stream Project report (GCCSPR) was commissioned by Cambridge City Council and Cambridge Water as part of an audit of chalk streams in the Cam catchment. This report covers an area downstream of Uttlesford.

### 4.7.1 Pressures

Many of Cambridge's chalk streams, like Uttlesford's, are in "poor" or "moderate" condition according to the WFD classification. Reasons for this have been recognised within the Chalk Streams Project Report as:

- Flow pressures - Because of the increase in population, abstraction rates have increased. If groundwater levels are too low, the water can't be retained by the ground and consequently, the stream run dry.
- Channel modifications - Modified channels can become deeper and straighter increasing water flow. Subsequently, natural gravels and silt get washed away which are important for flora and fauna species.
- Poor water quality - Aquifers feed chalk streams, but so does rainwater runoff. Runoff from fields can increase silt, nitrates and phosphates causing poor water quality.

### 4.7.2 Assessment

Species can be a good indicator of healthy watercourses, including chalk streams. 20 watercourses within the Greater Cambridge district have been assessed using Rapid Assessment of Biodiversity and Community Value to record species richness and general

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14 CaBA Chalk Stream Strategy Report: CaBA CSRG Strategy MAIN REPORT FINAL 12.10.21 (catchmentbasedapproach.org)
15 Angling Trust- Chalk Stream Charter: https://anglingtrust.net/keeping-rivers-flowing/chalkstream-charter-2/

river features. This assessment resulted in RAG ratings of factors such as flow regime with overall results leading to actions being put in place for each river[16]. Many of the rivers were rated red for connectivity/ fish barriers and flow regime.

### 4.7.3 Management:

Once the assessment results were reviewed initial projects were put forward for each chalk stream. These projects included actions such as habitat creation and assessment of fish passage, as well as possible methods of funding to carry them out.

Many of the suggested projects can be grouped into five general headings:

- Hinging of trees and creation of low brash hedges: Hinging of trees is where a cut is made half way through the tree in question making a 90-degree angle to give shade to species such as trout in the stream.
- Gravel placement: Due to dredging, gravel is lacking in some water bodies which decreases habitat.
- Bank re-profiling: Straight riverbanks are steep and uniform which degrades habitat.
- “Dig ‘n’ dump”: Creating more varied river channels by moving materials dug up from the riverbed can create new habitat.
- Long-term ambitions: Projects such as large-scale bed-raising and the removal of weirs will aid in fish passages and increasing the flow of the river.

### 4.7.4 Applying this knowledge to Uttlesford

Drawing on the GCCSPR, restoration recommendations of the chalk streams themselves will be valuable in working towards achieving “good” WFD status in the future.

The “dig and dump” recommendation is possible within Uttlesford, although the locations should be carefully assessed to avoid damage to existing habitat / species. Structures such as berms could be a less disruptive alternative to creating new habitat. Berms are commonly made of woody material placed on river margins and secured to the riverbank using stakes. By increasing flow rate around meanders, it varies gravel distribution. Another way to improve flow are flow deflectors. This is where large logs are secured in the riverbed and the waters altered flow creates varied gravel coverage (Wessex River Trust, 2022).

Other alternatives defined within the report could be Himalayan balsam removal to let native species thrive and planting water crowfoot which provides habitat for common chalk stream invertebrates.

[16] Greater Cambridge Chalk Streams Project Report - Cambridge City Council

# 5 Recommendations

## 5.1 Introduction

When considering chalk stream protection and new developments, it is important to consider the three main points to protecting chalk streams; flow, water quality and habitat. In addition, it is imperative to understand the effects of new developments on chalk streams' natural hydrology and ecology.

The section below outlines measures that could be taken to mitigate the pressures identified in Section 3.

It should be noted that changes to the abstraction and aquifer recharge may result in changes in groundwater levels in the catchment. Where development has occurred in areas that are artificially dry due to long term suppression of groundwater levels, consideration should be made of the impact of increasing groundwater levels in these areas.

## 5.2 Water efficiency

Residential development in Uttlesford is currently required to meet the Building Regulations optional standard of 110 litres per person per day (l/p/d). Continuing with this standard a business as usual approach in the new Local Plan would result in a large increase in water demand during the plan period. This is outlined in the Stage 2 WCS and is predicted to be an additional 5.46Ml/d by the end of the plan period. The impact of different water efficiency targets is also summarised in the Stage 2 WCS. The CaBA strategy recommends a minimum of 90l/p/d in chalk stream areas.

This could be achieved through a mix of water efficient fittings and rainwater harvesting (RwH) / greywater recycling (GwR) into new build housing.

Demand from non-household development should also be addressed and non-household development required to achieve the appropriate BREEAM standard.

BREEAM is an efficiency assessment criteria for measuring the sustainability of buildings. The BREEAM New Construction Standard awards credits across nine categories, four of which are related to water: water consumption, water monitoring, leak detection and water efficient equipment. This leads to a percentage score and a rating from "Pass" to "Outstanding". Home Quality Mark (HQM) is another assessment measure for developments. HQM measures environmental performance and is a badge for developers to use to show their builds are to a good environmental standard. The Council has the opportunity to seek BREEAM or HQM status for all new, residential and non-residential buildings.

As Uttlesford is entirely within one water resource zone, development anywhere within Uttlesford has the potential to increase water demand, and therefore abstraction from chalk aquifers. Measures to improve water efficiency should therefore be applied to the whole of Uttlesford regardless of whether the development is in a chalk stream catchment.

**Recommendation 1 – Adopt CaBA strategy recommendation of 90l/p/d throughout Uttlesford**

**Recommendation 2 – Require all new non-residential buildings achieve BREEAM "Outstanding" for water throughout Uttlesford**

## 5.3 Water Neutrality

The Council may wish to consider achieving water neutrality for the Uttlesford Local Plan. Achieving water neutrality involves a twin track approach. First the demand for water from the new development must be reduced as far as is practicable, then this remaining demand should be offset within the region. In following this approach, the volume that requires offsetting can be reduced, reducing the cost of the overall scheme. This is noted in the

Waterwise neutrality definition, and they define three steps to achieve water neutrality in their recent review[17]:

- Reduce water demand in the new development through improvements in efficiency
- Re-use water where possible
- Offset the remaining water demand from new development. Offsetting can be done by RwH and GwR retrofitting mentioned above.

Potential measures to offset additional water demand could include retrofitting water efficient fittings in council houses, and RwH in schools within Uttlesford. Retrofitting such measures in schools is particularly attractive as they are more likely to be maintained and could form part of a wider educational benefit.

In order to further reduce the additional demand from growth, policies could be defined that seek to offset some or all of the additional demand (after water efficiency measures). This approach could allow the Local Plan to be water neutral or to approach neutrality. Pilot studies looking at approaches to water neutrality are underway with Affinity Water and other stakeholders as part of Ofwat's Water Breakthrough Challenge scheme[18], but delivery is some way off. Some LPAs within the south east are currently looking at a water neutrality strategy in response to a Natural England requirement to for the local plan to be water neutral to protect sensitive habitats, but this is the first of its kind in the UK, a strategy will not be completed until later in 2022 and defining, setting up and running such a scheme is complex and costly.

**Recommendation 3 – Explore the feasibility of achieving water neutrality in the Stage 2 Water Cycle Study**

## 5.4 Riparian Buffer Zones

### 5.4.1 The need for a buffer zone

Development or agricultural encroachment close to a chalk stream, or on the natural flood plain has the potential to cause the following problems:

- Water quality impact through surface-water runoff
- Reduction in groundwater flow by diverting runoff straight to surface water drainage
- Loss of habitat / biodiversity
- Disconnection of the river from its natural flood plain, the chalk aquifer and superficial deposits e.g. gravels.
- Prevention or restriction of future river restoration work.

These issues could be managed in part by designating a buffer zone around chalk streams to prevent further development or encroachment by agriculture.

### 5.4.2 Definition of a buffer zone

A buffer zone should be of sufficient size to prevent or reduce the problems listed above, and this may be different distances in different parts of the catchment based on local conditions and the size of the natural floodplain, a zone which is critical to the interaction of water between the aquifer, alluvial deposits and the river channel. To define the natural flood plain, a combination of Flood Zone 2 and the British Geological Survey (BGS) "Geological Indicators of Flooding" dataset was used to create a GIS shapefile defining the floodplain.

17 A Review of Water Neutrality in the UK (2021) – Waterwise
18 Water neutrality at NAV sites, Ofwat (2021). Accessed online at: https://waterinnovation.challenges.org/winners/water-neutrality-at-nav-sites/ on: 22/06/2022

In some areas Flood Zone 2 does not extend far beyond the bank, in these areas the buffer zone should be extended in order to provide the required benefit. Under the Water Resources Act 1991 and the Land Drainage Byelaws 1981 current Environment Agency guidance already defines an area of 8m from the bank of a main river, within which development is not allowed unless exempt by the local council. For chalk streams this should be extended to 15m, and would contain the principle of "no development" except for some exemptions such as essential infrastructure, soft landscaping and recreational uses (following an impact assessment).

For agriculture, the EA provides guidance for buffer strip design[19] that suggests a width of 5-15m dependent on field conditions, with steeper slopes (potentially faster flow) requiring wider strips. Due to the sensitive nature of chalk stream ecosystems a 15m buffer strip on all agricultural land would provide a precautionary approach. Considering this guidance alongside CaBA's agricultural buffer zone suggestions, see section 4.5, 15m has been adopted as a suitable distance for the protection of the chalk streams and incorporated into the natural flood plain layer to create a provisional riparian buffer zone.

Although agricultural practices are not, on the whole, regulated by the planning system, local authorities are considered as partners in the delivery of the national Nature Recovery Network[20] and are required, through the NPPF, to conserve and enhance the natural environment. It is therefore recommended that a minimum 15m buffer zone is adopted on both agricultural land and new development sites with buffer strips used on field margins adjacent to chalk streams, in addition to the principle of no development within the buffer zone. This zone should extend further than 15m where necessary in line with the natural flood plain.

A zone of this type would prevent further riparian squeeze and provide room for future river restoration work to renaturalise channels. More opportunities would exist to manage runoff and infiltrate the water rather than provide overland flow routes to the river if hard standing were allowed closer to the riverbanks.

This approach is also recommended by CaBA chalk stream strategy (P128). Note that, where a proposed development is partly within a proposed buffer zone, it is recommended that the red-line boundary of the development is drawn to the site boundaries, including to the river centreline where the site includes river ownership. Trimming site boundaries to exclude buffer zones can result in strips of inaccessible and unmaintained land beside rivers. Rather, the buffer zone should be integrated into the site masterplan, and utilised for biodiversity and amenity benefits.

The provisional riparian buffer zone is defined in Appendix E.

As discussed in 2.1, ditches form an important part of the habitat, and are required to be scoped-in to BNG calculations. The riparian zone for a ditch is considered to be 5m from the bank top, but due to the sensitive nature of chalk streams, and in-line with the recommendations for rivers, the riparian zone should be increased for ditches feeding chalk streams to 10m, and the same protections applied.

**Recommendation 4 – Apply a riparian buffer zone in chalk stream areas to exclude all development within the natural flood plain or 15m of the bank, whichever is larger. A buffer of 10m should be applied to ditches that feed chalk streams.**

**Recommendation 5 – Apply a vegetated buffer strips on agricultural land within 15m of a chalk stream and 10m from a ditch feeding a chalk stream.**

## 5.5 Cattle fencing

As mentioned previously, cattle can have increase sediment within chalk streams, degrading habitat. By implementing fencing, bank erosion and thus sediment pollution can be reduced. Other alternatives alongside fencing are creating alternative drinking troughs within the

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19 Rural Sustainable Drainage Systems (RSuDS), Environment Agency (2012). Accessed online at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291508/scho0612buwh-e-e.pdf on: 22/06/2022

20 DEFRA (2022) Nature Recovery Network

field, and construction of crossing points if the streams are being degraded by cattle walkways.

