Daglingworth Stream & Gumstool Brook Water Resources Situation

15 June 2022

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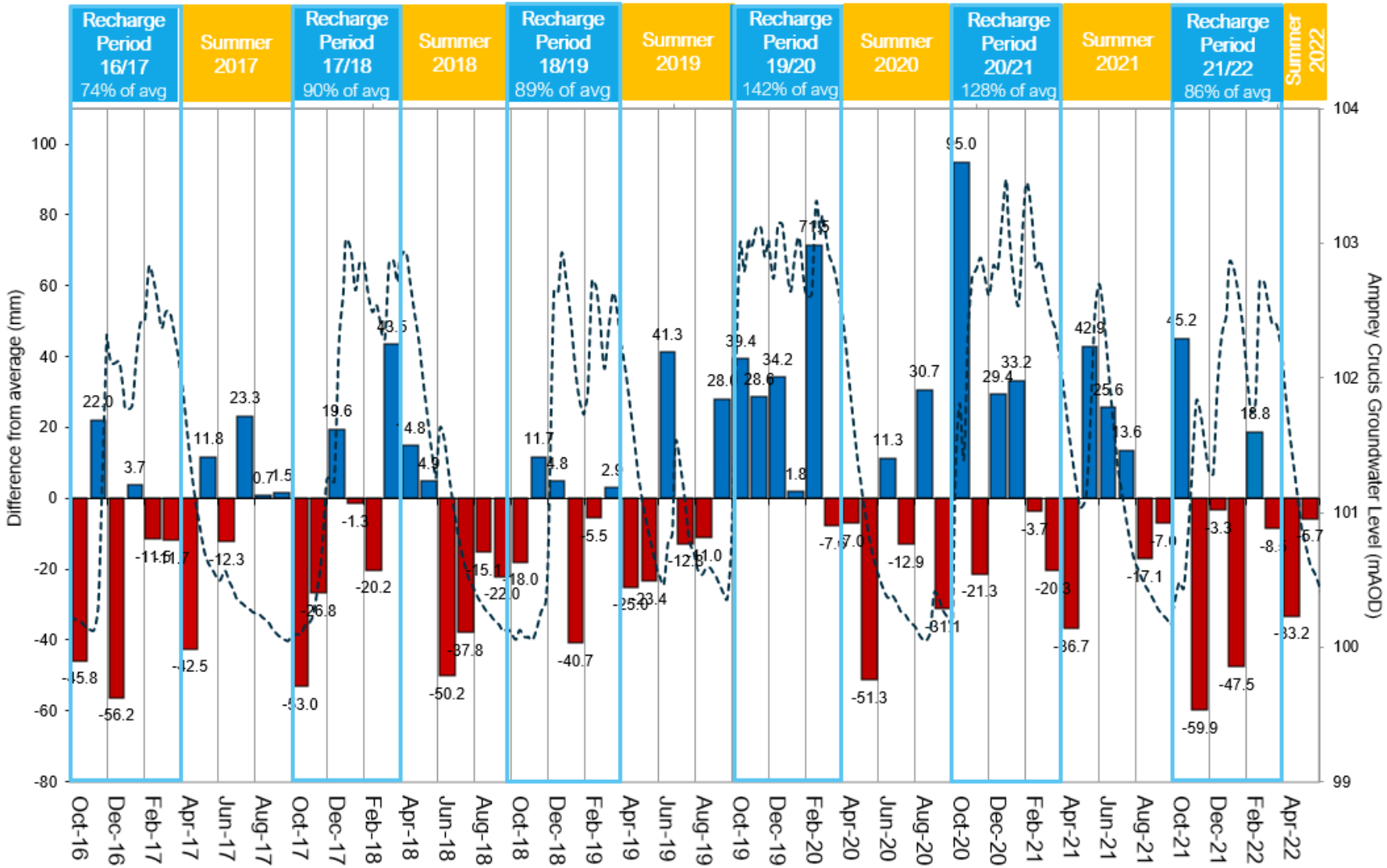
Water resources situation

Key Updates

- Rainfall, recharge & river flows – The wider catchment picture
- Flows in streams in & around Cirencester – The local issues
- Future investigation & understanding
- Working together

