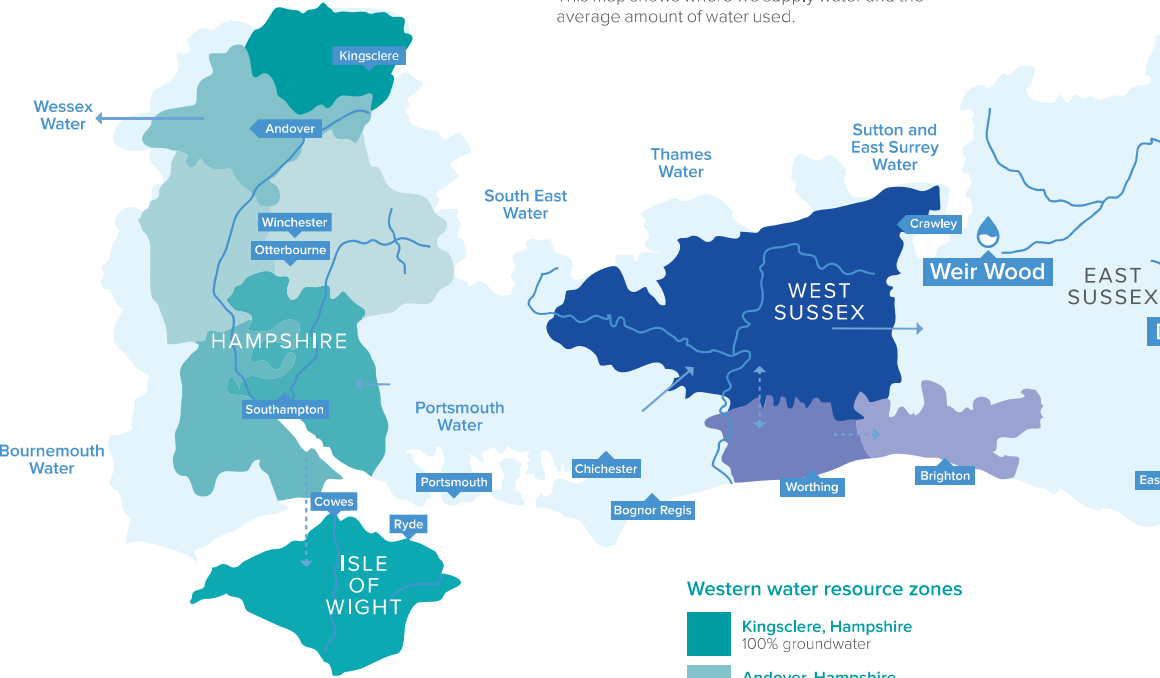


Where your water comes from today

We supply water to more than one million homes and businesses in Kent, Sussex, Hampshire and the Isle of Wight.

Most of the region is officially classed as seriously 'water-stressed', which means that at times the demand for water can be higher than the amount available. However, each county also has different water sources and experiences different weather. It's not unusual for one area to be in drought while supplies are normal in a neighbouring area. This is also because the area we supply is divided into 14 separate 'water resource zones'.

This map shows where we supply water and the average amount of water used.



Western area

North Hampshire takes all of its water from groundwater. South Hampshire takes one-third from groundwater and two-thirds from the River Test and the River Itchen. The Isle of Wight takes its water from the River Yar, the River Medina and groundwater, but also relies on water pumped across from south Hampshire for a third of its drinking water.



Metered water use per person per day:
Hampshire – 124 litres
Isle of Wight – 122 litres



Unmetered water use per person per day:
Hampshire – 147 litres
Isle of Wight – 215 litres

Western water resource zones

- Kingsclere, Hampshire**
100% groundwater
- Andover, Hampshire**
100% groundwater
- Rural Hampshire**
100% groundwater
- Winchester, Hampshire**
100% groundwater
- Southampton East, Hampshire**
52% river, 48% groundwater
- Southampton West, Hampshire**
100% river
- Isle of Wight**
47% groundwater, 23% river, 30% transfers

Central area

Brighton, Worthing and surrounding areas take all their water from groundwater, while North Sussex has a mix of water from rivers, groundwater, a reservoir and a water supply from Portsmouth Water.



