Cam Valley forum

Why all is not well with the River Cam: 1

Stephen Tomkins

Our best local chalk Stream: in good times

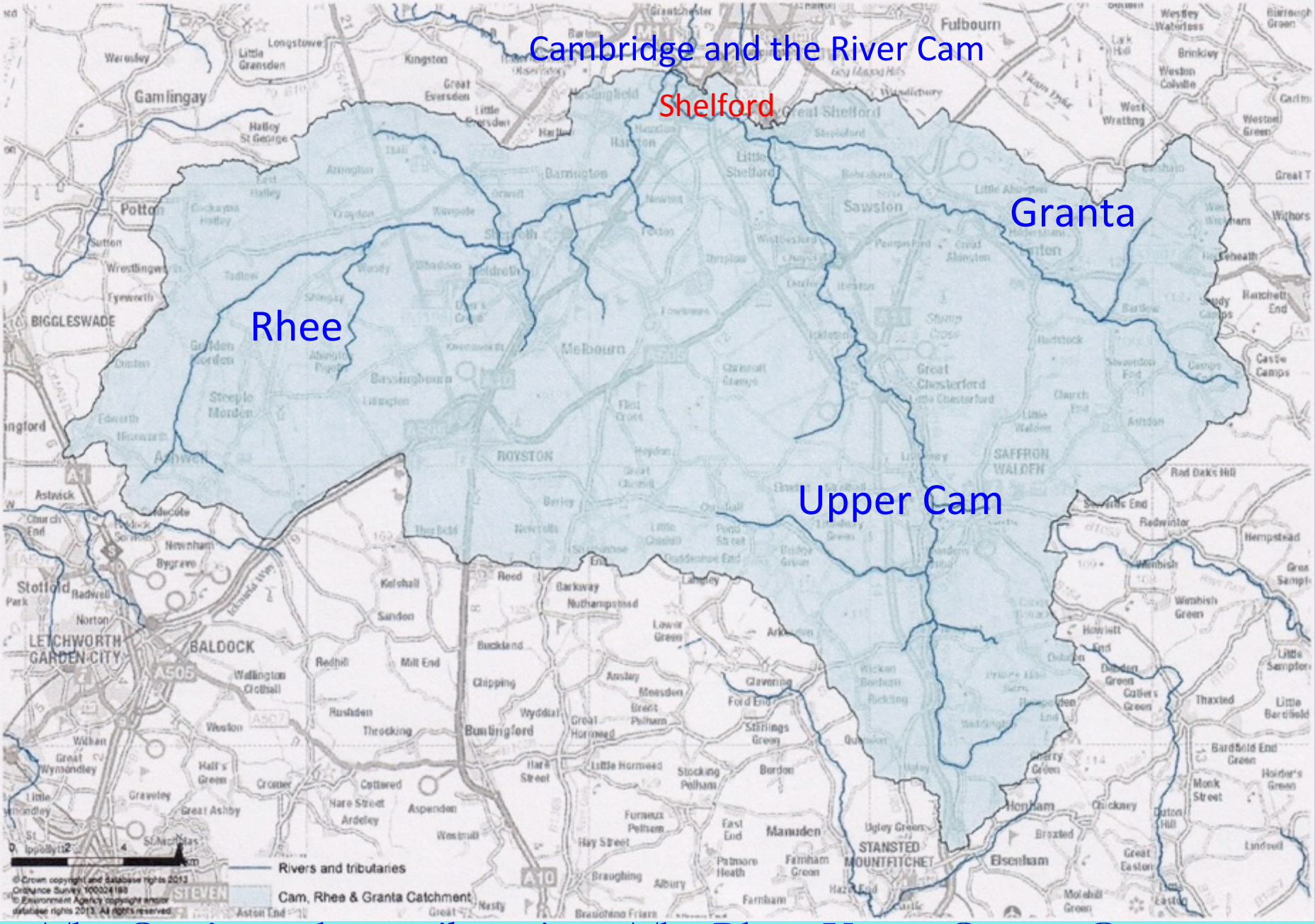
The empty Granta: in bad and dry times

Part 1 (of two parts)

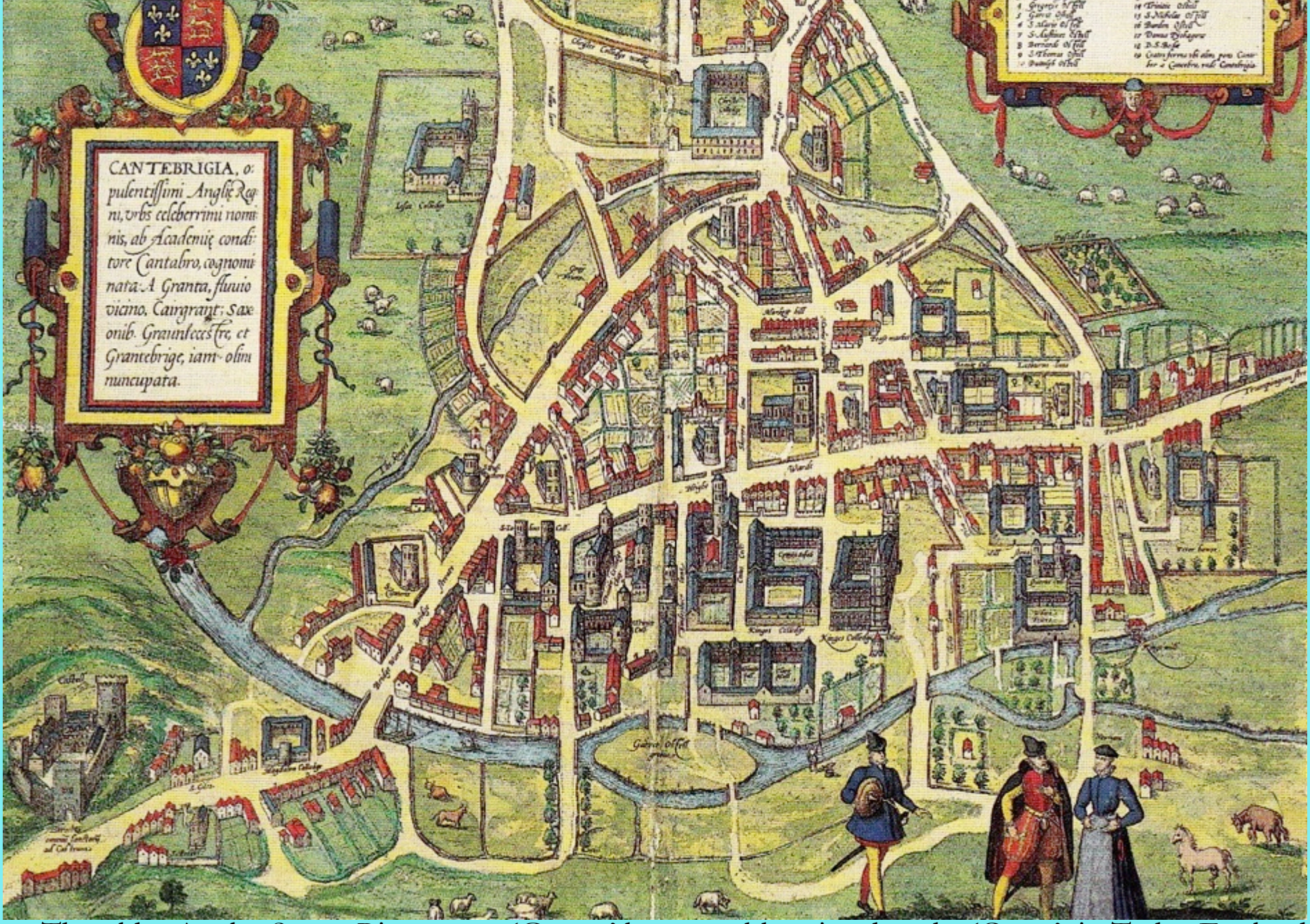
- The Cam
- Why all is not well with the river (summary)
- Some history of where our water supplies come from
- Water shortage, Low river flows, Pollution & Loss of wetlands
- All about Chalk streams and why they matter
- Rainfall and river flows
- Winter rainfall is key aquifer recharge

Children in Cambridgeshire have not seen a good clear Chalk stream like this in decades

The River Nar in Norfolk: Photo Charles Rangeley-Wilson



The Cam's southern tributaries – The Rhee, Upper Cam & Granta



The older Anglo–Saxon River name 'Grante' became abbreviated to the 'Cante' in Tudor England. Cambridge was therefore 'Cantebrigia', here as it was in 1575.