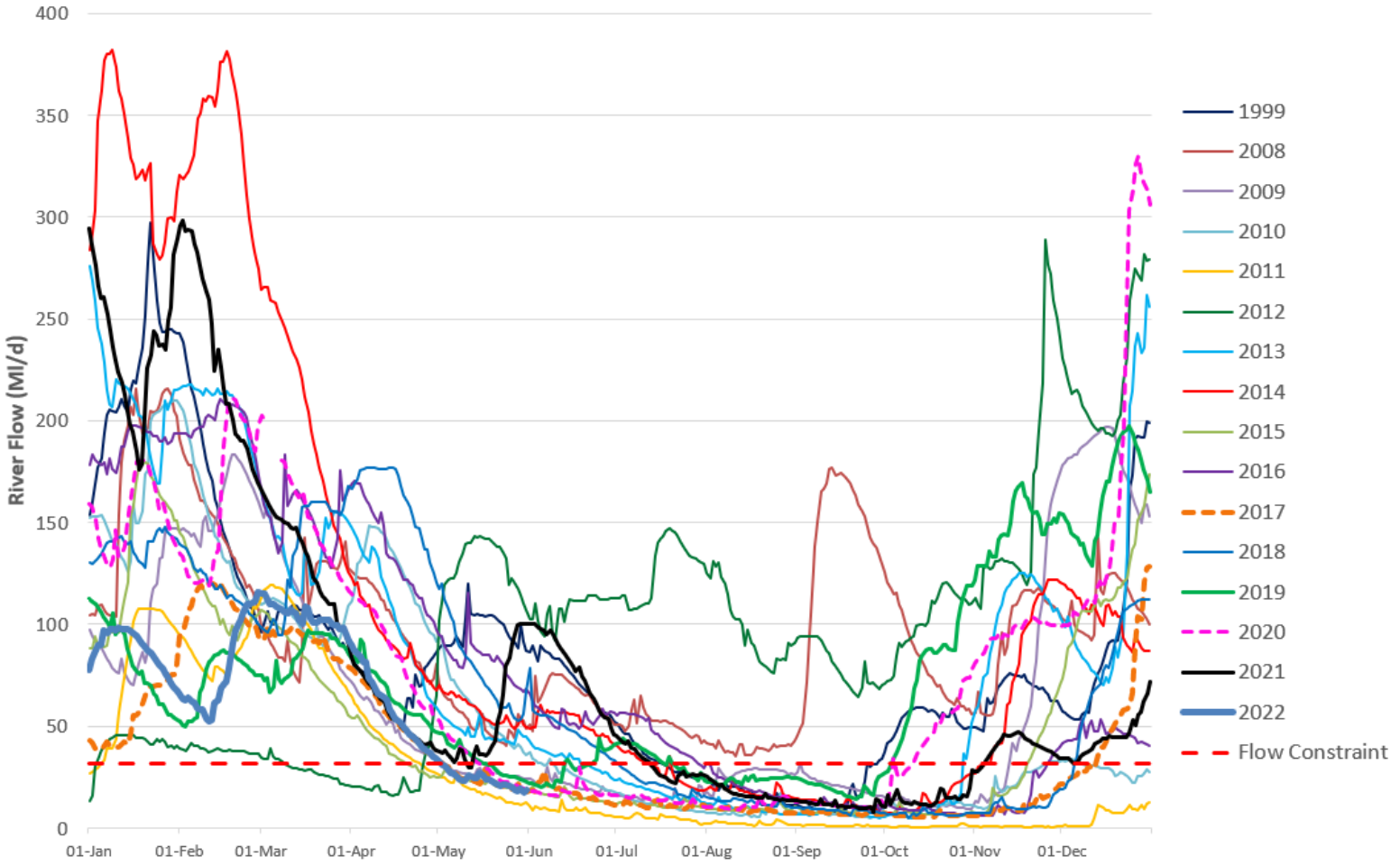
Rainfall, aquifer recharge & groundwater levels



- Natural groundwater flows out of aquifers drive river flows, especially important in drier weather
- Groundwater level rises due to rainfall during autumn & winter recharge periods
- General pattern is similar each year but significant variations occur from year to year
- Above average rainfall in 2020/21 recharged aquifers & high groundwater levels
- Significantly below average rainfall in 2021/22, lowest since 2016/17
- Below average recharge in 2021/22 has also resulted in lower winter groundwater levels