**Recommendation 6 – Encourage responsible land management such as cattle fencing through the Nature Recovery Strategy**

## 5.6 Education

Public engagement can often help environmental issues by providing low budget, high impact work. Many of the chalk streams go through built up areas and public engagement with communities and riparian owners would be beneficial to raise awareness of chalk streams and responsible riparian ownership. This could be done through a combination of community meetings and leafleting. An example of this is at Watlington in Oxfordshire at the head of the Chalgrove Brook chalk stream. The Watlington Climate Action Group[21] have carried out leafletting and raised awareness through local artists to engage the community. This has resulted in public engagement in practical conservation clearing the brook and creating trout spawning habitat.

**Recommendation 7 – Undertake a public engagement exercise to raise awareness of chalk streams and encourage responsible riparian ownership**

## 5.7 SuDS

Runoff from development sites that makes its way directly to a chalk stream is a potential route for diffuse pollution as well as not being available to recharge the chalk aquifer. The SuDS hierarchy (as required in Essex County Council's SuDS guidance[22]) should be enforced for all development.

Infiltration SuDS (where appropriate based on Source Protection Zones) are strongly recommended, with deep borehole SuDS being an option where the surface geology makes a typical infiltration scheme unfavourable. This would allow the chalk bedrock underneath to be accessed, increasing recharge of the aquifer.

Within chalk stream catchments (as defined by the WFD surface water catchments), a particular focus should be paid to water quality management.

Due to the importance of the chalk aquifers as a water source for public consumption, attention must be paid to the source protection zones (SPZs). Implemented by the Environment Agency (EA) the zones are based on an estimate of the time it would take for a pollutant which enters the saturated zone of an aquifer to reach the source of abstraction or discharge point (Zone 1 = 50 days, Zone 2 = 400 days, Zone 3 is the total catchment area). The Environment Agency will use SPZs (alongside other datasets such as the Drinking Water Protected Areas (DrWPAs) and aquifer designations as a screening tool. The EA have published a position paper[23] outlining its approach to groundwater protection which includes direct discharges to groundwater, discharges of effluents to ground and surface water runoff.

This guidance defines runoff from roofs or from roads as "clean water" discharges which may not require a permit. However, they are still a potential source of groundwater pollution if they are not appropriately designed and maintained.

Where infiltration SuDS schemes are proposed to manage surface runoff they should:

- Be suitably designed;
- Meet Government non-statutory technical standards[24] for sustainable drainage systems – these should be used in conjunction with the NPPF and PPG; and

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21 Chalk Streams | Watlington Climate Action Group: https://www.watlingtonclimateaction.org.uk/chalkstreams
22 The sustainable Drainage Systems Design Guide for Essex, Essex County Council (2022). Accessed online at: https://www.essexdesignguide.co.uk/suds on: 22/06/2022

24 Sustainable Drainage Systems: non-statutory technical standards, Department for Environment, Food & Rural Affairs (2015). Accessed online at: https://www.gov.uk/government/publications/sustainable-drainage-systems-non-statutory-technical-standards on: 24/01/2022

- Use a SuDS management treatment train

A hydrogeological risk assessment is required where infiltration SuDS is proposed for anything other than clean roof drainage in a SPZ1. The SPZs covering Uttlesford are shown in Figure 5.1 Source protection zones in Uttlesford.

Where infiltration to the ground is not possible, SuDS systems draining to chalk streams either directly or via a surface water sewerage system must implement appropriate measures to address the peak flow, volume and quality of runoff. Details advice on designing SuDS to manage water quality are provided in the CIRIA SuDS manual.

Managing pollution close to its source can help keep pollutant levels and accumulation rates low, allowing natural processes to be more effective. Treatment can often be delivered within the same components that are delivering water quantity design criteria, requiring no additional cost or land-take.

SuDS designs should control the 'first flush' of pollutants (usually mobilised by the first 5mm of rainfall) at source, to ensure contaminants are not released from the site. Best practise is that no runoff should be discharged from the site to receiving watercourses or sewers for the majority of small (e.g. less than 5mm) rainfall events.

**Recommendation 8 – Enforce the SuDS hierarchy as defined in the Essex SuDS guidance with a focus on encouraging infiltration SuDS and deep borehole SuDS where appropriate.**

## 5.8 Neighbouring authorities

The River Stort leaves Uttlesford and passes through Bishops Stortford before re-entering and running along the Uttlesford boundary. The River Cam also continues north of Uttlesford into Cambridgeshire. Protecting chalk streams will therefore require a collaborative approach, working with neighbouring authorities and other stakeholders.

**Recommendation 9 – Continue and strengthen existing partnerships with neighbouring authorities and other stakeholders to define coordinated policies for chalk stream protection.**

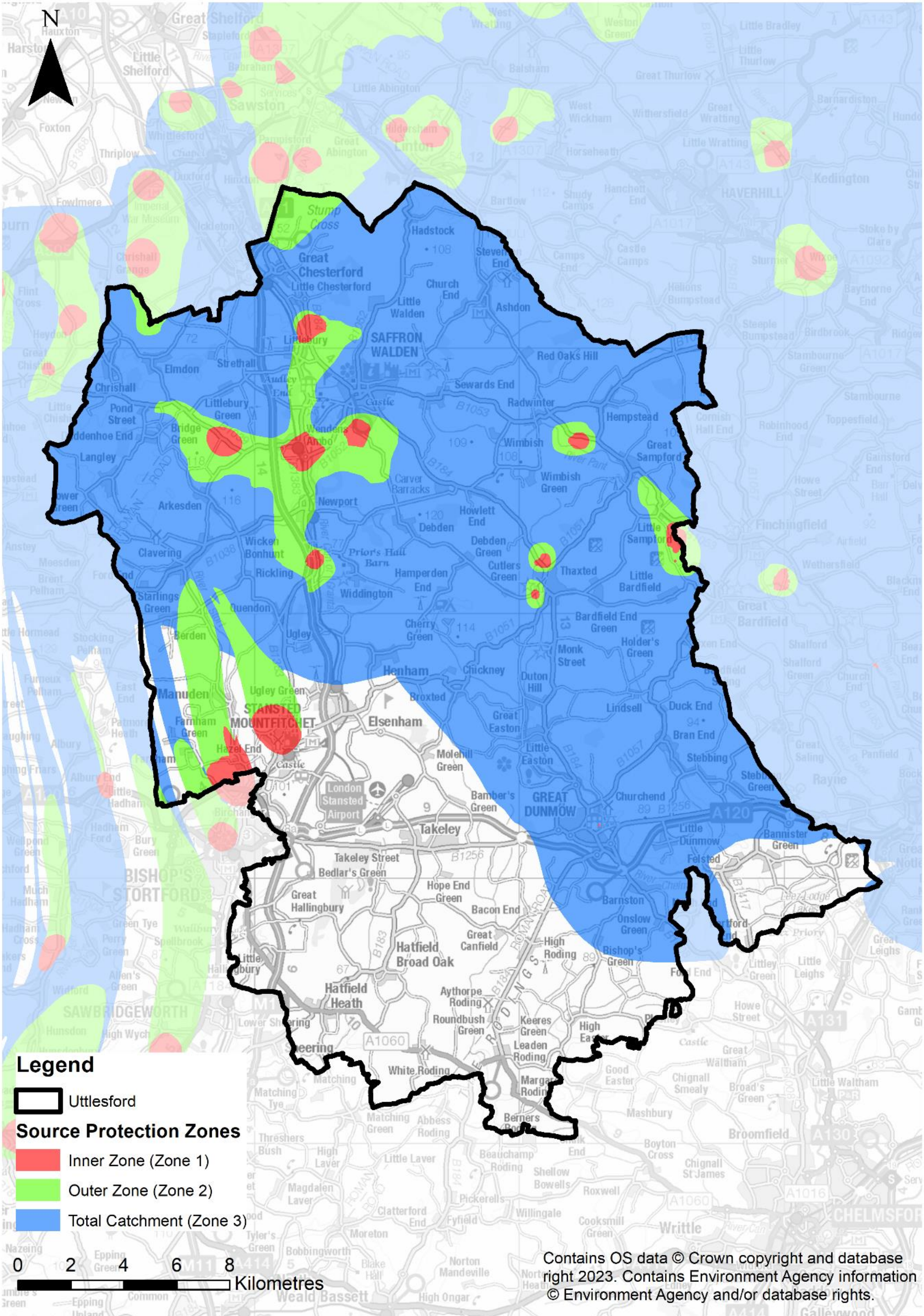



**Figure 5.1 Source protection zones in Uttlesford**

# 6 Summary and overall conclusions

## 6.1 Conclusions and recommendations

With the UK having stewardship over most of the worlds chalk streams it is important that these unique habitats are protected and their deterioration is reversed. Alongside the growing population and need for housing this is not always an easy balance.

Over-abstraction, encroachment by agriculture and development on the natural floodplain and pollution from runoff, and wastewater discharges are causing damage to chalk streams in Uttlesford. Opportunities exist through Local Plan policy to prevent further damage being caused by planned development during the plan period, and provide opportunities for future river restoration work. The focus of this report is on measures that can be taken by the local authority.

The following measures are recommended:

**Table 6.1 Recommendations for chalk stream protection**

| Measure type | Recommendation |
|---|---|
| Water efficiency | Recommendation 1 – Adopt CaBA strategy recommendation of 90l/p/d throughout Uttlesford<br>Recommendation 2 – Require all new non-residential buildings achieve BREEAM “Outstanding” for water throughout Uttlesford |
| Water neutrality | Recommendation 3 – Explore the feasibility of achieving water neutrality in the Stage 2 Water Cycle Study |
| Riparian Buffer Zone | Recommendation 4 – Apply a riparian buffer zone in chalk stream areas to exclude all development within the natural flood plain or 15m of the bank, whichever is larger. A buffer of 10m should be applied to ditches that feed chalk streams<br>Recommendation 5 – Apply a vegetated buffer strips on agricultural land within 15m of a chalk stream and 10m from a ditch feeding a chalk stream |
| Cattle fencing | Recommendation 6 – Encourage responsible land management such as cattle fencing through the Nature Recovery Strategy |
| Education | Recommendation 7 – Undertake a public engagement exercise to raise awareness of chalk streams and encourage responsible riparian ownership |
| Sustainable Drainage Systems (SuDS) | Recommendation 8 – Enforce the SuDS hierarchy as defined in the Essex SuDS guidance with a focus on encouraging infiltration SuDS and deep borehole SuDS where appropriate. |
| Neighbouring authority engagement | Recommendation 9 – Continue and strengthen existing partnerships with neighbouring authorities and other stakeholders to define coordinated policies for chalk stream protection |