Why all is not well with the river Cam.

A Summary of some ‘inconvenient truths’

- We are in a genuinely water stressed area.
- Our Chalk streams are fed from a diminishing aquifer.
- All our domestic water is supplied from the same aquifer source.
- Climate change is now significant.
- Pollution is an increasing issue, despite some aspects improving.
- There are increasing water demands and an increasing population.

I will invite you to think outside the box. **How can we put it right**?

- We need to understand what is not OK.
- We need to understand why we have gone so badly wrong.
- Saving Chalk streams is imperative.
- Saving water is imperative.
- Changing what can be changed will not happen overnight.
- How might we manage our water resources better?

Thomas Hobson
1544-1631

Hobson's Conduit has been bringing potable Chalk stream water into Cambridge since 1609, from Nine Wells Spring (south of New Addenbrookes Hospital)

Thomas Hobson
endowed the Hobson's Trust.

'Conduit Head' is at Brookside.

His memorial is at Nine Wells

Cambridge's drinking water sources are still (97%) from the Chalk

Hobson's conduit was built from **Nine Wells** in **1609**.
This was the main source of Cambridge drinking water for over 250 years.

Cherry Hinton Pumping Station: 1855 (the Cambridge Water Company)
main source of Cambridge drinking water for 45 years

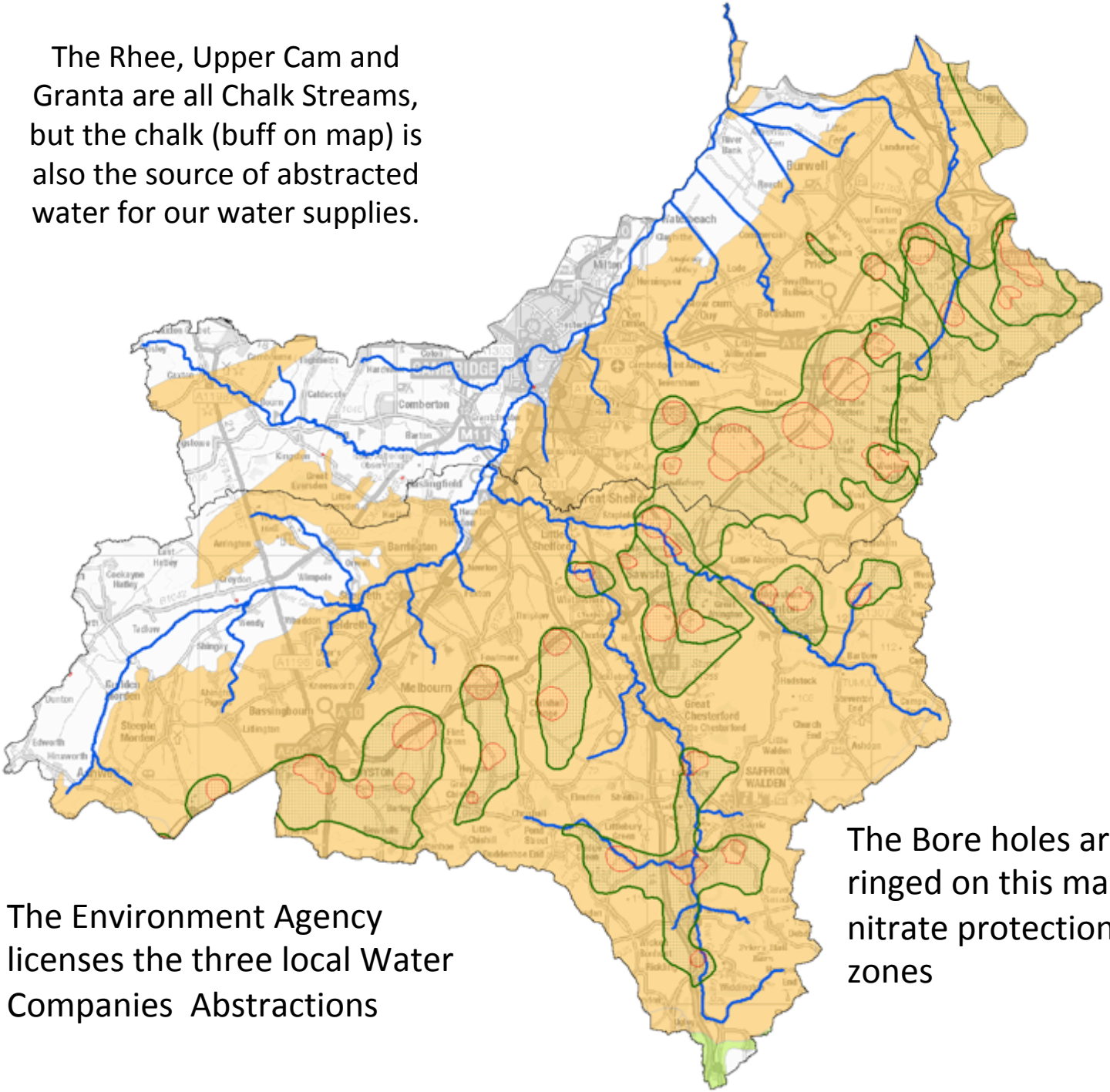
Fulbourn Village Pumping Station built **1891**
Sourced all Cambridge water for 30 years.
One of the earliest chlorinated supplies in the UK.

The Fleam Dyke Pumping Station (right): built **1921.**

This was the first of the now many Cambridge Water Company's deep chalk wells**.**

As the first deep pump borehole it supplied half the (old) County of Cambs and Isle of Ely with all of its water needs until 1950.

The Rhee, Upper Cam and Granta are all Chalk Streams, but the chalk (buff on map) is also the source of abstracted water for our water supplies.



The Bore holes are ringed on this map of nitrate protection zones

The Environment Agency licenses the three local Water Companies Abstractions

Both these Cambridgeshire area maps are to the same scale

Water supply areas

The Water abstraction area

Water shortage, Low river flows, Pollution & Loss of wetlands

The Siren Voices

I965 Cambridge Meeting of the British Association

1970s Hobson's Conduit fails and Nine Wells dries up.

1987 Gro Bruntland "Our Common Future" *World Commission on Environment and Development.* The first call for 'Sustainable Development'

1990s British Geological Survey, The Institute of Hydrology, UK.
Failure of the Cam is inevitable. Augmentation begins.