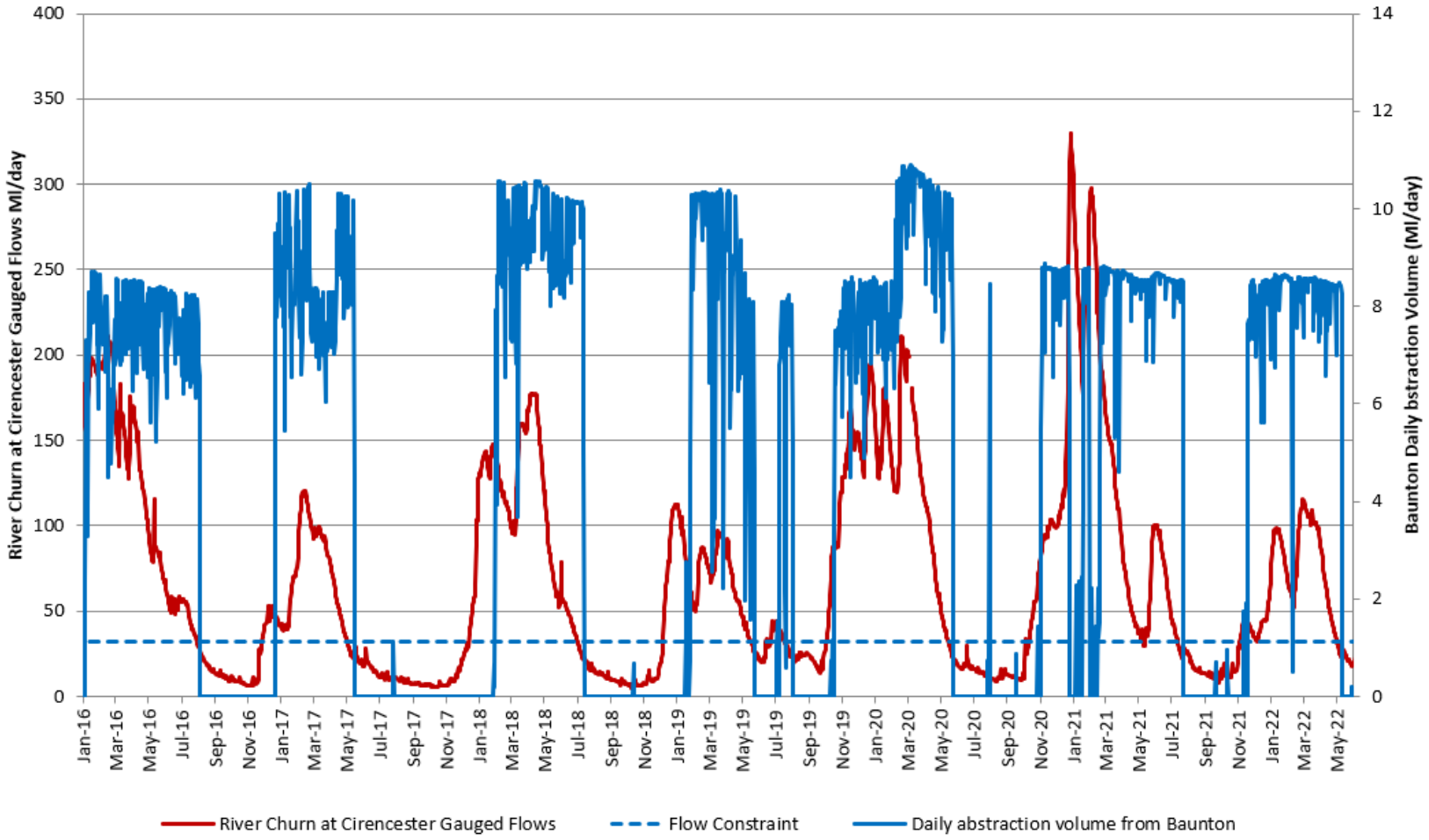
Flow in the River Churn

- Flows vary from year to year but follow the general pattern of groundwater levels in the Great Oolite aquifer
- Higher winter flow when groundwater levels are high, with river flow also increasing in response to rainfall-runoff. Flows decline in summer & autumn as groundwater levels fall
- This general pattern has been seen in 2021 but a dry late spring followed by a dry autumn & winter has resulted in below average flows last year
- The dry start to 2022 has continued to result in below average flow in the River Churn, similar to those seen in 2017