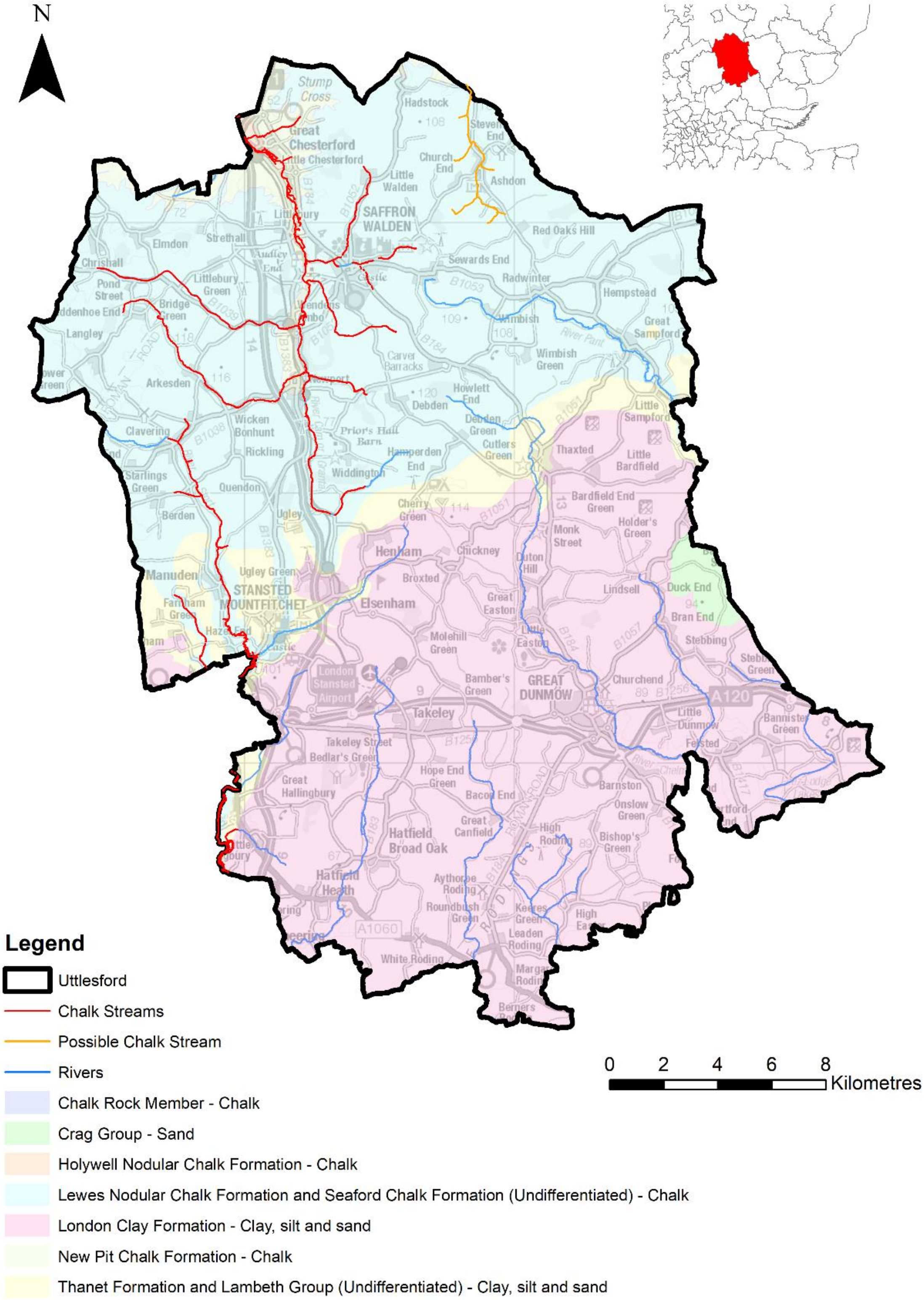
The Chalk Stream Strategy published by CaBA contains a number of recommendations that may be outside of Local Authority control, but should be encouraged where possible.

Balancing the needs of nature and the growing population is difficult but achievable. By building on the current measures and recommendations in place it is possible to enhance Uttlesford’s chalk streams and surrounding habitat biodiversity.

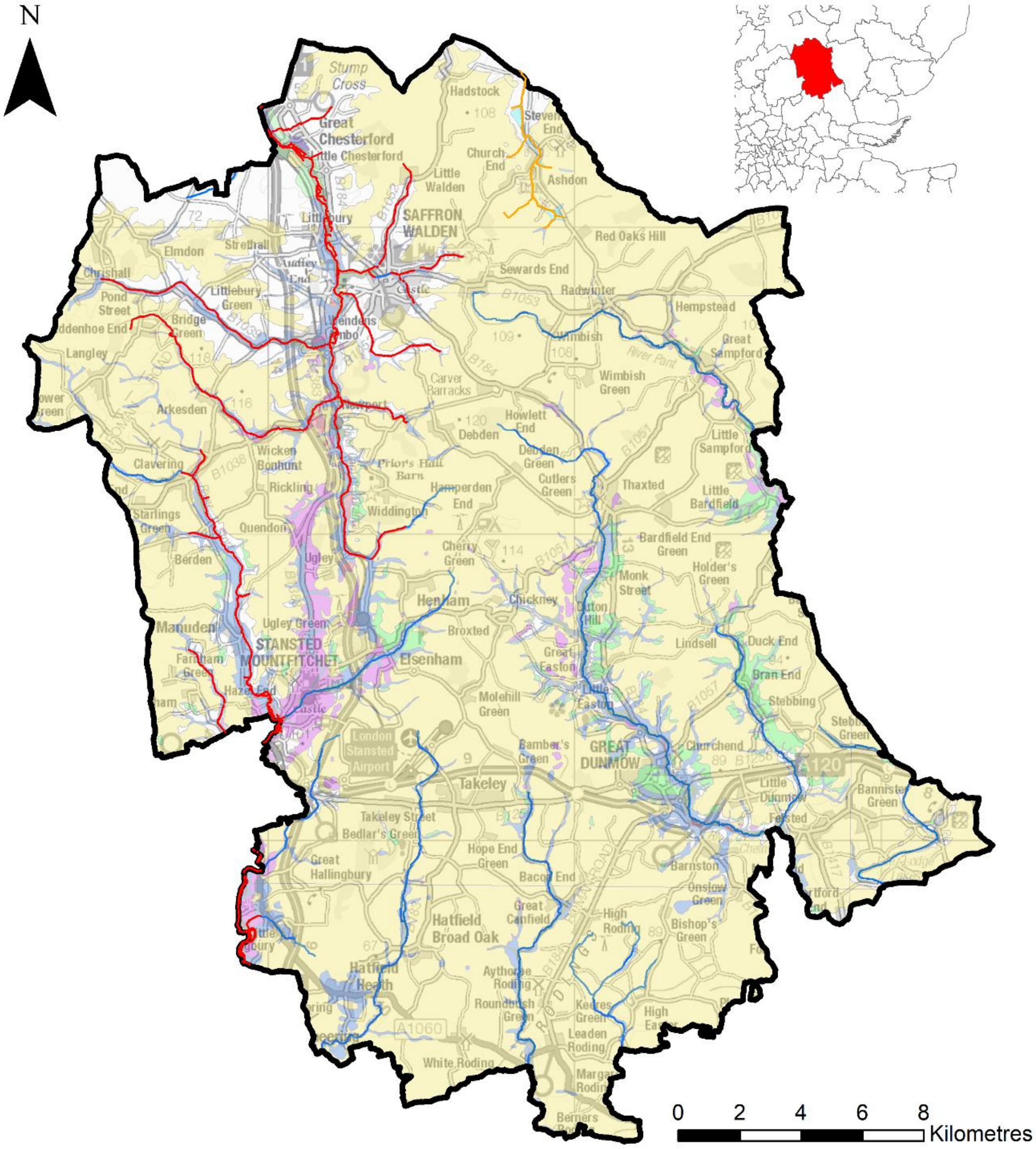
# Appendices

# A Appendix: Geology of Uttlesford

## A.1 Bedrock Geology of Uttlesford



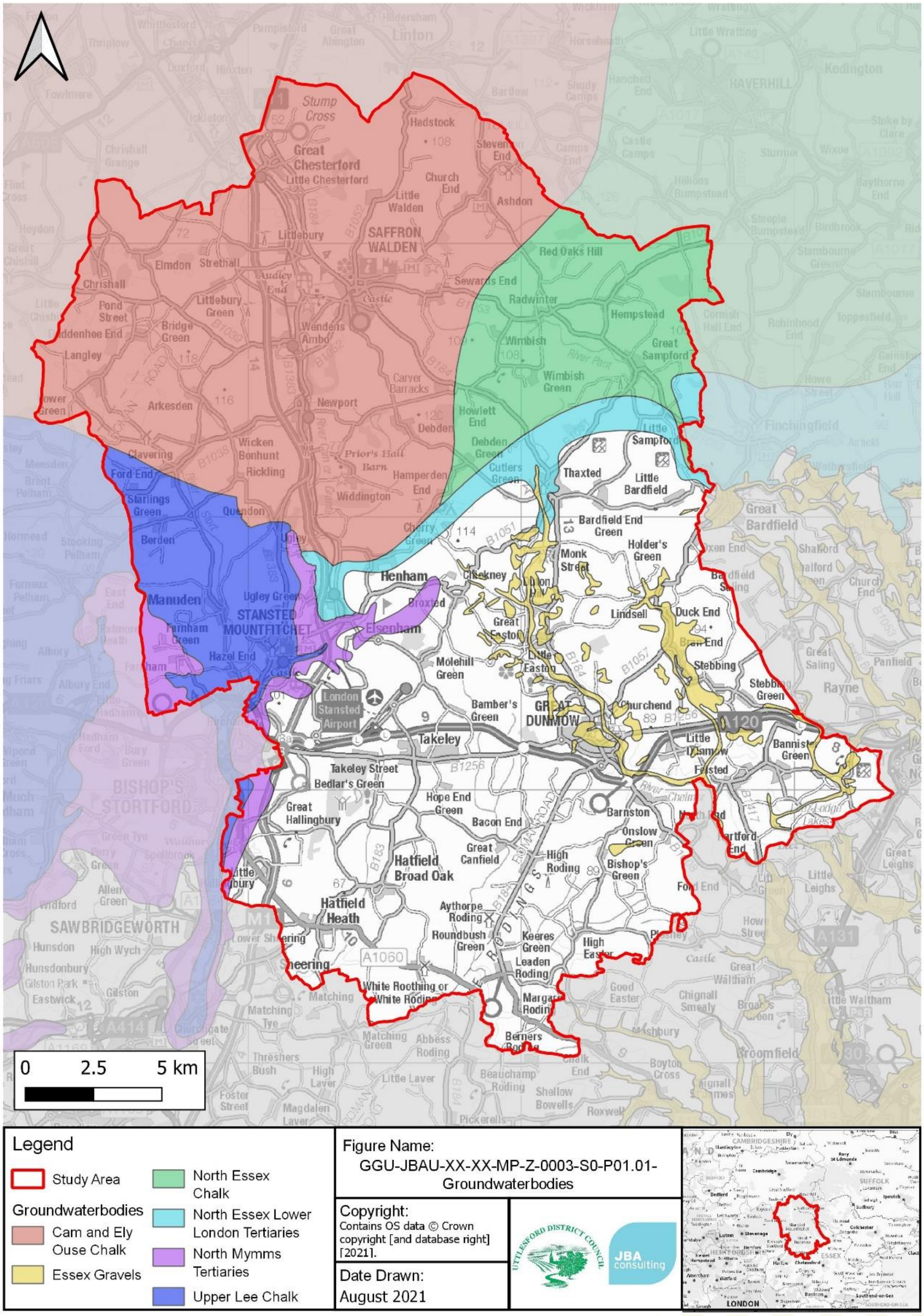
## A.2 Superficial Geology of Uttlesford




**Legend**

- Uttlesford
- Chalk Streams
- Possible Chalk Stream
- Rivers
- Alluvium - Clay, silt, sand and gravel
- Glaciofluvial Deposits, Mid Pleistocene - Sand and gravel
- Glaciolacustrine Deposits, Mid Pleistocene - Clay and silt
- Head - Clay, silt, sand and gravel
- Kesgrave Catchment Subgroup - Sand and gravel
- Lowestoft Formation - Diamicton
- River Terrace Deposits (Undifferentiated) - Sand and gravel
- River Terrace Deposits, 1 - Sand and gravel
- River Terrace Deposits, 1 to 2 - Sand and gravel
- River Terrace Deposits, 2 - Sand and gravel
- River Terrace Deposits, 3 - Sand and gravel
- Tufa - Calcareous tufa

## A.3 Groundwater bodies in Uttlesford



# B Appendix: Chalk stream categories

The CaBA Chalk Stream Strategy groups chalk streams into four types:

(Reproduced from CaBA Chalk Stream Strategy 2021)

**"Group A: classic slope-face chalk streams**. These are streams that rise directly from the chalk, flow over chalk and then in some cases – usually in their lower reaches – over younger tertiary (sand and clay) deposits. This group would include the majority of the Hampshire-basin streams and the majority of those that flow into the Thames basin. Most of the iconic chalk streams like the Itchen or Test or Kennet are in this group. Group A can be sub-divided into slope-face streams that flow from and largely across chalk (e.g. Chess) and those that rise from chalk but mostly flow over tertiary outcrops (e.g. Wandle).