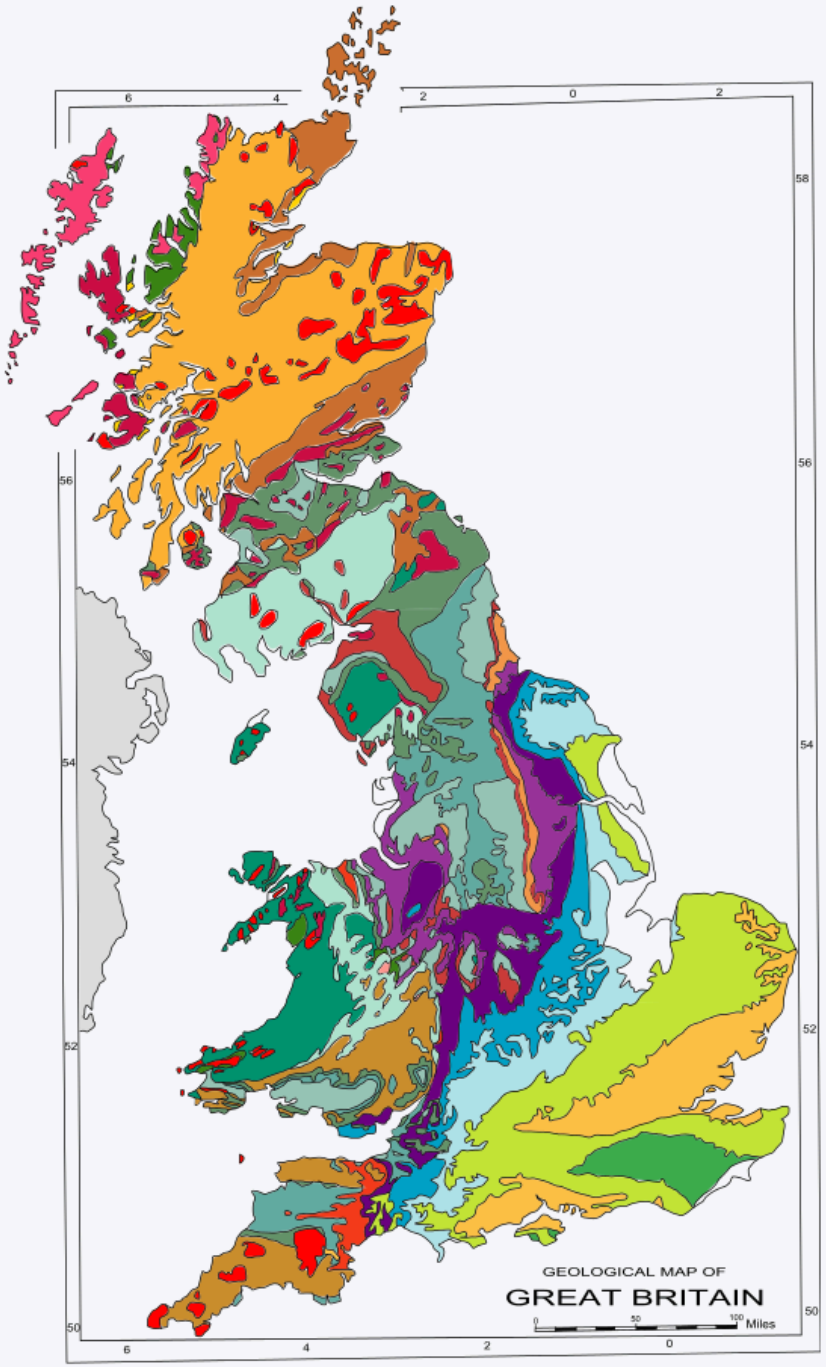
2000 EC Water Framework Directive.
Our legal obligation is now to improve watercourses.

2016 Environment Agency showed that nearly a quarter of all the rivers in England are still at risk from too much water being abstracted, leaving too little for wildlife:

2020 The Stantec report to GCP and the EA warned again of unsustainability

Geology of Great Britain

- Quaternary (Alluvium)
- Paleogene / Neogene (Tertiary)
- Cretaceous
- Lower Cretaceous
- middle/upper Jurassic
- lower Jurassic
- upper Triassic
- lower Triassic
- upper Permian
- lower Permian
- upper Carboniferous (Coal Measures)
- middle Carboniferous
- lower Carboniferous (limestone)
- Devonian
- Ordovician / Silurian
- Cambrian
- Neoproterozoic
- Proterozoic (upper Precambrian)
- Lewisian (lower Precambrian)
- granite
- Paleogene volcanics