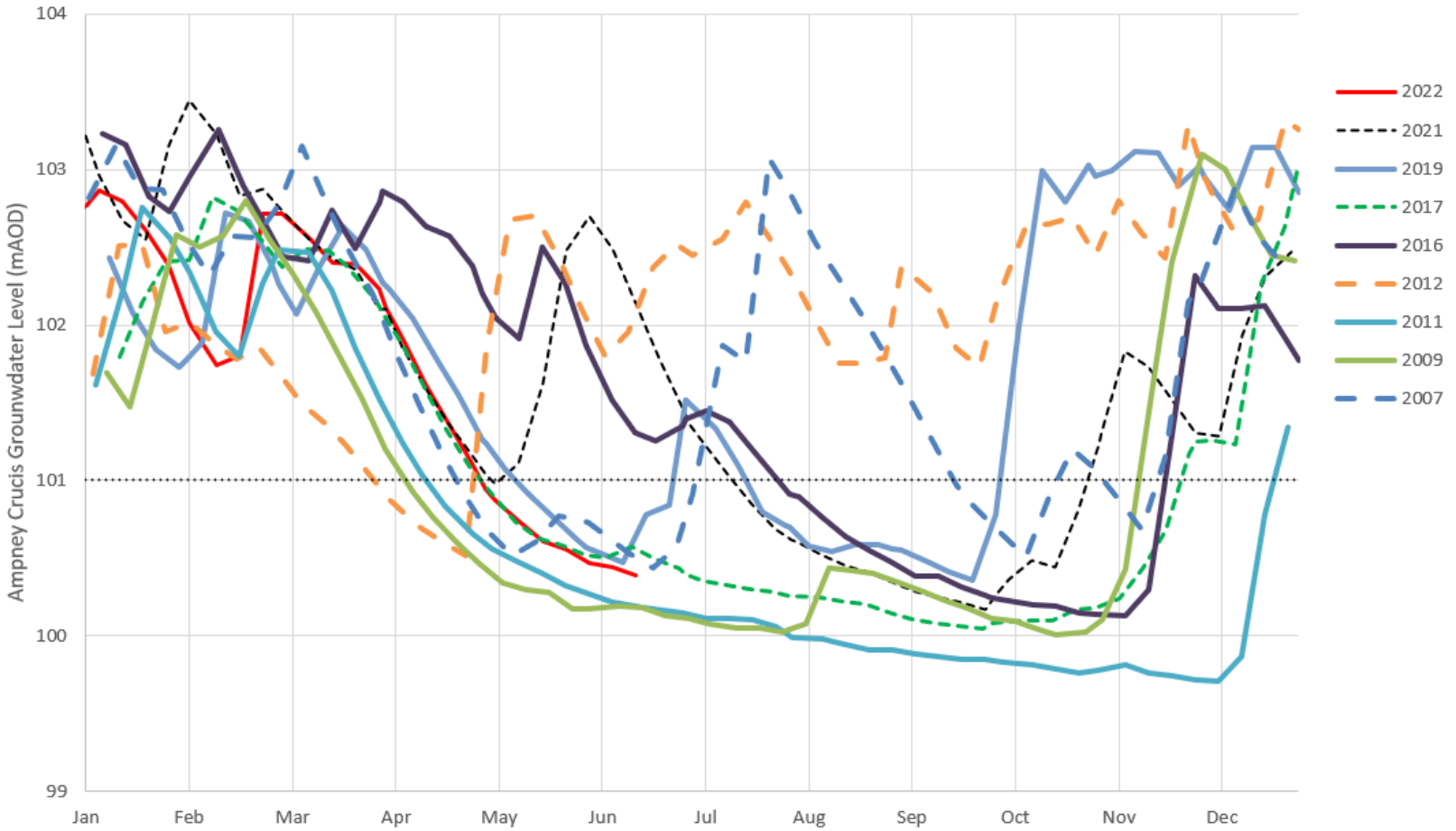
Flow in River Churn & abstraction flow constraint operation

- River flow generally falls below 32 Ml/d almost every year
- With flow <32 Ml/d, groundwater pumped from Baunton for public supply stops; a requirement of Thames Water's licence from EA
- In recent years the flow constraint has been triggered between May and July
- In 2022, the constraint was triggered earlier in May
- As flows in the River Churn are below 32 Ml/d, Baunton will not be pumped unless there is a public water supply emergency



Deep Great Oolite: Year-on-year groundwater trends

- There is a long term consistent relationship between flows in the River Churn and groundwater levels
- Flow in the River Churn falls below 32 Ml/d when Great Oolite groundwater levels at Ampney Crucis fall below 101 m above OD
- Groundwater levels show significant variability from year to year
  - early decline (2009)
  - late decline (2016)
  - early recovery (2019)
  - late recovery (2011)
  - exceptional years (2007 & 2012)
- Continued groundwater level decline in summer 2022, ahead of autumn & winter recovery, will influence flows in the Churn, Daglingworth Stream & Gumstool Brook



- The decline in groundwater levels in 2022 is following a similar trend to that seen in 2017
- We could see low flows in the River Churn, Daglingworth Stream & Gumstool Brook this summer & early autumn

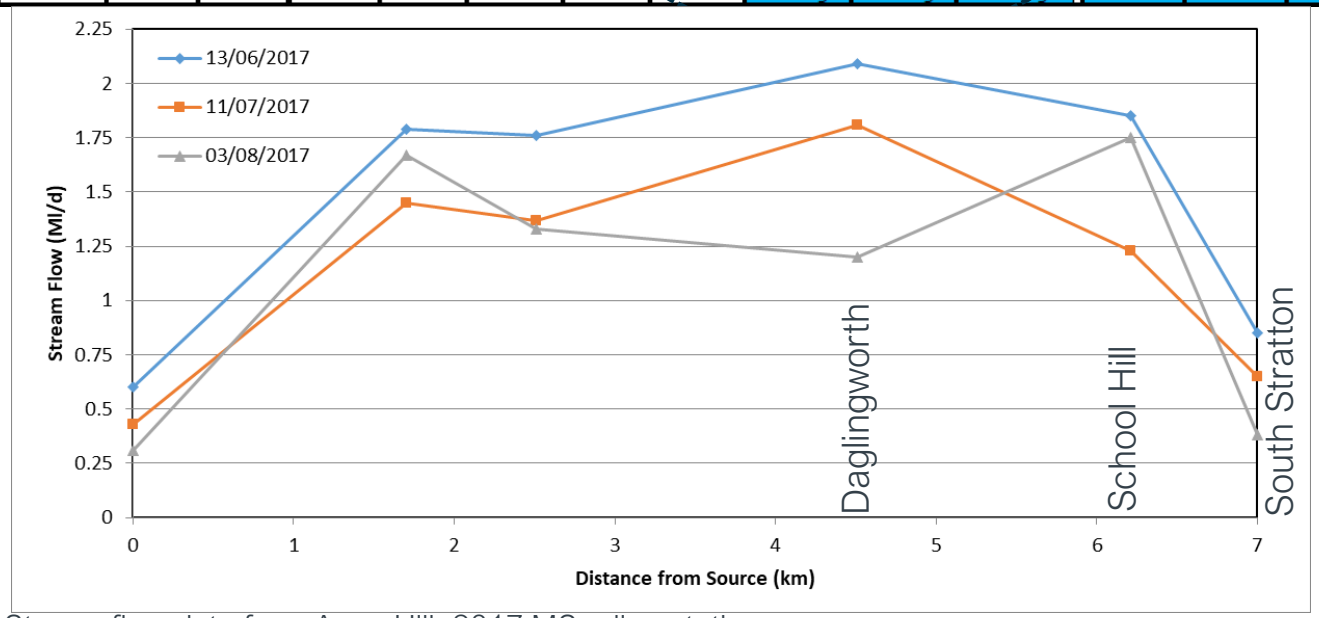
Flows in the Daglingworth Streams & Gumstool Brook