**Group B: mixed-geology chalk streams**. These are streams which tend to rise beyond (i.e. to the north and west) of the chalk but then flow over / through the chalk – this is a minority of chalk streams but the Great Stour in Kent is a good example, rising on gault clay / greensand and then flowing through the chalk. The Nadder is another example, as is the Hampshire / Wiltshire Avon and the Dorset Frome. These streams will have 'flashier' flow regimes, will tend to colour after heavy rain and take longer to clear too, because of the influence of the headwater geology.

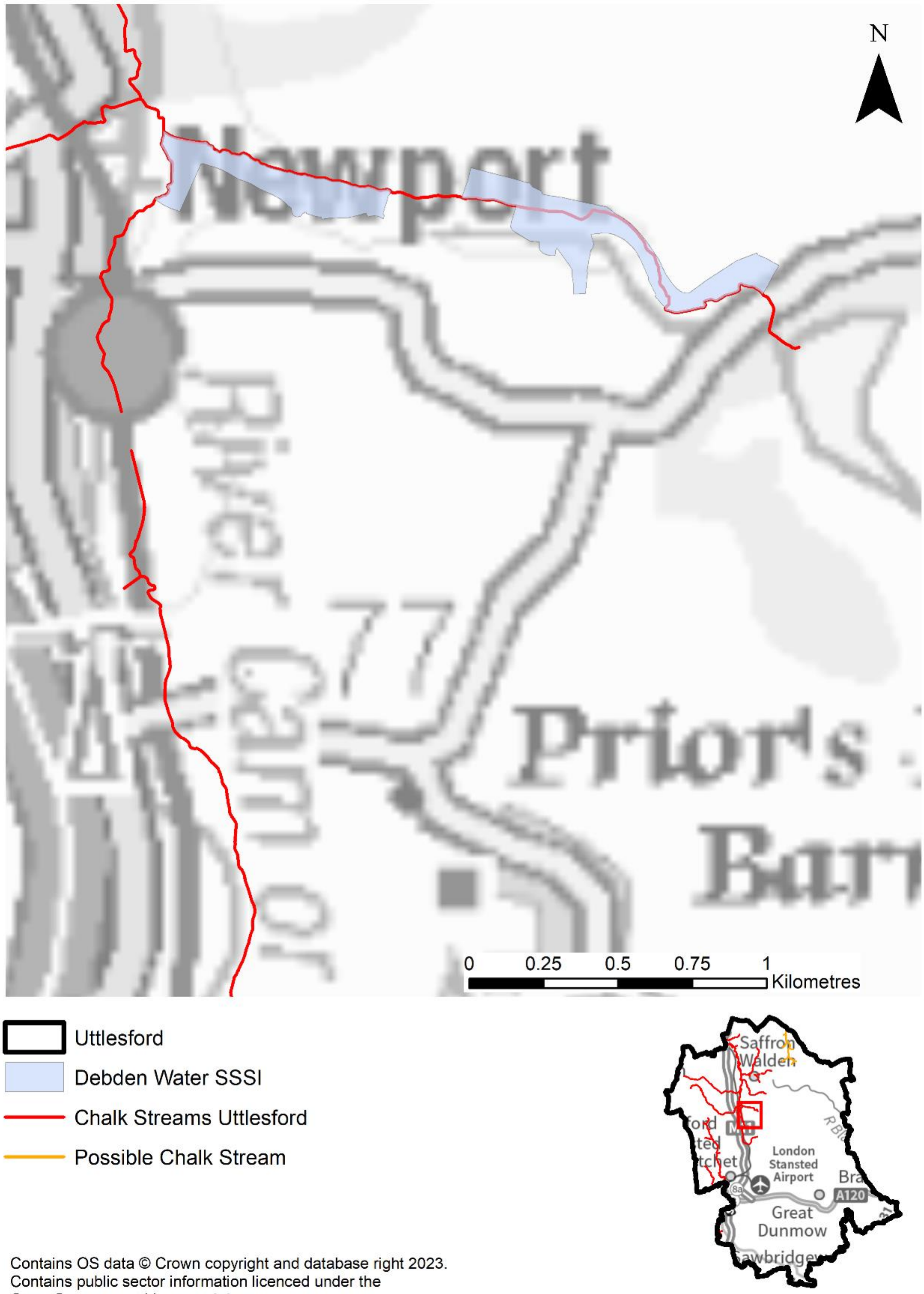
**Group C: scarp-face chalk streams**. These are the scarp-slope streams which rise at the base of the chalk and tend to run for a short distance over older (clay rich) chalk and then flow out onto the underlying gault clay and greensand beds. The Fontmell Brook in Dorset is a scarp-slope stream, as are the Lewknor and Chalgrove west of the Chilterns, likewise the streams rising along the spring-line of the Sussex Downs, or the north-flowing streams of the Gog Magog Hills, the westward flowing streams in north-west Norfolk and all the streams west of the Yorkshire Wolds.

**Group D: Pleistocene ice-impacted chalk streams** can fall into any one of the above categories but these streams rise from chalk that was directly impacted by major glacial action during the Pleistocene. This group would include the northern Chiltern streams and the East Anglian, Lincolnshire and Yorkshire streams. Group D could be further subdivided into streams that flow from chalk over glacial outwash deposits (the Wensum) and those that flow from chalk onto older (pre-glacial) river deposits, such as the pre-glacial Bytham River which flowed eastwards from the Midlands across Norfolk and emptied into the North Sea north of Lowestoft: the streams that lie between the Chilterns and Norfolk."

# C Appendix: Sites of Special Scientific Interest

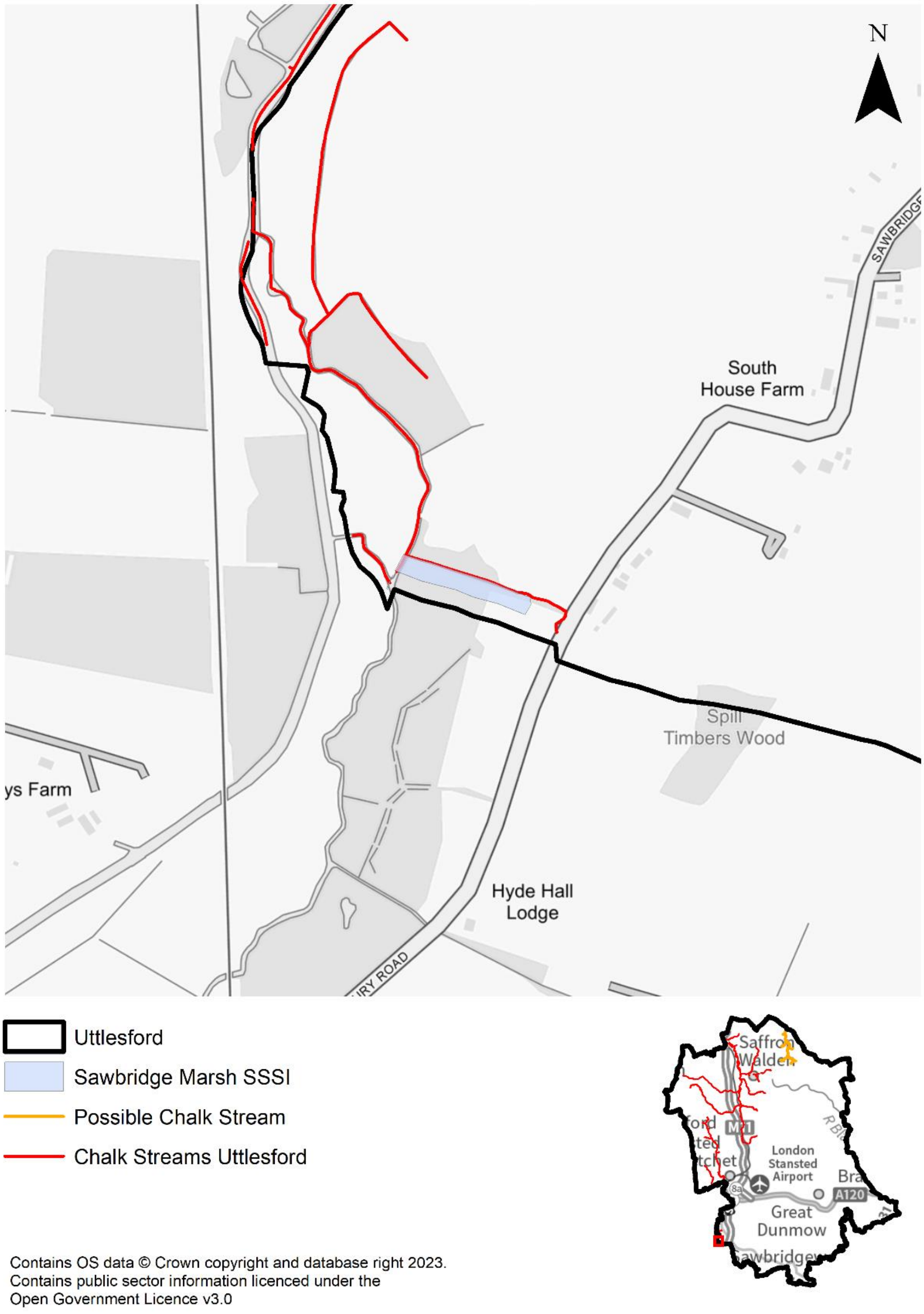
## C.1 Debden Water

Debden water is a freshwater stream and a tributary of the River Cam. Debden Water has several disused gravel pits throughout the site with varied topography which supports numerous habitats such as calcareous grassland. Species present include Lady's Bedstraw (*Galium verum*) and Pyramidal Orchids *(Anacamptis pyramidalis*). Like many other orchid species, the pyramidal orchid is declining in number making it important to protect this site.