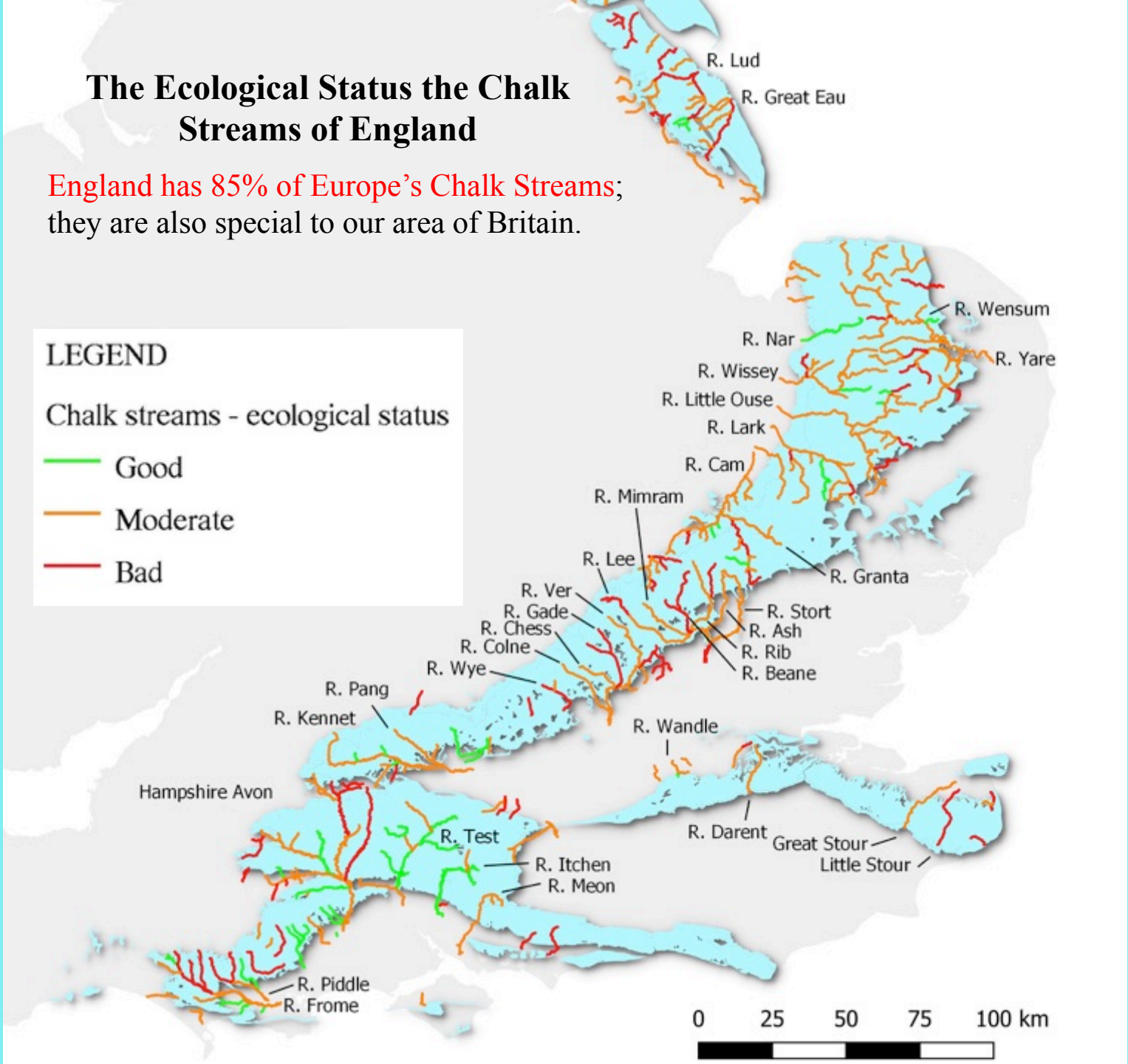
CHALK

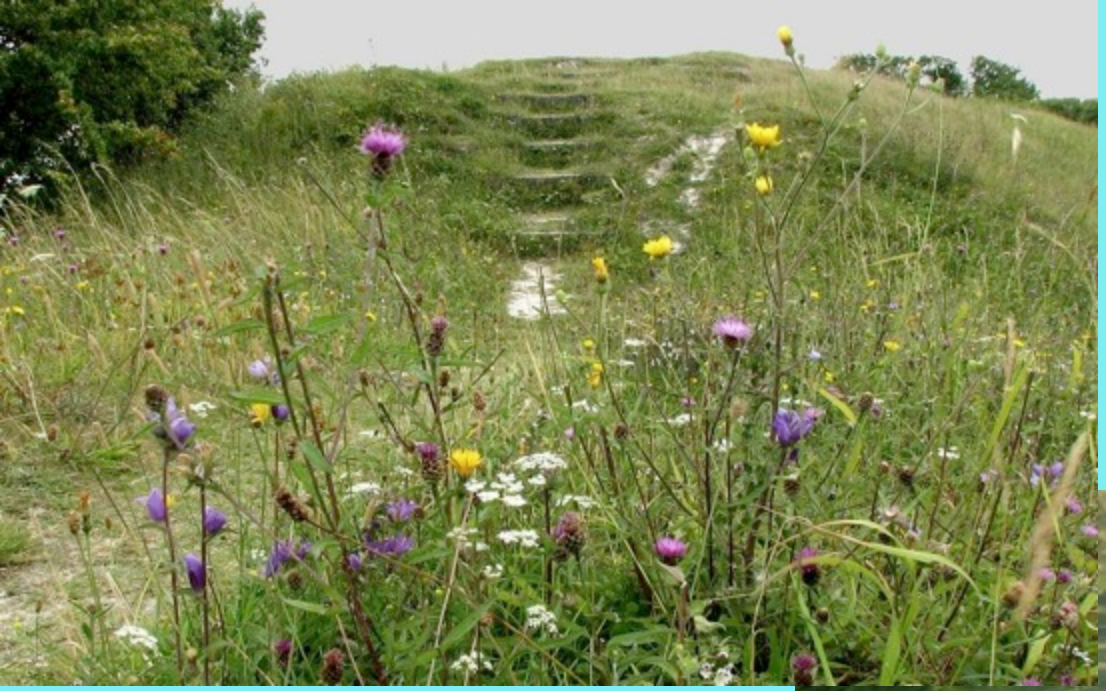
Geology governs much of a river's chemical nature, physical flow and biological character.

The **Cam, Granta** and **Rhee** are all Chalk streams, so too are the Cherry Hinton Brook, the Wilbraham River and all the Lodes

The Ecological Status the Chalk Streams of England

England has 85% of Europe's Chalk Streams; they are also special to our area of Britain.





The Uniqueness of Chalk Streams

Rainfall on the Chalk

↓

Percolation

↓

Aquifer groundwater provides storage of base-rich water in the Chalk

↓

Emergence above a basal impermeable stratum

→ Spring water →

Calcium rich, clear and 10° C

The Flora and Fauna of Chalk Streams

Rainfall

The majority of summer rainfall is lost in evapotranspiration.

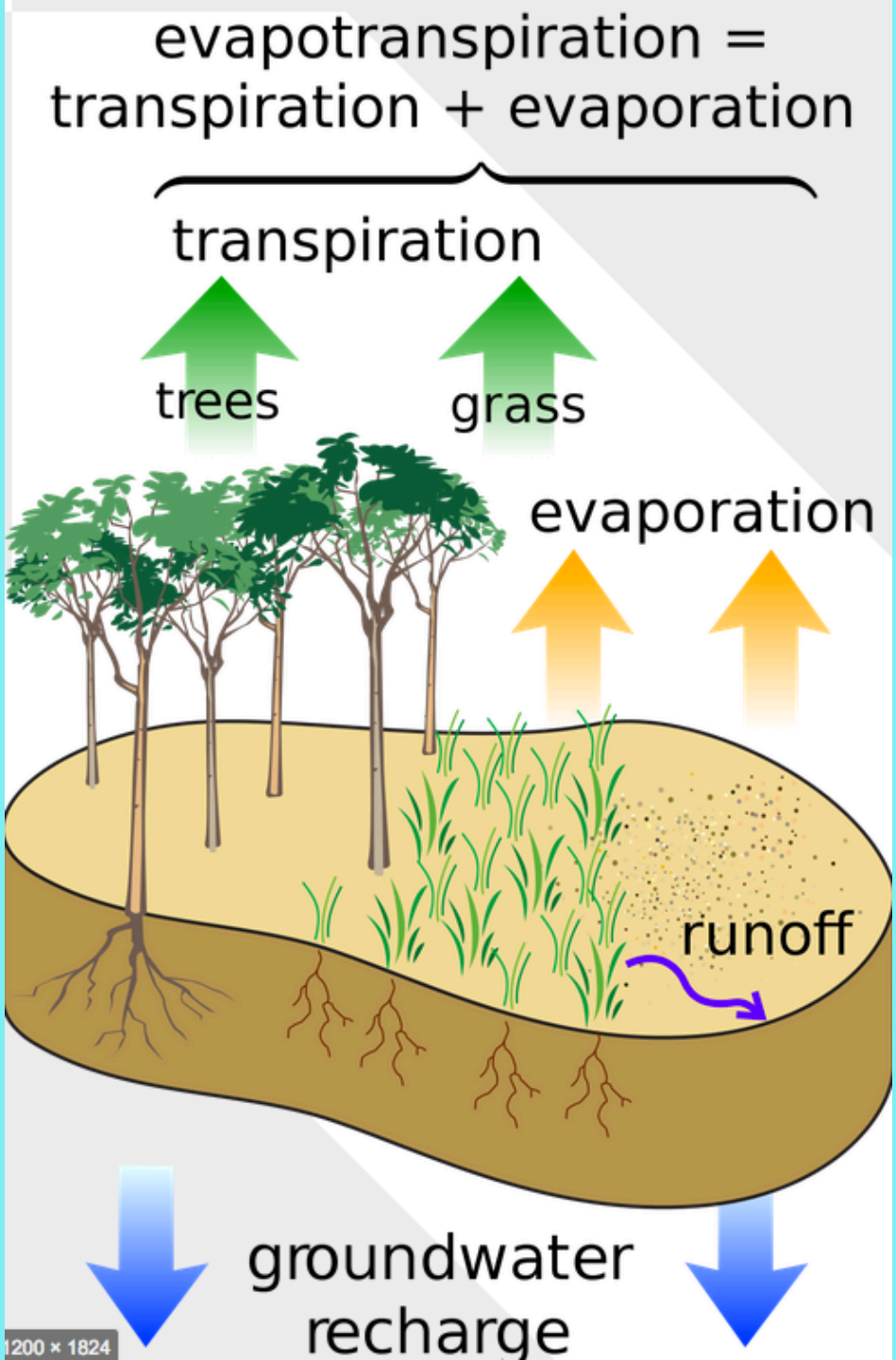
Commonly only the winter rainfall, which percolates deep into the soil, contributes anything to our chalk streams