What have we learnt from citizen science monitoring?

- Flow record from 2014, with some gaps, shows that stream flows vary significantly
- Lower reaches of Daglingworth Stream & Gumstool Brook have dried up; most recently apparent in 2018
- Stream starts drying in lower reaches, followed progressively by upper reaches drying
- Consistent with flows measured in 2017 decreasing downstream from Daglingworth to Stratton

Upstream → Downstream

		Date of observation	Dbourne Abbots - Yew Tree	Dbourne Leer	Middle Dbourne	Dbourne Rouse	Dworth	Lower End Dovecote	Stratton School Hill	South Stratton	Barton Lane Ciren	Gumstool Brook offtake	Gloucester St Bridge	Mill Stream	Mill Pond Overflow
18	a	30/01/18	ponded	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing
	b	13/03/18	mud	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	No visit	No visit	No visit
	c	23/04/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	No visit	No visit	No visit
	d	23/05/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	No visit	No visit	No visit
	e	19/06/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	flowing	slow flow	v slow flow	flowing	flowing	flowing
		13/07/18	No visit	No visit	No visit	No visit	No visit	No visit	No visit	Slow flow	v slow flow	dry	flowing	flowing	Slow flow
	f	21/07/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	v slow flow	v slow flow	dry	slow flow	slow flow	Little flow
	g	28/08/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	v slow flow	no flow	dry	no flow	no flow	no flow
	h	25/09/18	Dry	flowing	flowing	flowing	flowing	flowing	flowing	dry	dry	dry	v slow flow	v slow flow	no flow
	i	02/11/18	Dry	flowing	Flowing	flowing	flowing	flowing	No flow	dry	dry	dry	slow flow	slow flow	slow flow
	j	04/12/18	Dry	Flowing	Flowing	Flowing	Flowing	Flowing	Slow flow	dry	dry	dry	flowing	flowing	flowing
	k	07/12/18	No visit	No visit	No visit	No visit	No visit	No visit	No visit	flowing	flowing	flowing	flowing	flowing	flowing



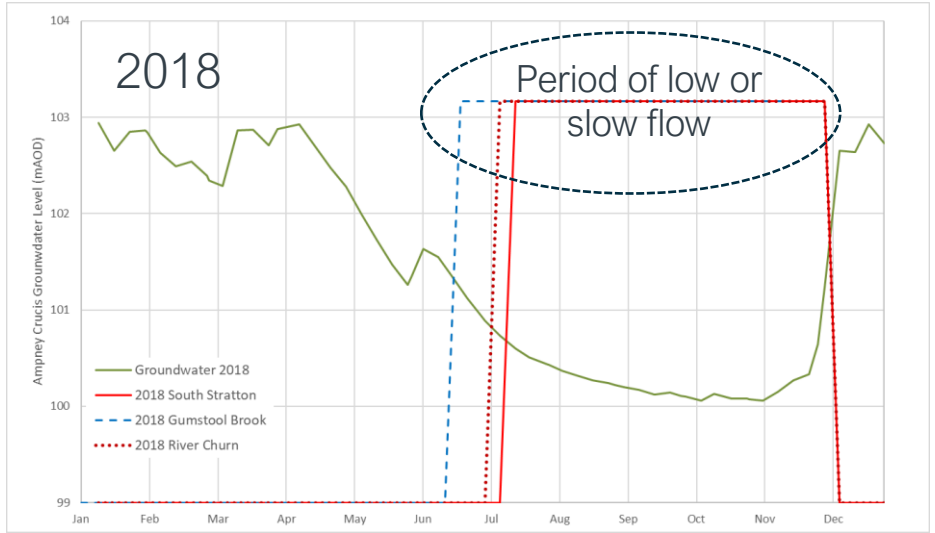
Stream flow data from Anna Hill, 2017 MSc dissertation