## C.2 Sawbridgeworth Marsh

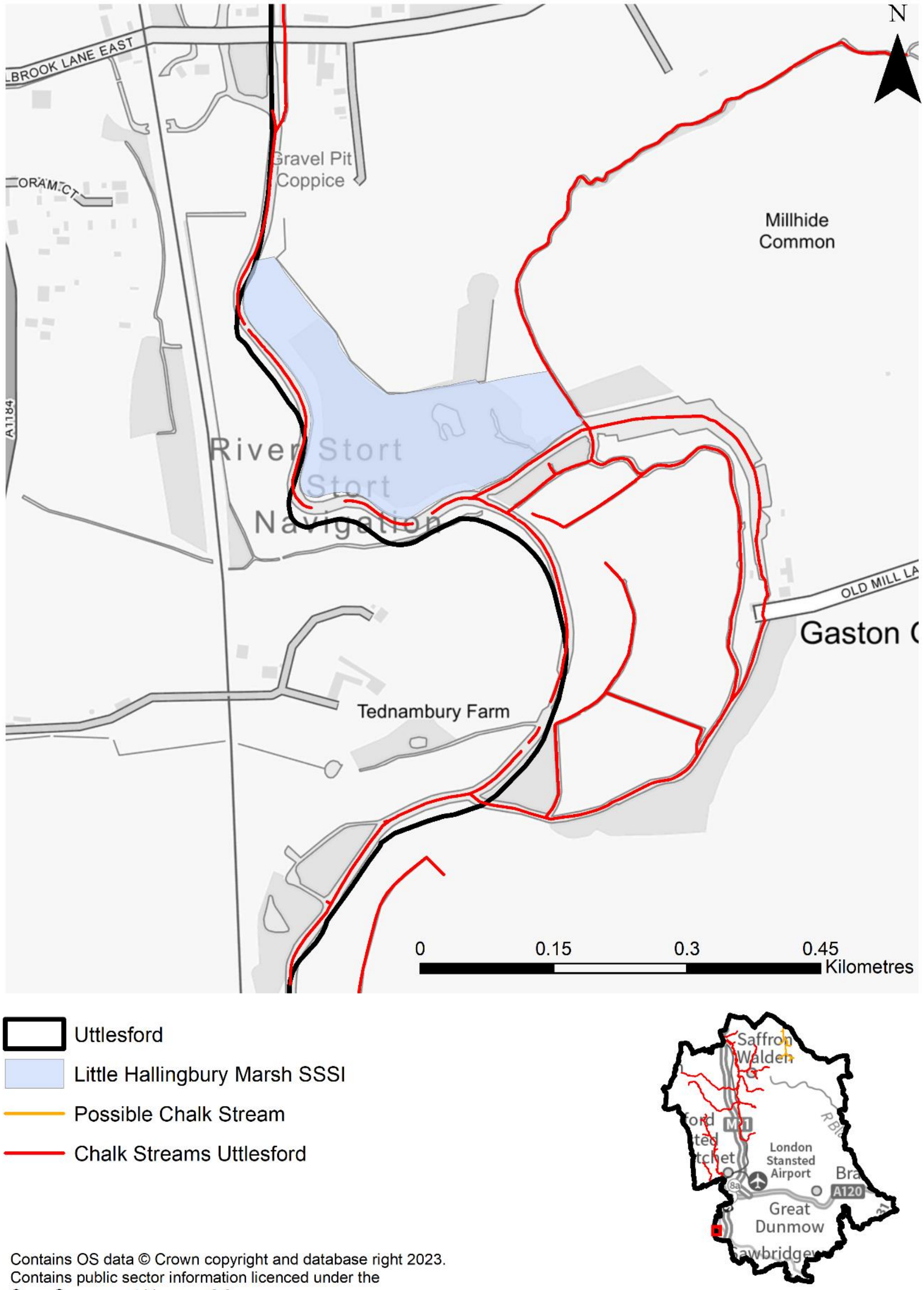
Sawbridgeworth Marsh is a tributary of the River Stort which is known to have an established Water Vole (*Arvicola amphibius*) population and managed by Essex Wildlife Trust[25]. It is home to numerous rare plants such as the Southern Marsh Orchid (*Dactylorhiza praetermissa*) and Marsh Valerian (*Valeriana dioica*) as well as being a valuable nesting habitat for Reed (*Scirpaceus*)and Sedge Warblers (*Acrocephalus schoenobaenus*).




25 Sawbridgeworth Marsh Nature Reserve | Essex Wildlife Trust (essexwt.org.uk)

## C.3 Little Hallingbury Marsh

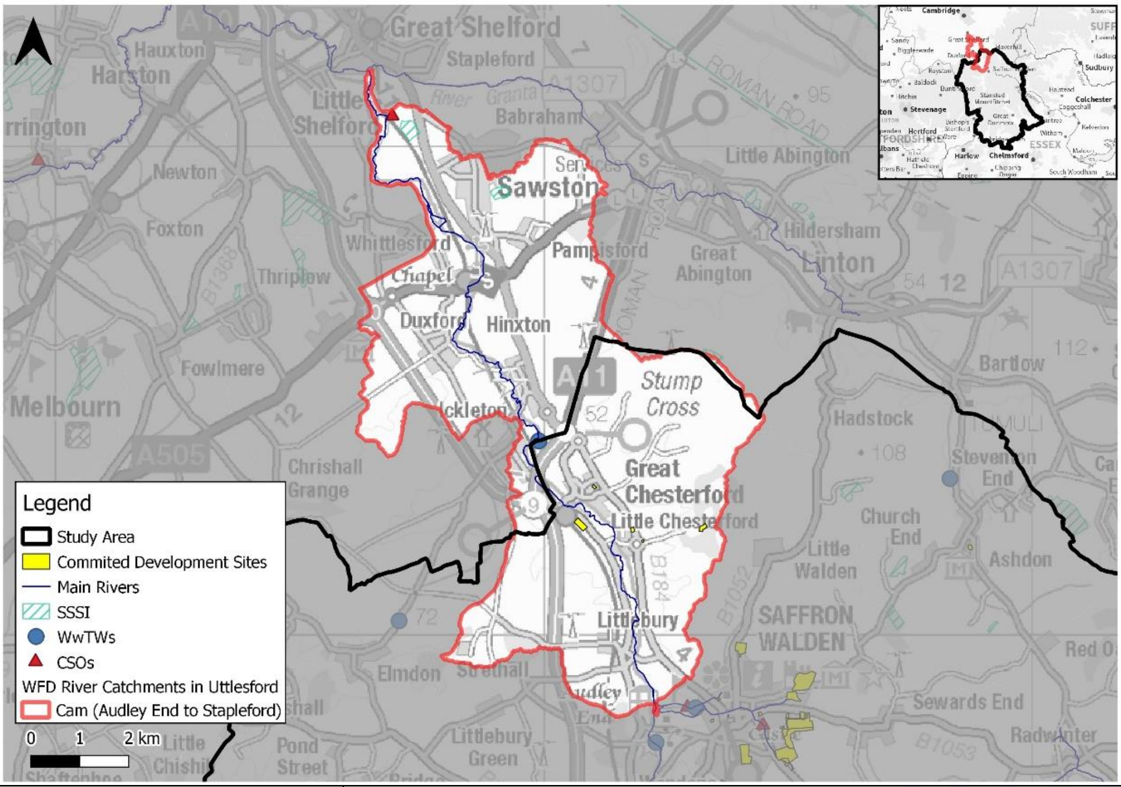
The third SSSI in close proximity of the Uttlesford chalk streams is Little Hallingbury Marsh. An unimproved wet grassland, Little Hallingbury Marsh is commonly used by overwintering birds for nesting and feeding. The marsh is mainly covered by reed sweet-grass (*Glyceria maxima*) and has a patch of woodland to the east edge of the site.



## D Appendix: WFD Catchment summaries

The mapping included in this section was produced alongside the Stage 1 WCS, and based on the growth information available at the time. It has not been updated as part of the Stage 2 WCS. The acronym CSO in the mapping refers to Combined Sewer Overflows (also known as storm overflows).

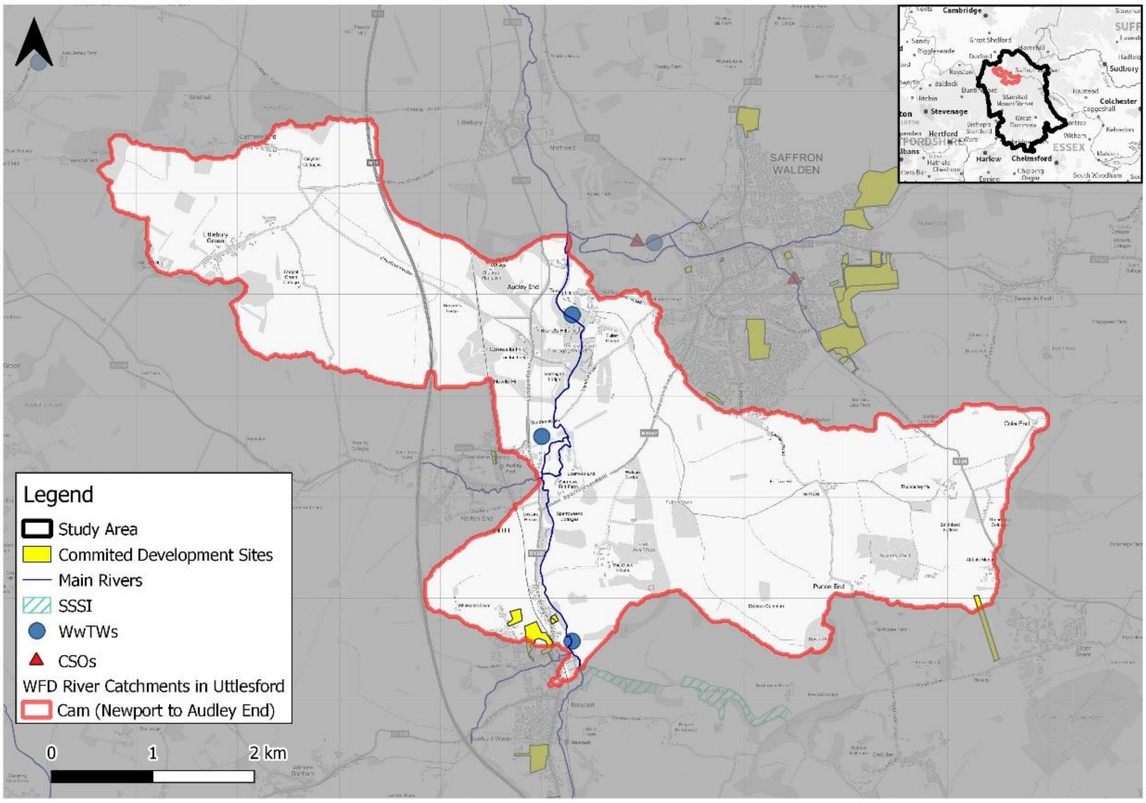
| WFD Catchment name | Cam (Audley End to Stapleford) |
|---|---|




| | |
|---|---|
| WwTWs | • Great Chesterford WwTW – Capacity likely to be used early in plan period based on just current commitments<br>• One development site not within sewer catchment |
| Chalk Stream | • Yes - River Cam |
| Storm Overflows | • Great Chesterford WwTW and Sawston WwTW (outside district) storm overflows. Both of these are located downstream of the Uttlesford District. Operating below threshold for investigation. |
| How many development sites are located in the catchment? | • Commitments and Consents - 5 Sites- 19 houses and 3,735m$^2$ of employment land<br>• New Settlement - Great Chesterford in Option 2b |
| WFD Status (2019) | • Overall Status - Poor<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Poor<br>• Reasons for not achieving good status:<br>The water industry, industry, and agriculture and rural land management are impacting flow, physical modification and point sources, leading to increased levels of phosphate and changes in the |

| | |
|---|---|
| | hydrological regime. |
| Potential issues in the catchment | • Chalk stream (Cam) present in catchment.<br>• Discharge from industry and sewers has prevented the catchment from achieving good status.<br>• Storm overflow present – but is performing ok<br>• The Great Chesterford new settlement would be a significant development in this area and would likely put a strain on any wastewater infrastructure and on the quality of the river it was discharging to. |