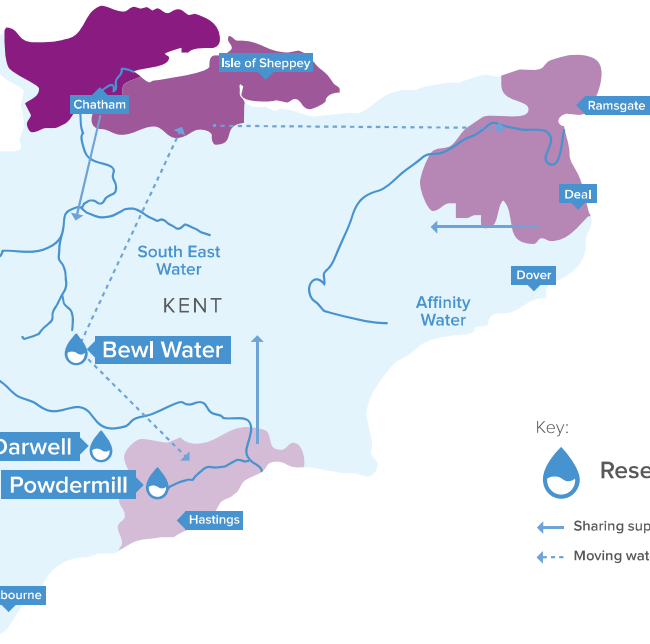
Metered water use per person per day:
127 litres



Unmetered water use per person per day:
179 litres

Central water resource zones

- North Sussex**
35% groundwater, 51% river, 8% reservoir, 6% transfers
- Worthing, Sussex**
98% groundwater, 2% transfers
- Brighton, Sussex**
100% groundwater



Key:



Reservoir

← Sharing supplies between water companies

← - - - Moving water in our supply zones

Eastern area

In Kent, Medway East, Medway West and Thanet take most of their water from groundwater and the rest from the River Medway, some of which is stored in Bexhill Water reservoir and later released into the River Medway. Hastings in Sussex takes most of its water from Darwell reservoir and Powdermill reservoir, with the rest from groundwater. Water is transferred by pipeline from Medway to Thanet, and from Medway to Hastings.



Metered water use per person per day:
123 litres



Unmetered water use per person per day:
169 litres

Eastern water resource zones

- Medway East, Kent**
100% groundwater
- Medway West, Kent**
56% river and reservoir, 44% groundwater
- Thanet, Kent**
77% groundwater, 2% river, 21% transfers
- Hastings, Sussex**
5% groundwater, 79% reservoir, 16% transfers

Appendix 6530-01/12:

WRMP Annex 3 Table 44 'Summary of deployable outputs for
Sussex North WRZ'

Table 44 Summary of deployable outputs for Sussex North WRZ

Name	MDO (MI/d)						PDO (MI/d)						DO Constraints		Decrease from WRMP14 (MI/d)	
	Normal Year	1 in 20 Year	1 in 100 Year	1 in 200 Year	1 in 500 Year	1 in 1000 Year	Normal Year	1 in 20 Year	1 in 100 Year	1 in 200 Year	1 in 500 Year	1 in 1000 Year	MDO	PDO	MDO	PDO
Pulborough Groundwater	20.00	20.00	20.00	20.00	0.00	0.00	27.00	27.00	27.00	27.00	0.00	0.00	Sustainable Yield (90 day)	Pump Capacity	-7.00	0.00
Pulborough Surface	30.58	17.22	4.19	1.17	0.00	0.00	33.00	22.91	8.07	3.81	1.08	1.08	Yield above Prescribed River Flow	Yield above Prescribed River Flow	6.58	0.50
River Arun	10.00	10.00	10.00	10.00	10.00	10.00	15.00	15.00	15.00	15.00	15.00	15.00	Licence	Licence	0.00	0.00
Weir Wood Reservoir	8.00	7.50	7.00	5.40	1.95	0.96	17.00	17.00	17.00	17.00	17.00	17.00	Yield	Treatment works	0.00	0.00
Petworth South	2.14	2.14	2.14	2.14	2.14	2.14	2.43	2.43	2.43	2.43	2.43	2.43	Annual Licence	Daily Licence	0.00	0.00
Petersfield	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Written down (needs treatment upgrade)	Written down (needs treatment upgrade)	1.60	1.96
Midhurst	2.19	2.19	2.19	2.19	2.19	2.19	2.88	2.88	2.88	2.88	2.88	2.88	Annual Licence	Daily Licence	0.00	0.00
West Chiltington	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Written down (needs treatment upgrade)	Written down (needs treatment upgrade)	3.12	3.12
Steyning	1.20	1.20	1.20	1.20	1.20	1.20	1.30	1.30	1.30	1.30	1.30	1.30	Demand constraint	Pump capacity	0.00	0.00
Total	74.11	60.25	46.72	42.10	17.48	16.49	98.61	88.52	73.68	69.42	39.69	38.61			4.30	5.58

Appendix 6530-01/13:

Correspondence from Natural England dated 16 December 2019

Date: 16 December 2019
Our ref: consultation 279526
Your ref: Wellfield reconfiguration various



BY EMAIL ONLY

Southern Water
By Email only - @southernwater.co.uk>

Customer Services
Hornbeam House
Crewe Business
Park
Electra Way
Crewe
Cheshire
CW1 6GJ

0300 060 3900

Dear

Discretionary Advice Service (Charged Advice)

Development proposal and location: Wellfield reconfiguration and licence change

Thank you for your consultations and discussions on the above received and discussed on various dates in July through December 2019). This advice is being provided as part of Natural England's Discretionary Advice Service. This advice is provided in accordance with the Quotation and Agreement dated 26 April 2019. Detailed advice is provided in Annex 1 based upon the information within the documents provided and listed below.

Southern Water has asked Natural England to provide an interim view of the Wellfield reconfiguration and licence change proposals including upon:

- Wellfield Abstraction Impacts Revision 2.3; 10 June 2019
- Arun Valley Sustainability Study – various documents comprising the whole study downloaded by Natural England on Various August dates in 2019
- Joint teleconferences on 5/6/2019 explaining Natural England emerging concerns and asking clarification questions of Southern water
- Natural England queries to Southern Water in email sent on 9/9/2019 discussed in meeting of 30/09/2019.
- Teleconference with Natural England, Environment Agency and Atkins December 2019
- Additional bore hole logs 12/12/19

This advice compiles a number of officers input including significant input from the following: the national senior specialist on ecohydrology, the national wetland specialist (Iain Diack), local bird casework specialist (Alison Giacomelli), as well as the signatory to the letter (Dr Louise Bardsley) and has been discussed with the Environment Agency.

SEMD

I have tried not to include any of the sensitive information on borehole location that is covered by the Security and Emergency Measures Direction (SEMD) in this response and we therefore hope this response can be released to external parties should the company wish to do so, following its own SEMD check.

■■■■■ consultation 279526 and various

commercialservices@naturalengland.org.uk

We would welcome any comments you might have about our service.

The advice provided in this letter has been through Natural England's Quality Assurance process.

The advice provided within the Discretionary Advice Service is the professional advice of the Natural England adviser named below. It is the best advice that can be given based on the information provided so far. Its quality and detail is dependent upon the quality and depth of the information which has been provided. It does not constitute a statutory response or decision, which will be made by Natural England acting corporately in its role as statutory consultee to the competent authority after an application has been submitted. The advice given is therefore not binding in any way and is provided without prejudice to the consideration of any statutory consultation response or decision which may be made by Natural England in due course. The final judgement on any proposals by Natural England is reserved until an application is made and will be made on the information then available, including any modifications to the proposal made after receipt of discretionary advice. All pre-application advice is subject to review and revision in the light of changes in relevant considerations, including changes in relation to the facts, scientific knowledge/evidence, policy, guidance or law. Natural England will not accept any liability for the accuracy, adequacy or completeness of, nor will any express or implied warranty be given for, the advice. This exclusion does not extend to any fraudulent misrepresentation made by or on behalf of Natural England.

Yours sincerely

■■■■■

Dr Louise Bardsley
Senior Adviser (Water Sector) Thames and South East RBD

CC ■■■■■ - Southern Water

CC Jane Birch and Alison Matthews - Environment Agency

Annex 1 - Detailed advice

1.1) Overarching plan interim advice

The following is the compiled view of the Natural England officers without prejudice (to further information that may be forthcoming from further monitoring) based on the best available evidence. When the word we is used it refers to the consensus view of the officers involved:

- A likely significant effect on the Waltham Brooks SSSI part of the Arun Valley SPA and Ramsar site **has** been excluded on the basis of objective evidence.
- We do not agree a likely significant effect has been excluded on the basis of objective evidence of the existing and new proposed wellfield on Amberley Wild Brooks SSSI part of the Arun Valley SPA, Ramsar site and SAC. There is no appropriate assessment so no view on the integrity test can be provided. An appropriate assessment on the impacts of the proposals on this site is required.
- We do not agree with the conclusion of the appropriate assessment with regards the Pulborough Brooks part of the site. We cannot be certain there is no adverse effect of the existing and new proposed wellfield abstraction on the integrity of the Pulborough Brooks SSSI part of the Arun Valley SPA, Ramsar and SAC, not only of the existing abstraction) but also of the new proposed reduced total abstraction – irrespective of whether you move the wellfield bore holes closer to the site.