Flows in the Daglingworth Streams & Gumstool Brook

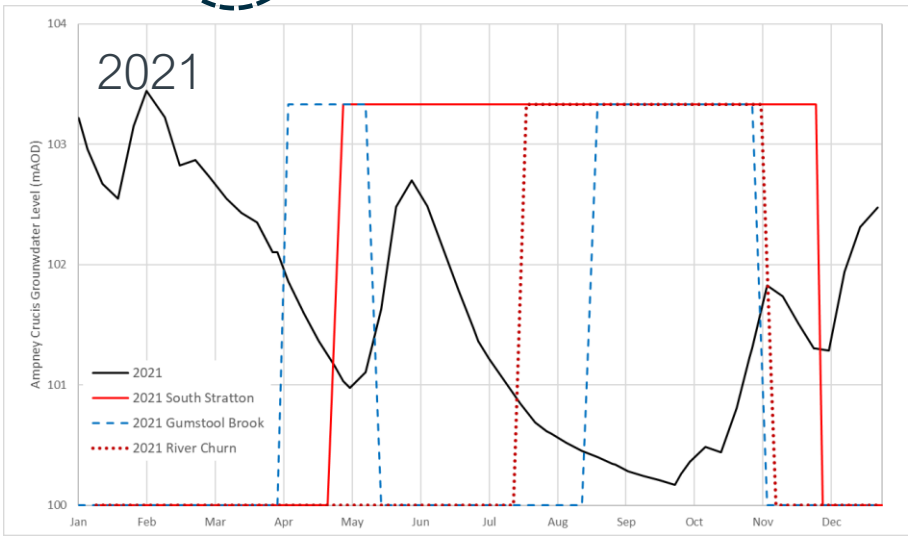
What have we learnt from citizen science monitoring?

- Daglingworth Stream recorded as having no flow in summer & autumn 2020, and from April to November 2021
- Extent of drying recorded as affecting a river reach around 750 m to 1.5 km long between Daglingworth & South Stratton
- Similar reductions in flow measured here previously, e.g. 2018, but concern about extent & duration of no flow in 2021

		Date of observation	Dbourne Abbots - Yew Tree	Dbourne Leer	Middle Dbourne	Dbourne Rouse	Dworth	Lower End Dovecote	Stratton School Hill	South Stratton	Barton Lane Ciren	Gumstool Brook offtake	Gloucester St Bridge	Mill Stream	Mill Pond Overflow
20	a	28/01/20	mud	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing
	b	20,21/02/20	flowing	flowing	flowing	flowing	flowing	flowing	flowing	flowing	overflowing	flowing	flowing	flowing	overflowing
	c	15/05/20	Dry	flowing	flowing	flowing	flowing	flowing	slow flow	flowing	flowing	flowing	flowing	slow flow	flowing
	d	12/06/20	Dry	flowing	flowing	flowing	flowing	flowing	Slow flow	No flow	slow flow	slow flow	flowing	Slow flow	no flow
	e	17/07/20	Dry	flowing	flowiing	flowing	flowing	flowing	dry	No flow	slow flow	slow flow	slow flow	slow flow	slow flow
	f	31/08/20	Dry	flowing	flowing	flowing	flowing	flowing	dry	No flow	slow flow	v slow flow	slow flow	slow flow	slow flow
	g	11/10/20	Dry	flowing	flowing	flowing	flowing	flowing	dry	No flow	flowing	slow flow	flowing	filling	filling
	h	27,28,29/11/20	Dry	flowing	flowing	flowing	flowing	flowing	dry	flowing	flowing	flowing	flowing	flowing	flowing
21	a	19/01/21	flowing	flowing	flowing	flowing	flowing	flowing	flowing	overflowing	flowing	flowing	flowing	flowing	flowing
	b	26/04/21	mud	flowing	flowing	flowing	flowing	flowing	dry	dry	flowiing	Slow flow	flowing	flowing	flowing
c	c	11/06/21	wet	flowing	flowing	flowing	flowing	flowing	dry	dry	flowing	flowing	flowing	flowing	flowing
d	d	09/07/21	wet	flowing	flowing	flowing	flowing	flowing	dry	dry	flowing	flowing	flowing	flowing	flowing
e	e	20/08/21	mud	flowing	flowing	flowing	flowing	flowing	dry	dry	dry	slow flow	slow flow	slow flow	no flow
f	f	25/09/21	mud	flowing	flowing	flowing	flowing	flowing	dry	dry	No flow	Slow flow	flowing	slow flow	v slow flow
g	26	29/10/21	wet	flowing	flowing	flowing	flowing	flowing	dry	dry	No flow	wet	flowing	slow flow	v slow flow
h	27	10/12/21	No visit	No visit	No visit	No visit	No visit	No visit	dry	dry	flowing	flowing	flowing	flowing	flowing
i	28	13/12/21	No visit	No visit	No visit	No visit	No visit	No visit	dry	dry	No visit	No visit	No visit	No visit	No visit
j	29	19/12/21	No visit	No visit	No visit	No visit	No visit	No visit	dry	dry	No visit	No visit	No visit	No visit	No visit
k	30	29/12/21	No visit	No visit	No visit	No visit	No visit	No visit	dry	v slow flow	No visit	No visit	No visit	No visit	No visit
l	31	31/12/21	No visit	No visit	No visit	No visit	No visit	No visit	dry	flowing	No visit	No visit	No visit	No visit	No visit