| WFD Catchment name | Cam (Newport to Audley End) |
|---|---|




| | |
|---|---|
| WwTWs | • Newport WwTW – currently at DWF permit limit<br>• Wendens Ambo WwTW – flow not monitored – small WwTW with limited capacity<br>• Audley End WwTW - flow not monitored – small WwTW with limited capacity |
| Chalk Stream | • Yes- River Cam |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - 3 Sites- 43 houses<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Bad |

| | |
|---|---|
| | • Reasons for not achieving good status:<br>The water industry, and agriculture and rural land management are impacting the flow and point sources, leading to increased levels of phosphate and changes in the hydrological regime. |
| Potential issues in the catchment | • Chalk stream present (Cam)<br>• Discharge from industry and sewers has prevented the catchment from achieving good status.<br>• Committed development in the WFD catchment falls into the Newport WwTW catchment. |

| WFD Catchment name | Cam (US Newport) |
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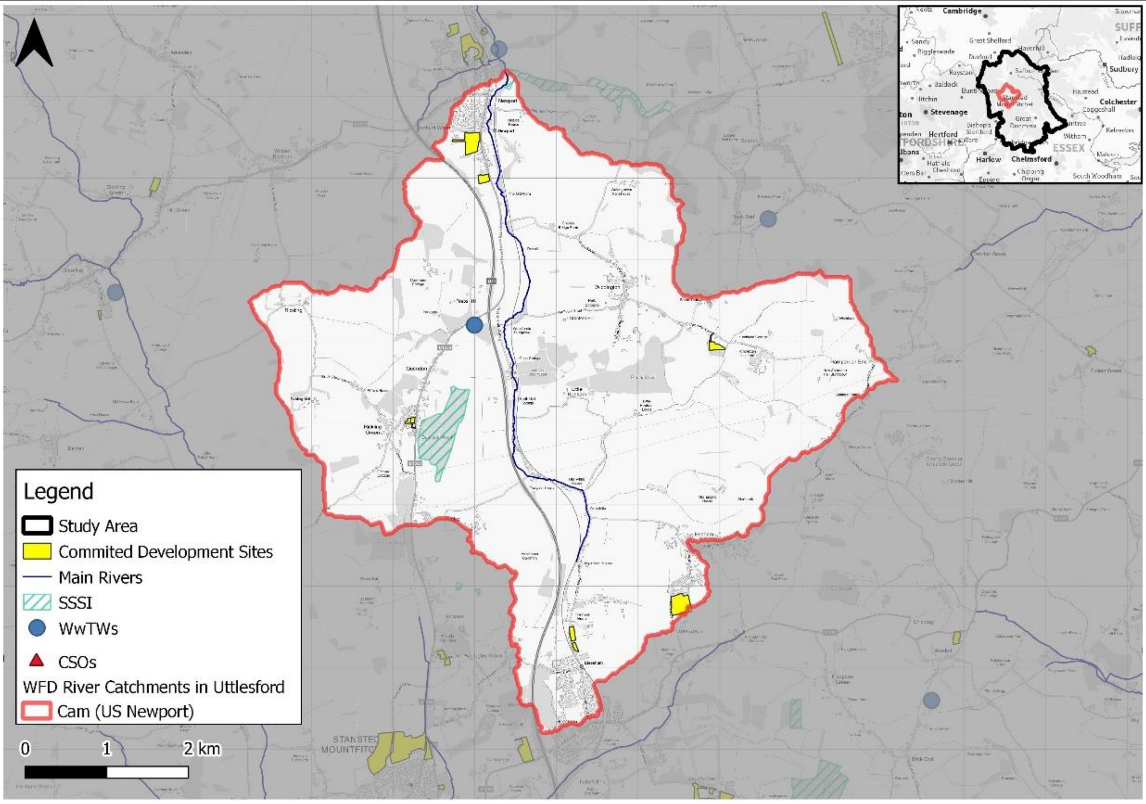


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| WwTWs | • Quendon WwTW – has capacity after commitments (135 dwellings)<br>• One development site is located outside of the Quendon WwTW catchment. |
| Chalk Stream | • Yes- River Cam |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - 8 Sites - 178 houses<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Moderate |

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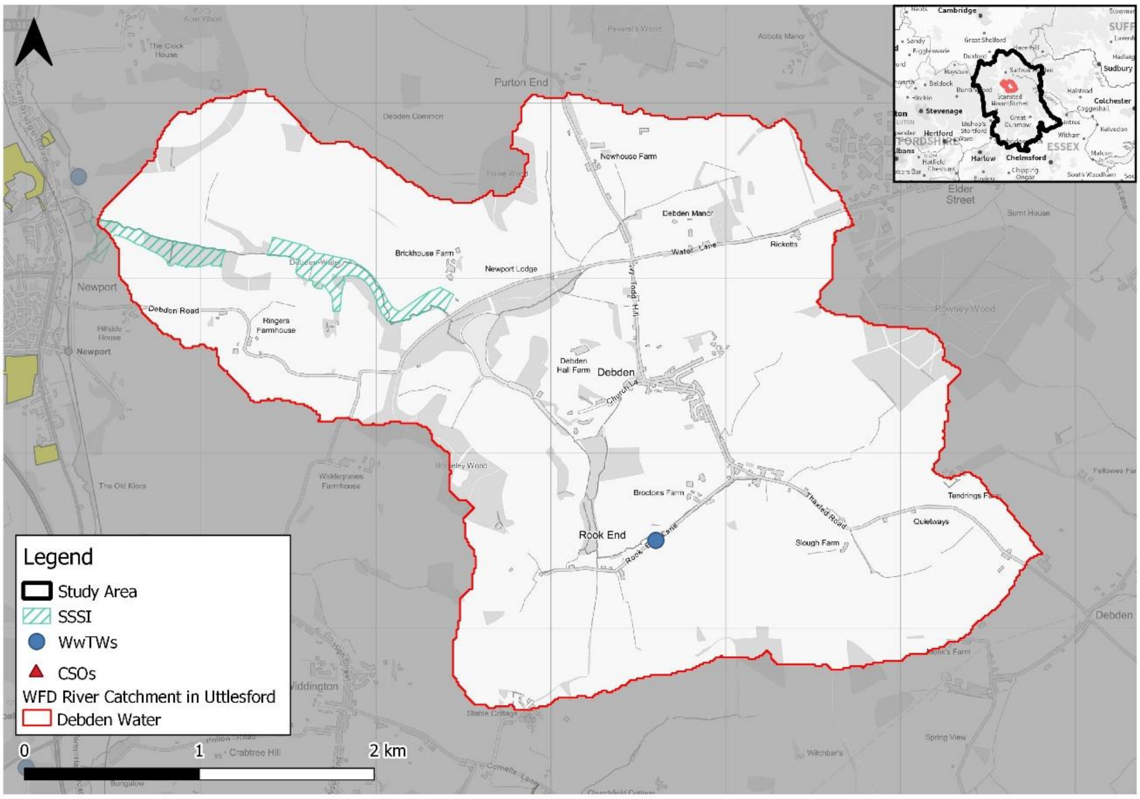
| | • Reasons for not achieving good status:<br>The water industry, and agriculture and rural land management are impacting point and diffuse sources, the flow and physical modification, leading to increased levels of phosphate, dissolved oxygen, and changes to the hydrological regime and invertebrates. |
| Potential issues in the catchment | • Discharge from sewage discharge, poor nutrient management, groundwater abstraction and land drainage has prevented the catchment from achieving good status.<br>• Committed development in the WFD catchment falls into the Quendon and Stansted Mountfitchet WwTW catchments. |

| WFD Catchment name | Debden Water |
|---|---|

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| WwTWs | • Debden WwTW – has capacity after commitments (247 houses) |
| Chalk Stream | • Yes - The catchment is underlain by chalk (headwaters of Cam) |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - None<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Poor<br>• Ammonia - N/A<br>• BOD - N/A |

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| | • Phosphate - N/A<br>• Reasons for not achieving good status:<br>The water industry is impacting physical modification leading to changes in mitigation measures assessments. |
| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer. |

| WFD Catchment name | Granta |
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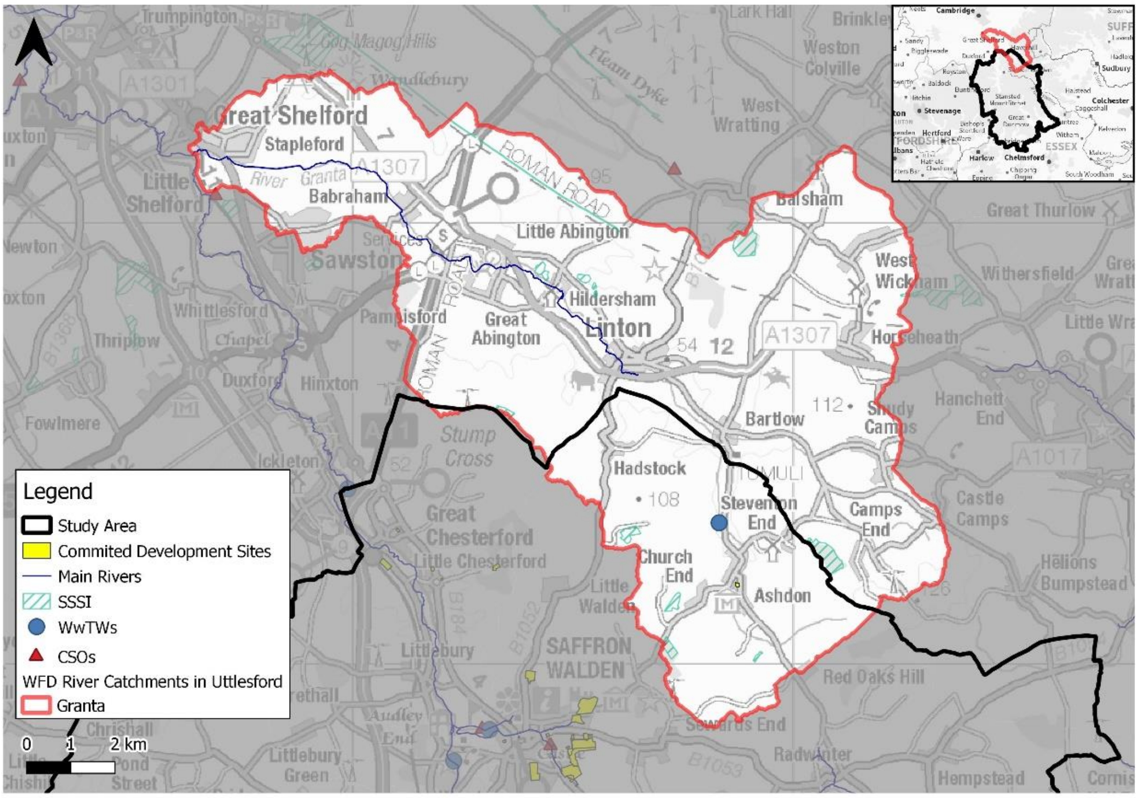
|  | |
| WwTWs | • Ashdon WwTW – has capacity (1,285 houses) |
| Chalk Stream | • Yes - The catchment is underlain by chalk. |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents – none<br>• New Settlement - none |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD – N/A<br>• Phosphate - Poor<br>• Reasons for not achieving good status:<br>The water industry, and agriculture and rural land management are affecting the flow and point sources, leading to changes in the hydrological regime and phosphate levels. |