1.2) Designated sites and current condition

The designated sites that are within the zone of influence of the Groundwater abstraction are summarised in table 1 below. This table includes a summary of interest features a link to the citation, Favourable Condition Tables (FCTs), Site improvement Plans (SIPs) Conservation Objectives and Supplementary advice to the Conservation Objectives (SACOs). Table one sets out designated site features and the current condition –note that condition assessment is out-of-date and has not included recent SACO information and is known, in terms of water quality at least, to be incorrect for Pulborough Brooks.

There are some additional evidence that the designated sites is not in good condition. There is a recent paper lead by Natural England staff that is soon to be published (Hicks *et al*, In Press) that assesses the plant community composition across Amberley Wild Brooks from historic and recent (2017) surveys. This paper shows statistically significant changes in the vegetation community, including those that form part of the Ramsar features and SSSI features, in the north of Amberley Wild Brooks, indicative of slowly drying conditions. The area that shows the significant community change is consistent with the area that is connected to the beds and therefore, theoretically, the abstraction. Though this drying may also be climatic, Natural England does not have sufficient evidence to rule out any combined impact of the climatic drying and the abstraction.

Though water levels and water quality are raised on the site improvement plans (SIP) abstraction is not raised explicitly as an issue in the SIPs. The key SAC attribute in the SACO linked to hydrology and water level states that *more investigation is needed for the interest feature* and as an interim uses the water levels designed to protect the wintering birds. This is unhelpful in the current case where the impacts are most likely on the ditch features of the Ramsar criterion 2 and 3 and on the SAC features in the summer/ early autumn and spring– so levels designed to protect wintering birds are of limited value to these features and for this assessment.

The SAC species has gone from Amberley Wild Brooks and despite extensive conservation efforts including Back from the Brink funding, it is declining on Pulborough Brooks. The decline in extent of aquatic plant population in the North and South (but not middle) brooks is also noted in the now out-of-date condition assessment.

Despite these concerns with the current targets and condition assessment of the site there are still some SACO attributes that require further examination with respect to the potential impacts of the proposed and existing abstraction in particular those related to the need to restore the site and enable it to adapt to climate change.

None of the relevant surface or groundwater bodies are meeting good ecological status however each of these bodies is treated separately in the South East River Basin district and there is no WFD monitoring of the Natura 2000 protected areas so only the groundwater body status is relevant to the assessment of the current project.

For the assessment of a new plan or project the evidence, though not strong suggests the existing abstraction may be contributing to existing site declines though declines are very slow and long term. There is a requirement that Natural England uses the best scientific evidence in its advice to competent authorities and so relying on what appear to be incorrect and out-of-date site condition would be unsound.

Designated Site	Site Condition and objectives ^{1 2} 08/11/2019	Summary of Designated Features
Waltham Brooks SSSI	47.39 hectares Unfavourable recovering (100%) Favourable condition tables	The SSSI Citation shows the Interest features which can be summarised as follows: • Aggregations of wintering birds (Bewick Swan) • Aggregations of non-breeding birds (Shoveler and teal) • Assemblages of breeding birds (mixed species) • Alluvial grazing marsh with ditches • Plant assemblage • Invertebrate assemblages • (Other supporting habitats include Fen Marsh and Swamp, standing open water and canals)
Amberley Wild Brooks SSSI	6.38 hectares favourable (1.95%) 321.11 Unfavourable recovering condition (98.05%) Favourable condition tables	The SSSI Citation shows the Interest features which can be summarised as follows: • Alluvial grazing marsh with ditches including S3, S5, S7 Swamp • Outstanding Invertebrate assemblages (W11 fast flowing water, W21 Mineral marsh and open water, W31 Permanent wet mire, F21 grassland scrub matrix) • Variety of Wintering bird species • <i>Leersia oryzoides</i> • <i>Carex vulpina</i> • RDB nationally scarce plant species • Ditch plant communities • Outstanding odonata assemblage • Outstanding vascular plant assemblage • Aggregations of breeding birds • Aggregations of wintering birds (Bewick Swan) • Aggregations of non-breeding birds (Shoveler and teal)

¹ The data was downloaded from various websites and Natural England's sites data base on 08/11/2019 any changes since then are not reflected in this table.

² The underpinning guidance on which the ditch habitat FCTs are based is currently being updated and water quality objectives on the Arun Valley SSSIs are likely to be tightened to meet the requirements of mesotrophic species such as *A. vorticulus*. In addition the current condition assessments do not include known failure of the existing water quality targets which have become apparent through casework and therefore site condition is known to be incorrect at time of writing.