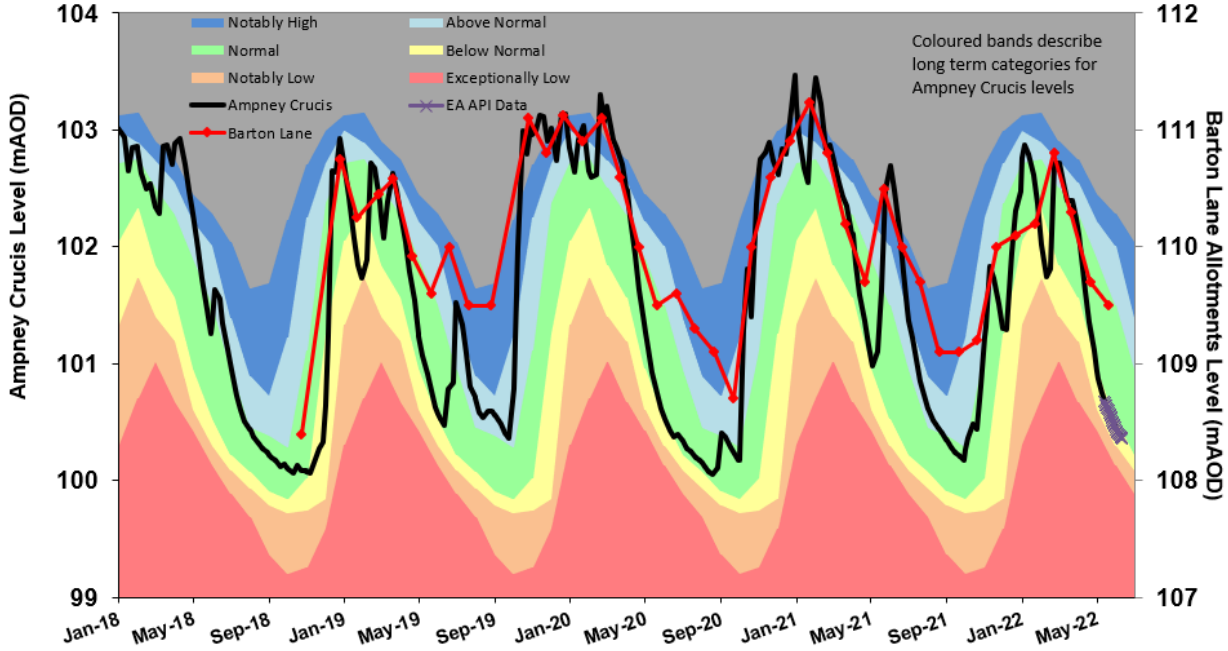
- Graphs show Great Oolite groundwater levels
- Include periods when there is low, slow or no river & stream flow:
  - River Churn <32 Ml/d
  - Slow flow in Gumstool Brook
  - No flow in Daglingworth Stream at Stratton

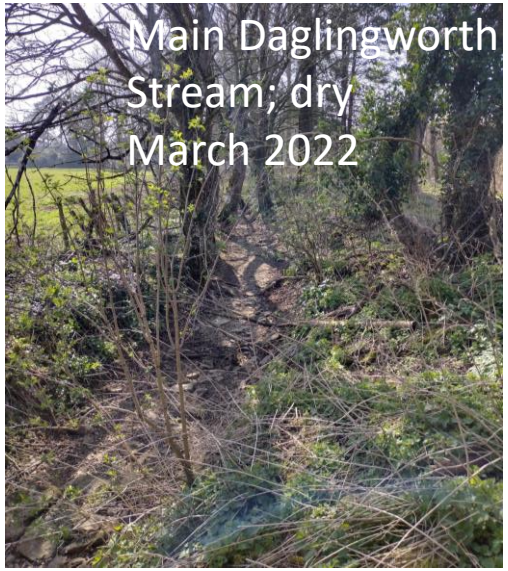


Deep Great Oolite & shallow Gravel groundwater

Monitoring information from citizen science

- Consistent pattern of groundwater fluctuations identified in the Great Oolite & Gravel aquifers
- Potential for interactions between groundwater in Gravel aquifer, the River Churn and Daglingworth Stream within Cirencester
- Local relationships between groundwater levels and topography, e.g. multiple stream channels, channel depth, are significant influences on stream flows





- Are there too many channels to support stream flows under dry weather and drought conditions?