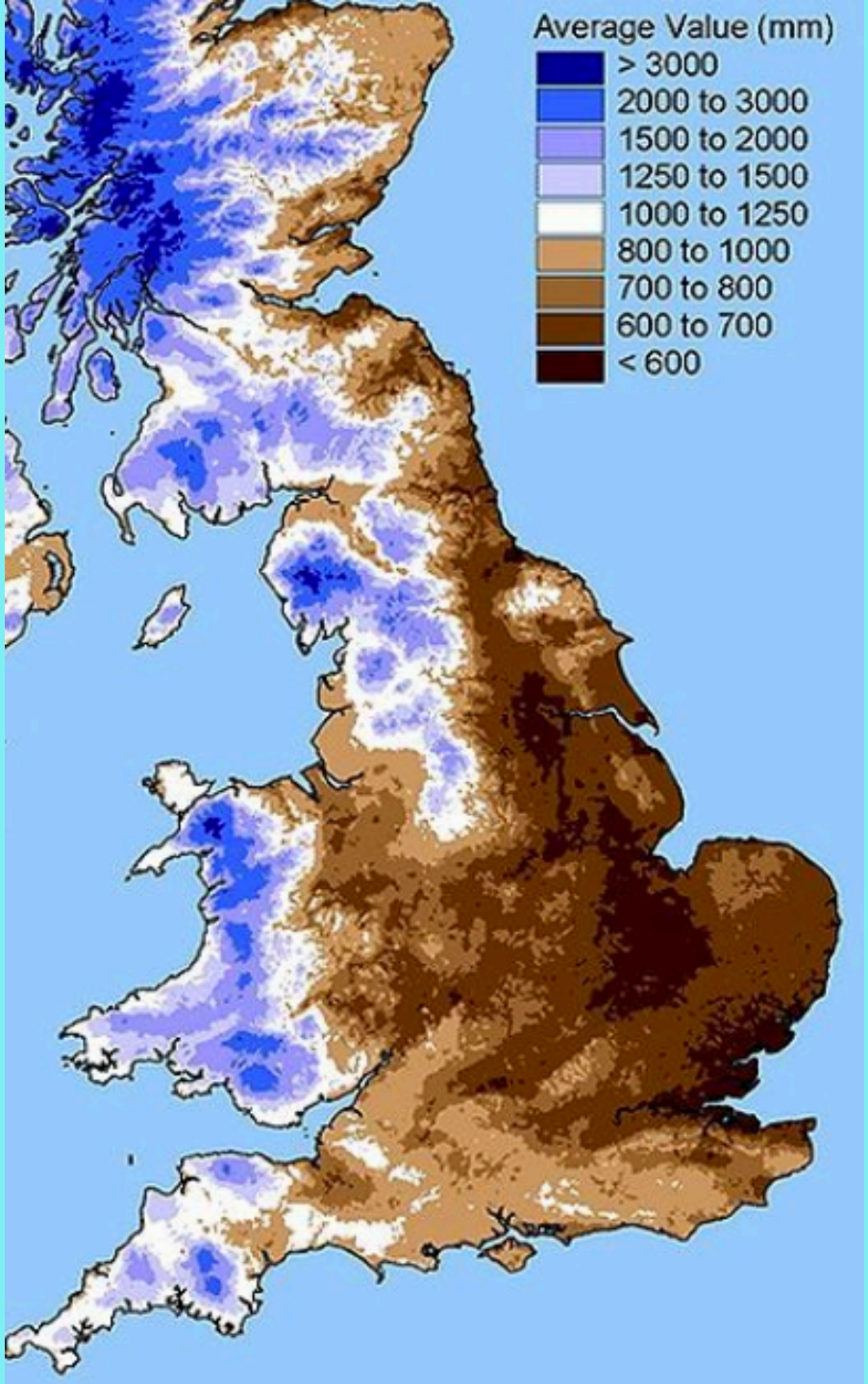
The Rhee, Cam and Granta flows are **winter rainfall dependent.**

Are we short of winter rainfall?

Are we increasingly short all round?

Is this an impact of 'climate change' in our rainfall patterns?





Rainfall

Cambridge is one of the driest places in Britain.

Stretham (on the road to Ely) is perhaps the driest place locally.

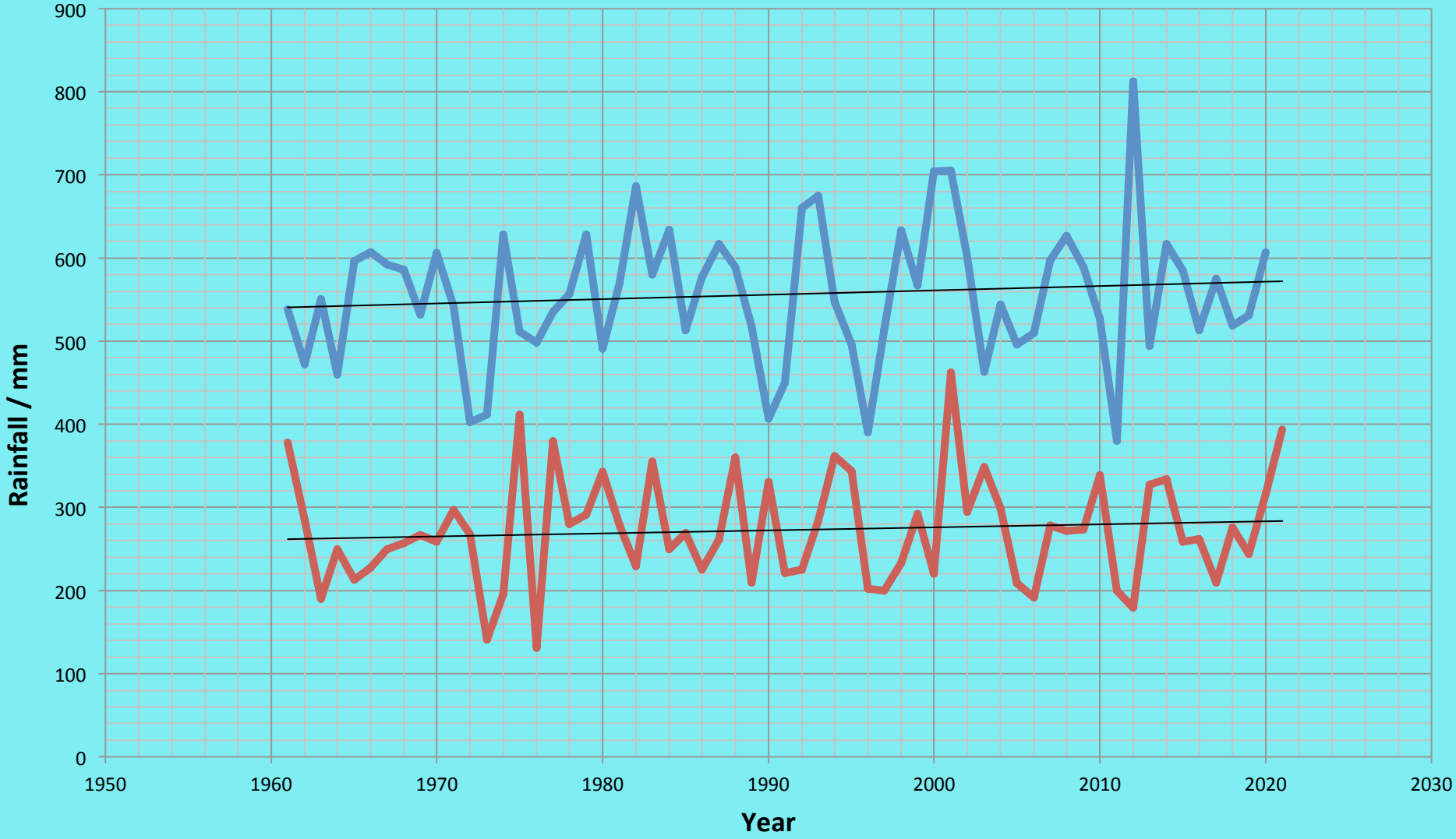
Our mean Cambridge rainfall is only 550 mm per annum