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| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Discharge from abstractions and sewage discharge has prevented the catchment from achieving good status. |

| WFD Catchment name | Slade |
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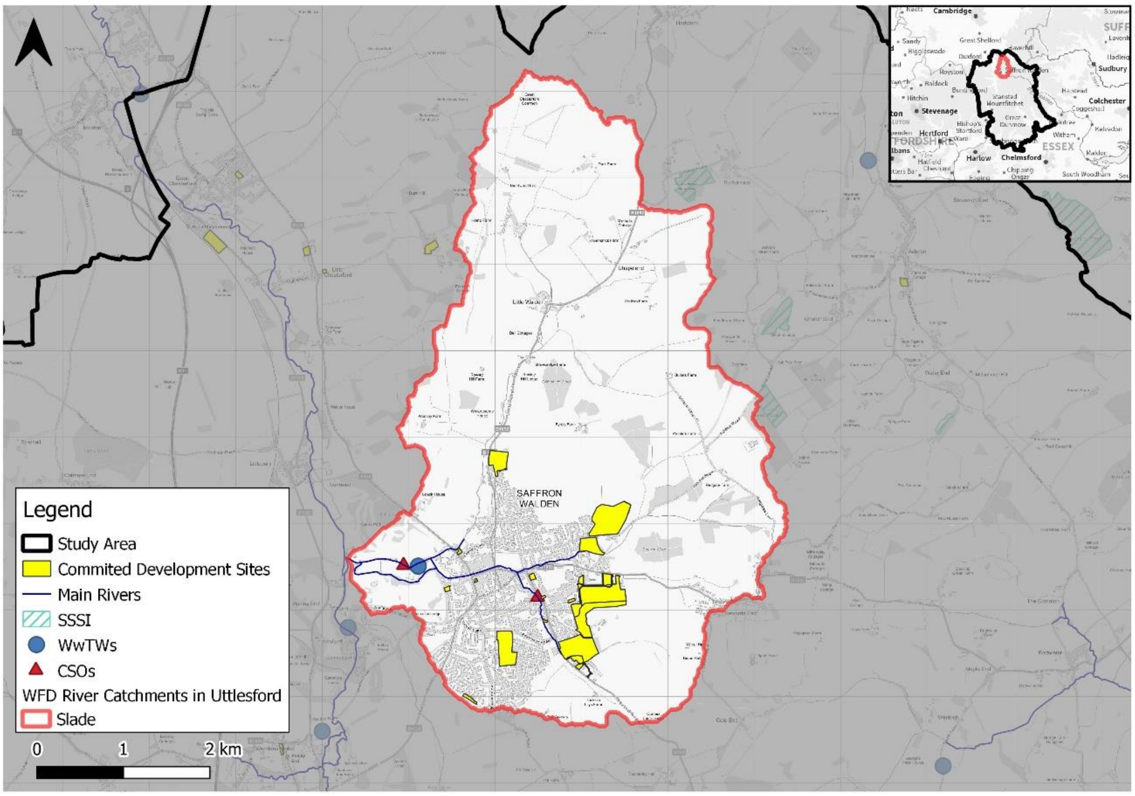


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| WwTWs | • Saffron Walden WwTW – has capacity after commitments (3,390 houses) |
| Chalk Stream | • Yes - River Slade (tributary of Cam) |
| Storm Overflows | • Saffron Walden WwTW and Saffron Walden Victoria THX OV storm overflows. The Saffron Walden WwTW storm overflow discharged five times for a total of 7.75 hours. The Saffron Walden Victoria THX OV discharged 3 times in 2020 for a total of 1 hour. |
| How many development sites are located in the catchment? | • Commitments and Consents - 18 Sites - 424 houses and 6,884m$^2$ of employment land<br>• New Settlement - Great Chesterford |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - Good<br>• BOD - N/A<br>• Phosphate - Poor<br>• Reasons for not achieving good status:<br>The water industry, agriculture and rural land |

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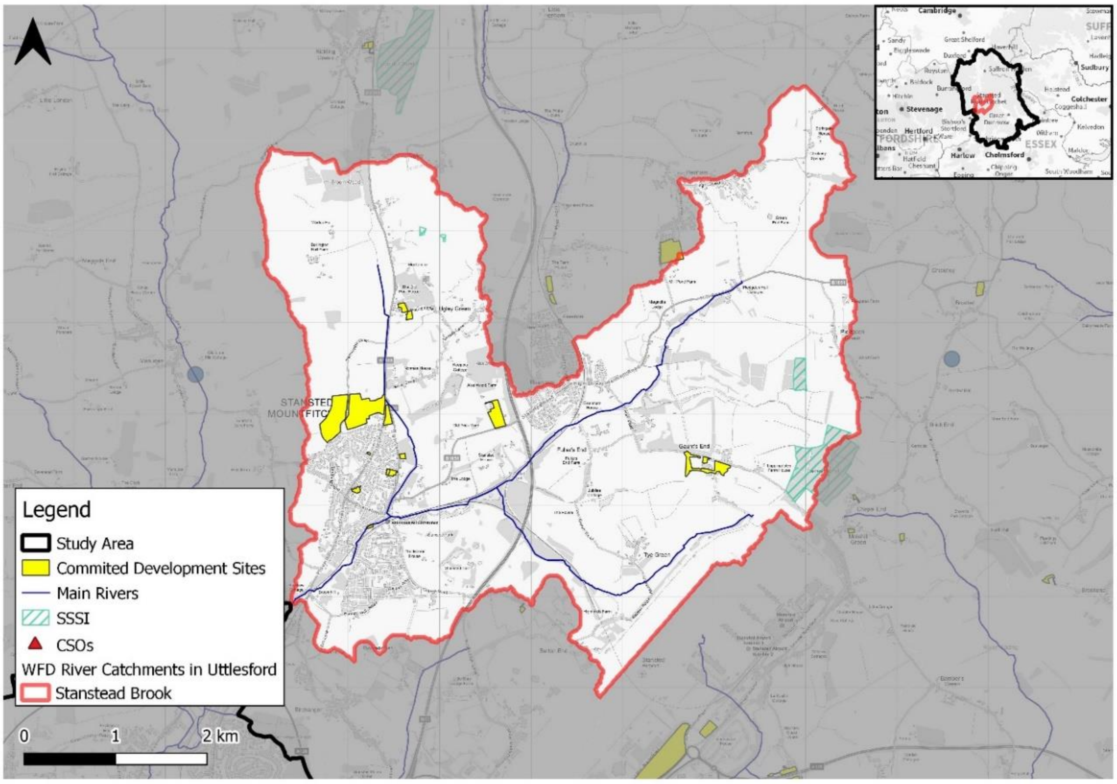
| | management, and urban and transport sectors are impacting the flow, point sources and physical modification, leading to changes in phosphate, and macrophytes and phytobenthos combined levels and invertebrates. |
| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Discharge from sewers, urbanisation and agriculture has prevented the catchment from achieving good status.<br>• The Great Chesterford new settlement would be a significant development in this area and would likely put a strain on any wastewater infrastructure and on the quality of the river it was discharging to. Significant development is also proposed around Saffron Walden which would put further pressure on the watercourse – which is a tributary of the River Cam (chalk stream) |

| WFD Catchment name | Stanstead Brook |
|---|---|
|  | |
| WwTWs | • None |
| Chalk Stream | • Partially - Part of the watercourse is underlain by chalk with parts of the catchment underlain by are underlain by Lambeth Group and Thames Group bedrock formations. |
| Storm Overflows | • None |

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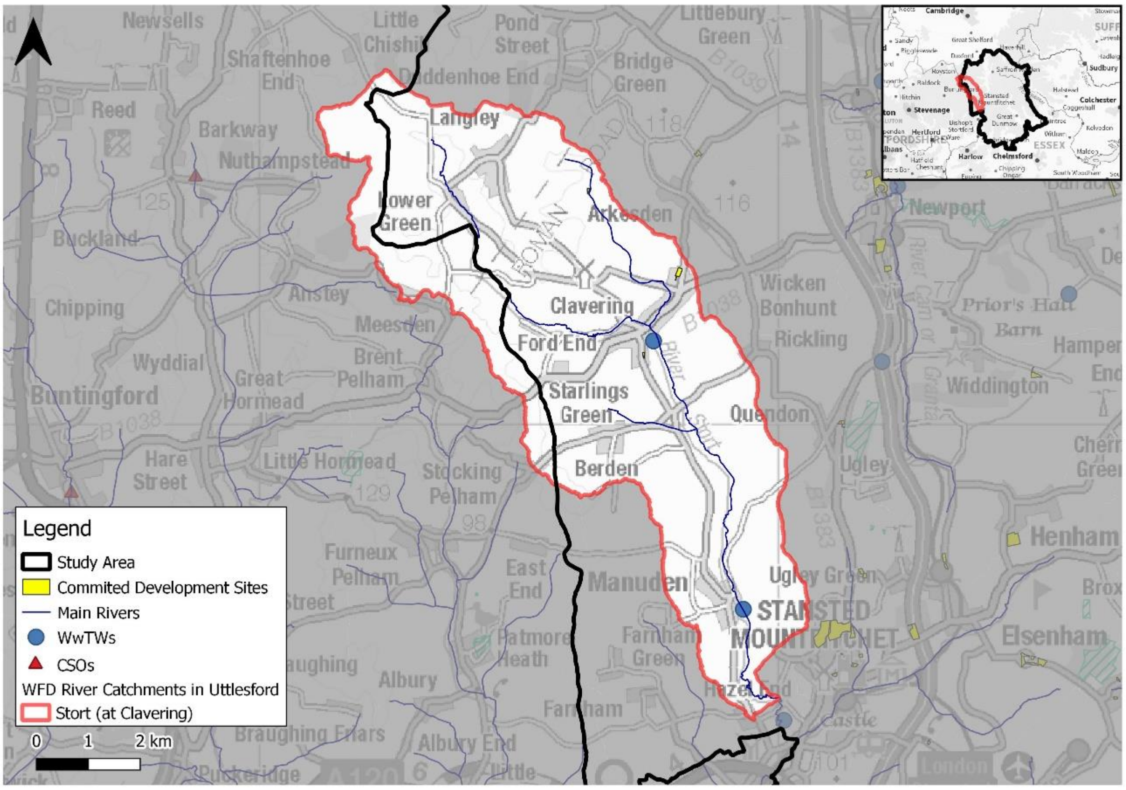
| How many development sites are located in the catchment | • Commitments and Consents – Sites - 349 houses and 8242m² of employment land<br>• New Settlement - Ugley |
| WFD Status (2019) | • Overall Status - Poor<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Good<br>• Reasons for not achieving good status: Mining and quarrying are impacting point sources and flow, leading to changes in the hydrological regime and invertebrates. |
| Potential issues in the catchment | • Part of the catchment is underlain by a chalk and the watercourse is likely to be fed by the chalk aquifer.<br>• Mining and quarrying activity is thought to be the cause of the watercourse not achieving good status due (ecological elements).<br>• Further deterioration in a waterbody already classified as "Bad" would be unacceptable<br>• The Ugley new settlement would be a significant development in this area and would likely put a strain on any wastewater infrastructure and on the quality of the river it was discharging to. |

| WFD Catchment name | Stort (at Clavering) |
|---|---|

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| WwTWs | • Manuden WwTW – has capacity after commitments (581 houses)<br>• Clavering WwTW – currently at or exceeding its DWF permit<br>• One development site is located outside of a public sewer catchment. |
| Chalk Stream | • Yes - River Stort |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - 3 Sites - 9 houses and 1,594m$^2$ of employment land<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Moderate<br>• Reasons for not achieving good status:<br>The water industry and agriculture and rural land management sectors are impacting point and diffuse sources, and suspect data, leading to changes in phosphate and dissolved oxygen levels, and the hydrological regime. |