Future investigation & understanding

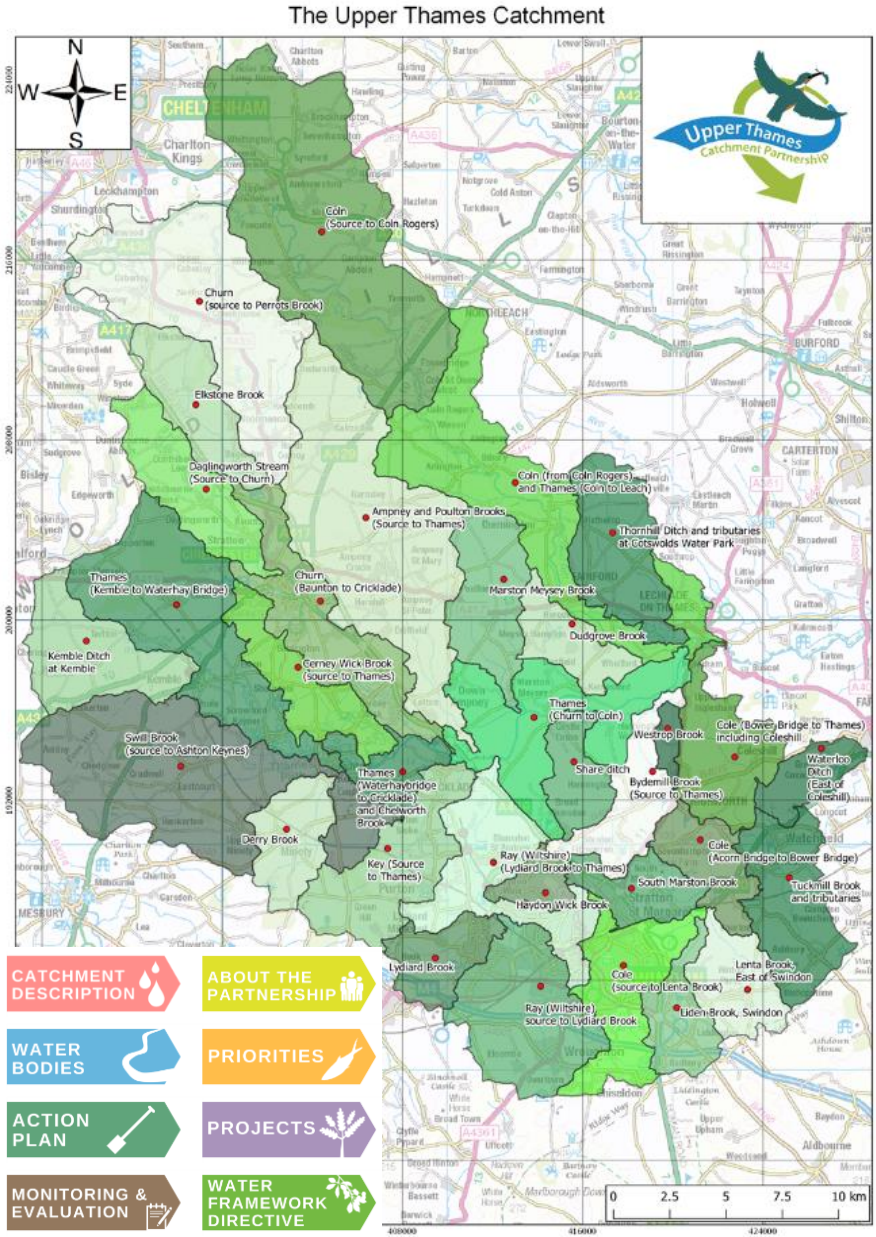
Development of citizen science

- Some suggestions are set out below for future investigation to develop understanding of the characteristics and functioning of the local streams
- This is an illustrative, not an exhaustive, list with different priorities and cost

Topic	Rationale	Priority	Cost
Maintain regular record of stream flow & groundwater level observations	Demonstrable benefits in improving awareness & understanding	High	£
Retain access to wider catchment river & groundwater data	Provides important context for local streams & is possible with data being available online from the gov.uk website	High	£
Implement stream spot flow & level monitoring	Enable stream flows in various reaches to be quantified & adequacy assessed	Medium	££
Stream channel topographic survey	Establish reaches with the higher potential for stream flow to occur & reaches where streams lose flow	High	£££
Stream ecological health	Structured recording and assessment of natural & artificial physical habitat of streams that influence aquatic wildlife (MoRPh surveys)	Medium	£

Working Together

- Preceding slides influenced by low flow but significant natural fluctuations in the water environment have been experienced in & around Cirencester with flood and low flows at the opposite extremes
- Multiple environmental and social drivers with diverse stakeholders having a wide range of interests, influence and funding possibilities
- Opportunity to participate in the Upper Thames Catchment Partnership, which includes the Daglingworth Stream & the Churn https://www.fwagsw.org.uk/upper-thames-catchment-partnership
- Hosted by FWAG, the Partnership is working towards delivering 'Good Ecological Status' for the rivers of the catchment, including
  - working with land managers on drainage
  - water quality improvements
  - delivering habitat restoration
- Working together, in partnership, should enable improved insight, integrated solutions and maintain stewardship of the streams




Thames
Water