Relative to our water demand we are in a 'water stressed region' comparable to Spain or Morocco. This has just been officially declared for the UK Government for 'principal chalk stream areas'

Is the amount of RAIN a problem?

Cambridge's Annual Rainfall (blue) **and Winter rainfall** (red)

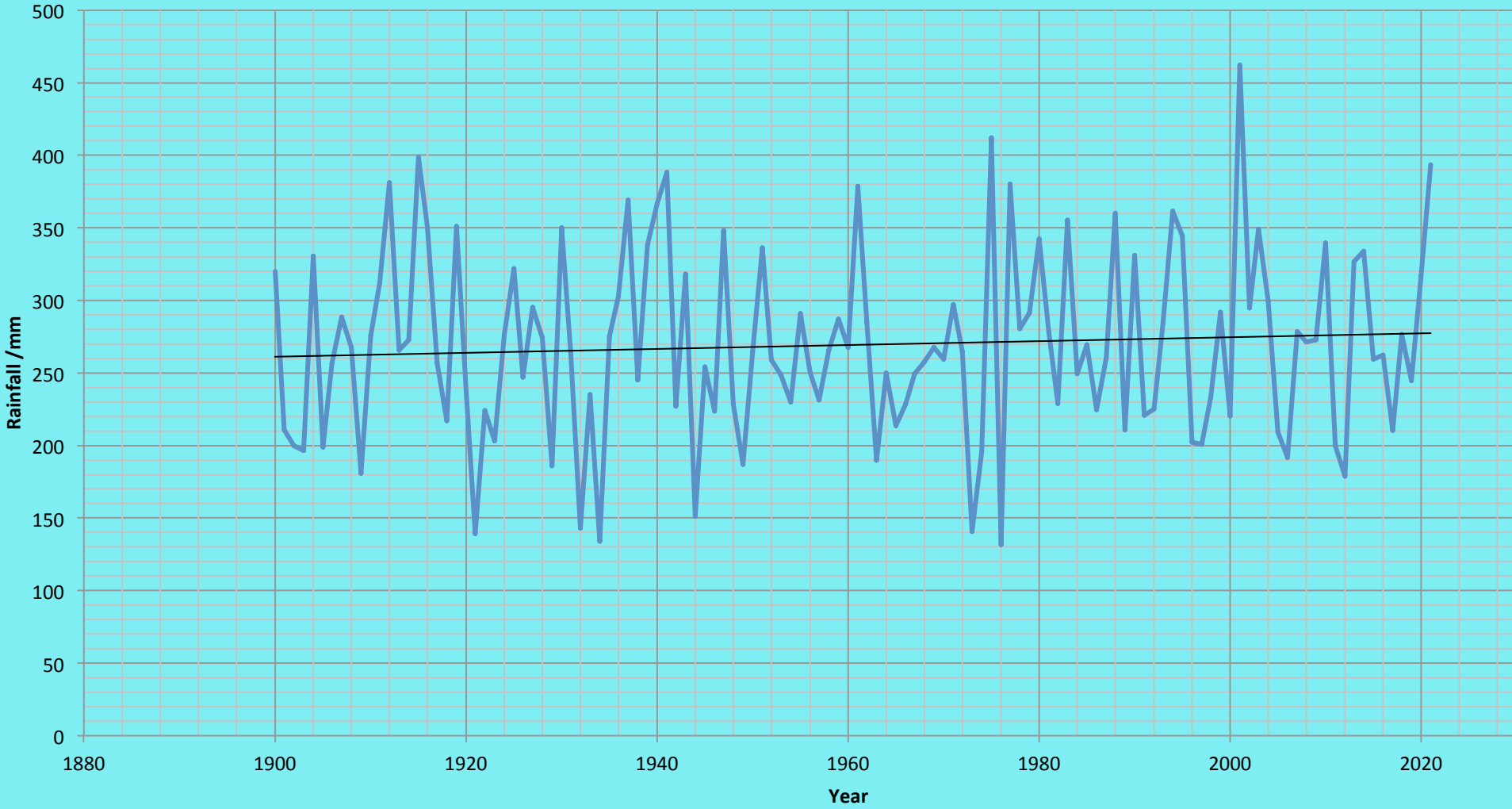
Winter rainfall is the only source for most of the ground water:



60 years of rainfall data from the University Botanic Garden 1962 to 2019

The Winter Rain for Cambridge since 1900. (Winters are Oct to March, ending in year shown)