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| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Discharge from sewers and poor soil management has prevented the catchment from achieving good status. |

| WFD Catchment name | Stort and Bourne Brook |
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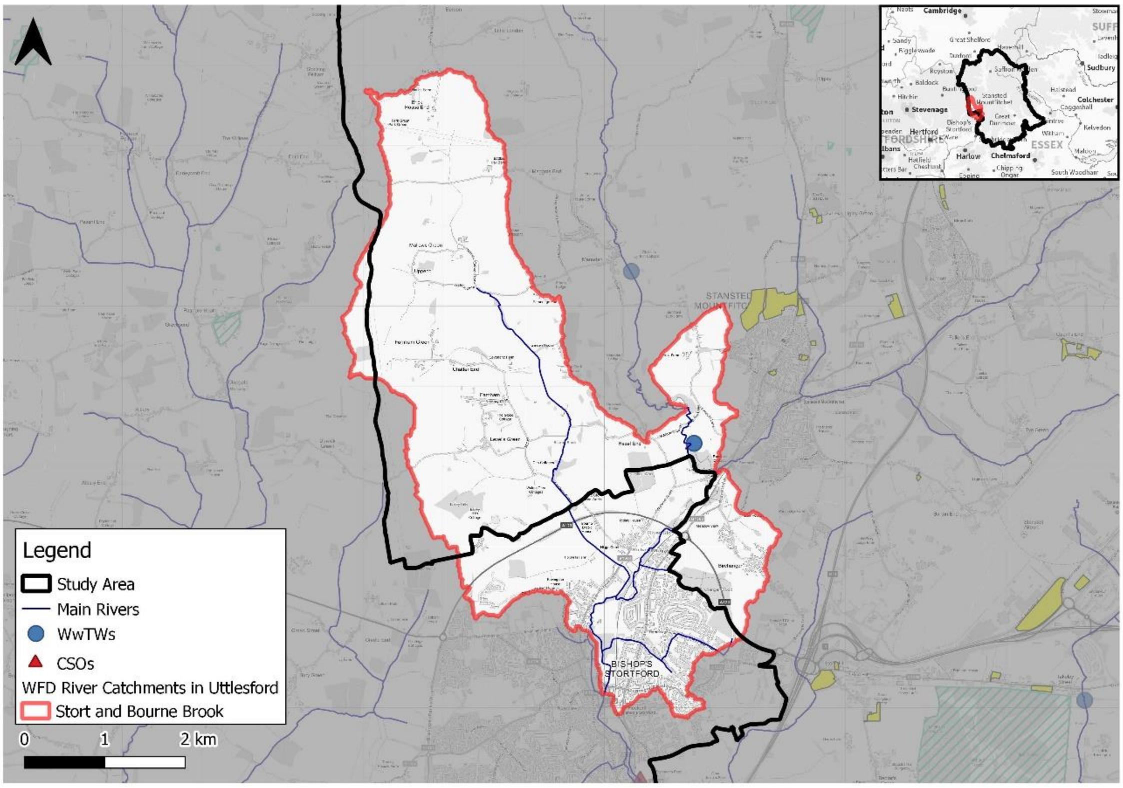
|  | |
| WwTWs | • Stansted Mountfitchet WwTW – has capacity (2,140 houses)<br>• New Nickel permit being applied and TW have expressed concerns about future growth preventing this being met |
| Chalk Stream | • Yes - River Stort and Bourne Brook |
| Storm Overflows | • The Stansted Mountfitchet WwTW storm overflow discharged 39 times in 2020 for a total of 305 hours – under threshold for investigation but this is into a chalk stream so should be addressed. |
| How many development sites are located in the catchment? | • Commitments and Consents - None<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Moderate<br>• Reasons for not achieving good status: |

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| | The water industry is impacting point sources, leading to increased phosphate and dissolved oxygen levels. |
| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Sewage discharge has prevented the catchment from achieving good status.<br>• The Stansted Mountfitchet Storm Overflow discharges to a chalk stream and its impact should be addressed. Further unmitigated growth could exacerbate this |

| WFD Catchment name | Wendon Brook |
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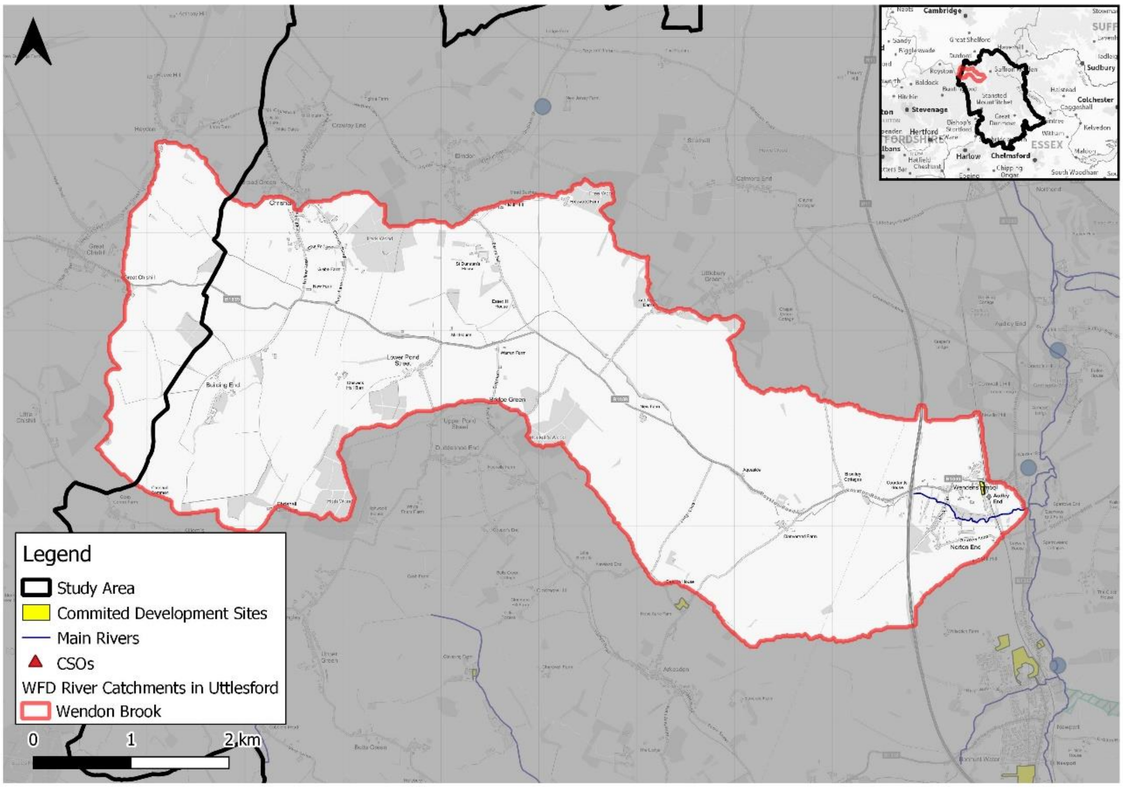


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|---|---|
| WwTWs | • None |
| Chalk Stream | • Yes - Wendon Brook |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - 2 Sites- 23 houses<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Good<br>• Reasons for not achieving good status:<br>The agriculture and rural land management, and |

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| | water industry are impacting flow and diffuse sources, leading to changes in the hydrological regime and phosphate levels. |
| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Surface and groundwater abstraction has caused some elements to not achieve good status. |

| WFD Catchment name | Tributary of the Cam |
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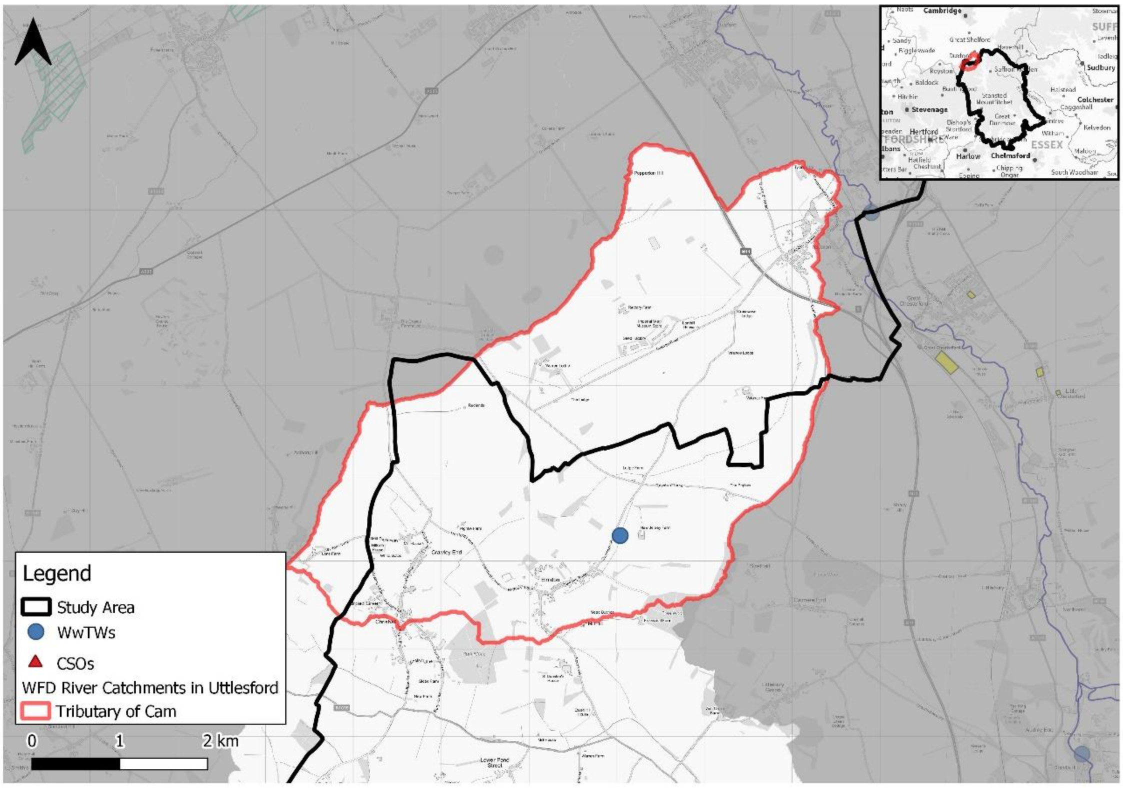
|  | |
| WwTWs | • Elmdon WwTW – has capacity after commitments (434 houses) |
| Chalk Stream | • Yes - River Cam |
| Storm Overflows | • None |
| How many development sites are located in the catchment? | • Commitments and Consents - None<br>• New Settlement - None |
| WFD Status (2019) | • Overall Status - Moderate<br>• Ammonia - High<br>• BOD - N/A<br>• Phosphate - Moderate<br>• Reasons for not achieving good status:<br>The water industry is impacting point sources and flow, leading to changes in phosphate and dissolved oxygen levels, and invertebrates. |

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| Potential issues in the catchment | • The catchment is underlain by a chalk and the watercourse is therefore predominantly fed by the chalk aquifer.<br>• Sewage discharge and groundwater abstraction have prevented the catchment from achieving good status. |

# E Appendix: Uttlesford Chalk Stream Exclusion Zone

<PROVIDED AS SEPARATE HIGH RESOLUTION MAP>

JBA consulting

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
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Newport
Peterborough
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Tadcaster
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