Data from University of Cambridge Botanic Garden

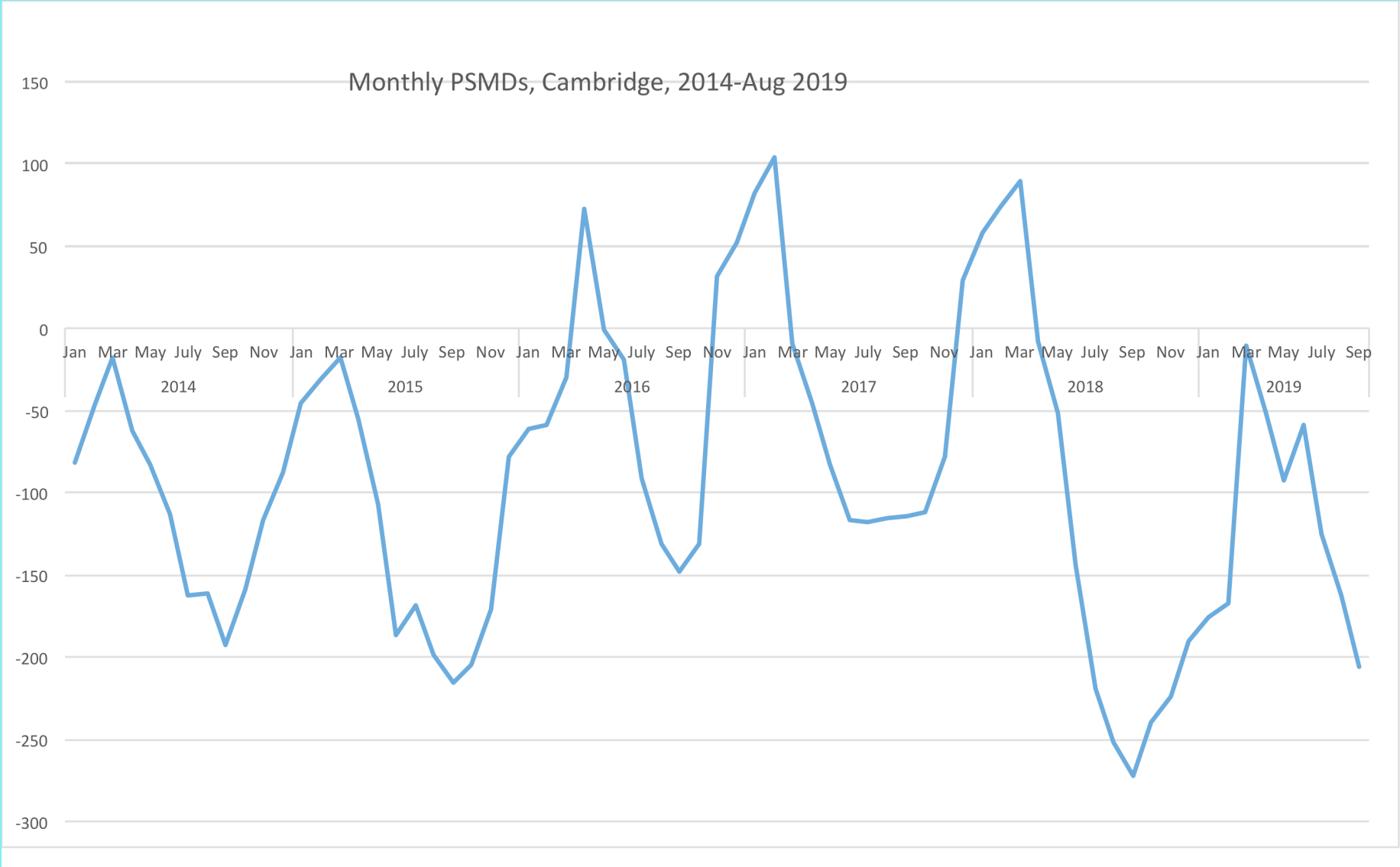


The 120 year pattern is essentially unchanged but the annual variation is considerable

Increasingly negative SOIL MOISTURE DEFICIT is our problem

Does your garden soil dry up ?

Potential Soil Moisture Deficit (*PSMD*) *Graph and calculations from R.Evans. EA Data*



Groundwater may not recharge at all if there are drier winters

How much does river flow vary ?

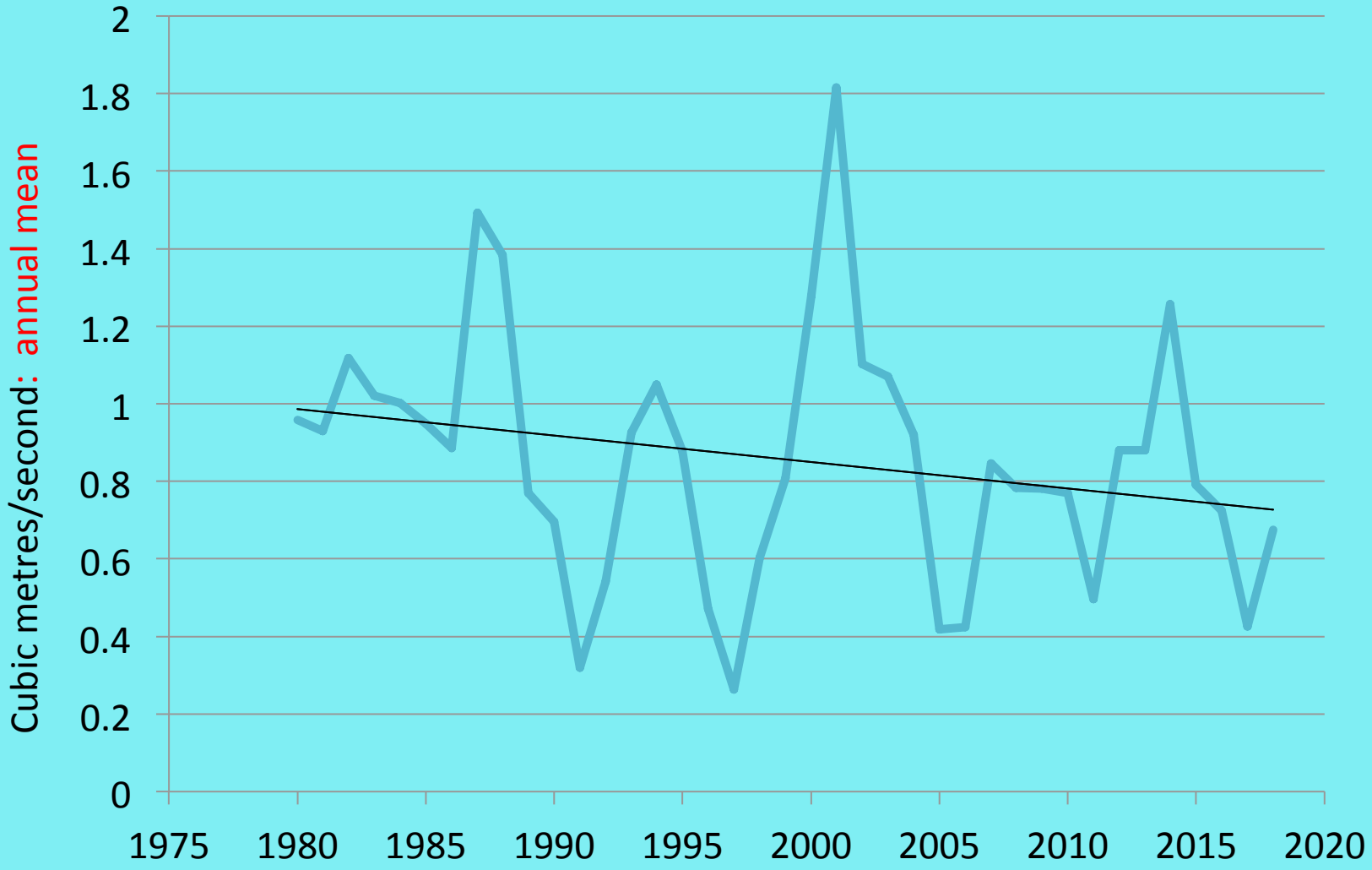
We have access to good flow data for the three main contributory Chalk streams of the Cam Valley: the Rhee, the Cam and the Granta.

An EA flow measuring weir ;

often these are now remotely monitored and data is live and commonly on-line.

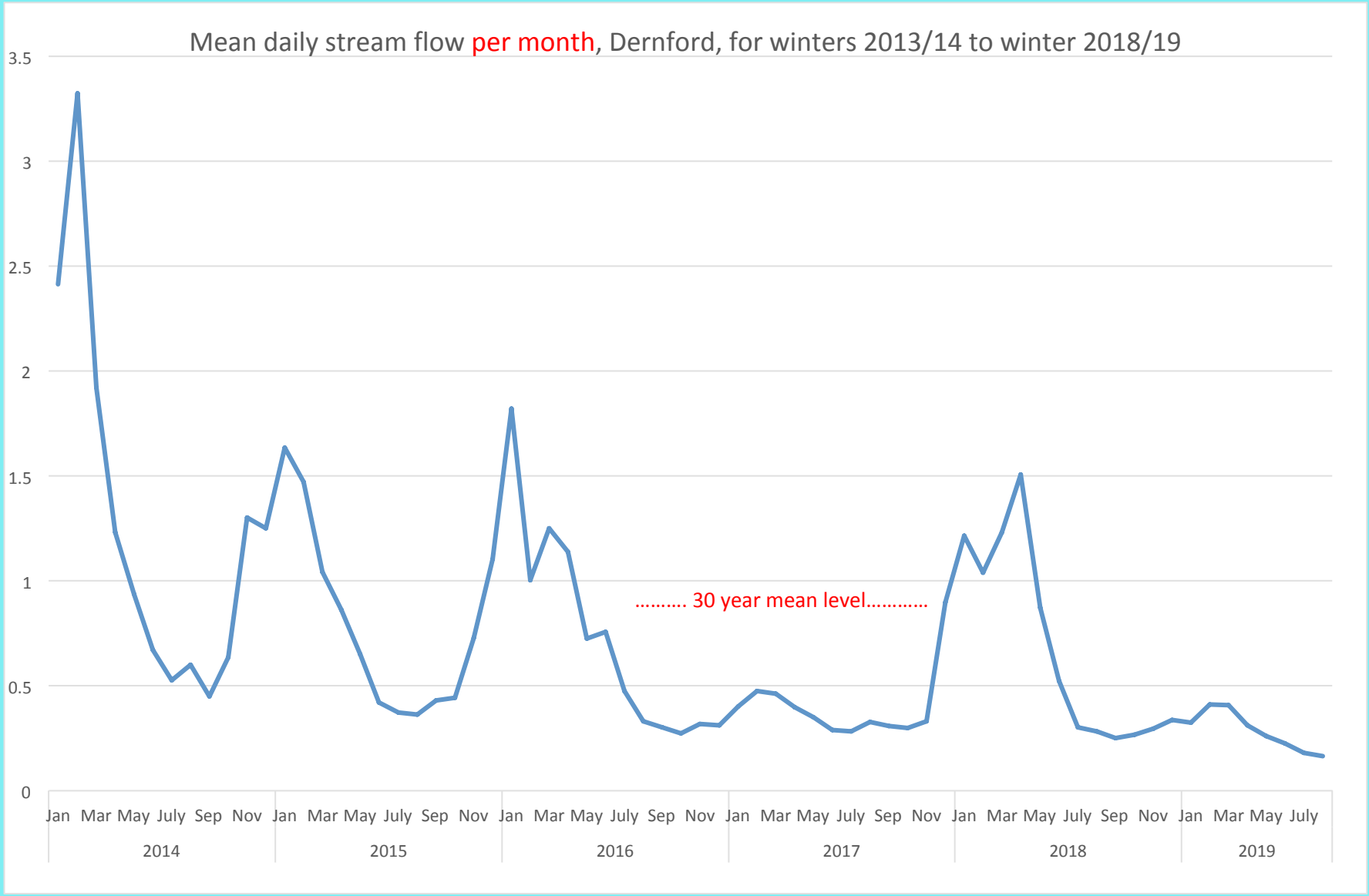
Little more than 10% of the annual rainfall flows down the Cam.

Mean annual flow rates of the River Cam at Dernford:
1980-2018, over the last 38 years (EA data) .



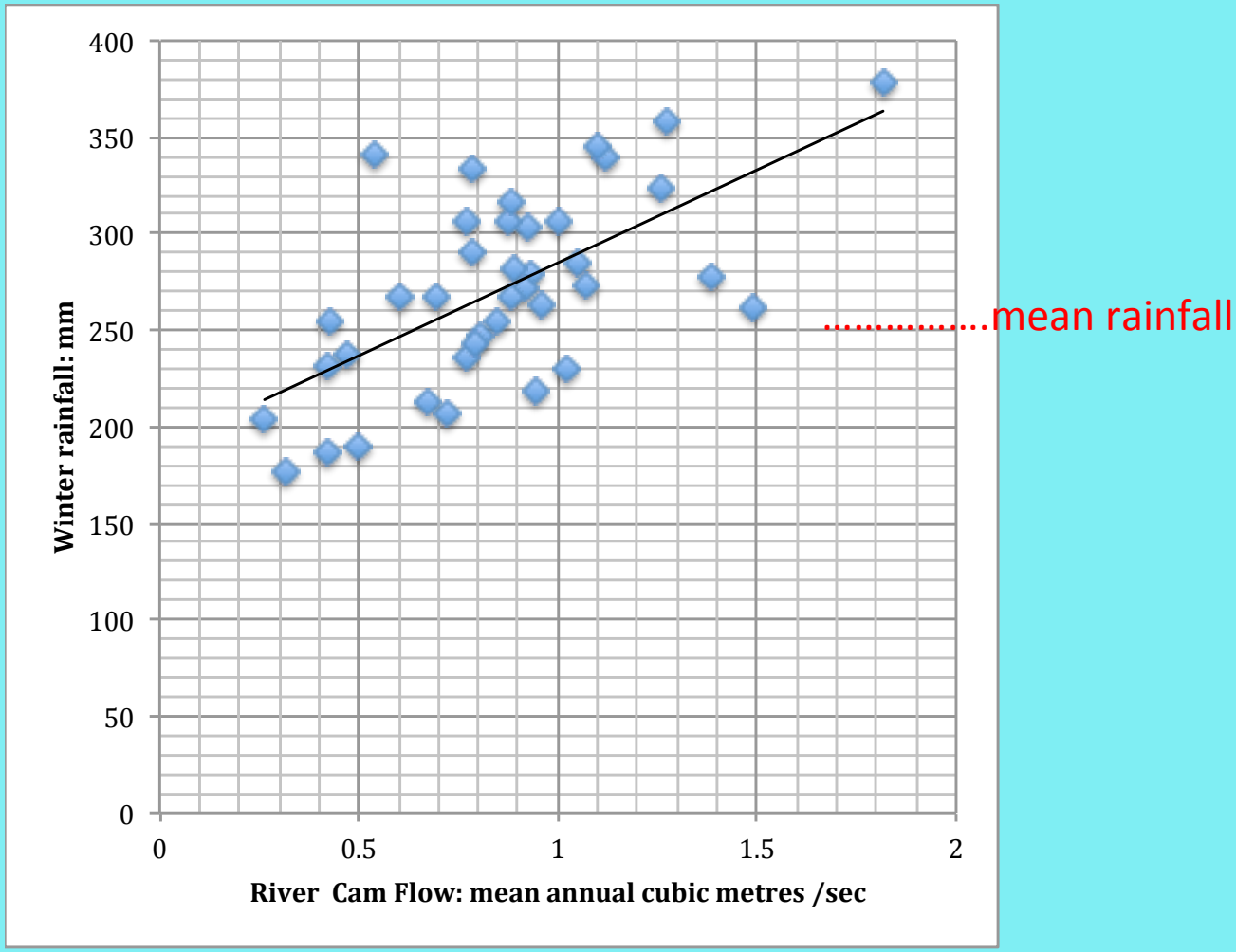
Flow is very variable, year on year, and seems to be reducing.

River Cam Flows (for the Upper Cam at Dernford) *Graph from R.Evans EA Data*



Upper Cam Flow in the last 6 years

1980-2018, a 38 year record of winter rainfall and annual River Cam flow



- Annual river flow correlates quite well with the previous winter rainfall.
- But more than 200 mm of rain, in winter, is essential for any significant annual river flow
- Flow is minimal without good winter rain.
- The lowest flows are only supported by water recycled from treated sewage effluent.

End of Part 1