		- Breeding bird assemblage (lowland damp grassland, woodland) (Other supporting habitats listed include Lowland neutral grassland and Broadleaved and mix woodland, lowland wet woodland)
Pulborough Brooks SSSI	160 hectares favourable (100%) Favourable condition tables	The SSSI Citation shows the Interest features which can be summarised as follows: - Outstanding vascular plant assemblage - Outstanding Invertebrate assemblages (W531, W21 Mineral marsh and open water, W31 Permanent wet mire,) - Assemblage of breeding birds of lowland damp grassland - Aggregations of non- breeding birds Wigeon, teal, pintail, shoveler, ruff, Bewicks swan). (other supporting habitats include lowland grazing marsh, standing open water and canals)
Arun Valley SPA	Conservation objectives Supplementary advice Site Improvement Plan	The SPA Citation shows the interest features which can be summarised as follows: - A037 <i>Cygnus columbianus bewickii</i> (Bewick's swan Non-breeding) - Water bird assemblage Non-breeding
Arun Valley Ramsar Site	Not available separately (currently combined with SPA and SAC)	The Ramsar site information sheet shows the interest features which has not been updated since 1999: - Criterion 2: Site holds 7 wetland invertebrates on British Red Data book as threatened and 1 of these is endangered Site holds 4 nationally rare and 4 nationally scare plant species - Criterion 3: Ditches hold outstanding aquatic native flora in addition to the rare and threatened species - Criterion 5: internationally important assemblage of waterfowl.
Arun Valley SAC	Conservation objectives Supplementary advice Site Improvement Plan	The Natura 2000 Standard data form is here and the JNCC site description and SAC citation provide the designation details. Features can be summarised below: S4058 <i>Anisus vorticulus</i> ; Little whirlpool ram's horn snail Habitat class codes in the SAC data form are as follows: 95% humid grassland mesophile grassland 2% Bogs, Marshes, Water fringed vegetation fens 1% Broadleaved deciduous grassland 2% Inland water bodies
WFD Water Bodies	Pulborough Brooks Arun TRaC Lower Greensand Arun and Western Streams Rother	GB107041013040 Moderate – this does not include most of the designated sites – just parts of the mid brooks (PB unit 3) GB54070410500 Moderate but based on the main channel only – this does not include information on the protected areas. GB40701G503100 Overall groundwater classification Poor GB107041012810 Overall classification moderate The main designated freshwater wetlands are included in the Transitional and coastal water bodies and in the South East Trac

		management catchment which means they are divorced both from the underpinning aquifers (which are in a different management catchment) and the upstream catchment in the South East River Basin District plan (RBD). This must be rectified in the next plan.
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1.4 Ecological Impact Assessments

The Arun Valley Vision Report (AVSS) looks at impacts on the SPA interest features and also looks at some of the Ramsar features though not in a concerted or cohesive manner. The SAC was not considered as it had not yet been notified. The hydrological targets chosen in the AVSS were those set for site management of the agricultural system and based on no net loss or reduction in species or habitats based on ditch communities and wet grassland communities.

This report used scale of impacts linked to wetland mechanisms which were based on the sub-optimal standard for the appropriate wet grassland community. The relationship between these standards and the conservation objectives and the legislative tests is poor or absent. There is no reference to the need to restore elements of the site to achieve long term goals though this may be due to the reported favourable condition of Pulborough Brooks. The ecological conclusions of the AVSS report cannot be relied upon for the current investigation of abstraction impacts.

The Draft Habitats Regulations Assessment sent to Natural England in July 2019 excludes a likely significant effect on Waltham Brooks and Amberley Wild Brooks and most of Pulborough Brooks on the basis of lack of hydrological connection. An appropriate assessment has been undertaken on the impacts on Pulborough Brooks south, Ramsar site criteria 2 and 3.

The interest features are correctly identified in the draft HRA 2019 (dated June 2019) however there are a number of issues and uncertainties that result in Natural England's disagreeing with the conclusions of the draft HRA and they are as follows:

- No appropriate assessment has been undertaken for Amberley Wild Brooks parts of the SPA, SAC and Ramsar sites and Natural England believe a likely significant effect of the existing and proposed abstraction has not been ruled out on objective evidence.
- The draft HRA appropriate assessment 2019 does not have proper reference to the relevant elements of the supplementary advice to the conservation objectives and therefore does not assess all likely significant effects (for example the need to adapt to climate change, synergistic impacts between water quality and ground water inputs, the restoration objective for the SAC species).
- The draft HRA 2019, relies on the underpinning assessment of the abstraction which in turn relies on the underpinning AVSS reports. Both the 2019 abstraction impact assessment and the AVSS have significant uncertainties and therefore the project is not certain to avoid an adverse effect
- The draft HRA 2019 repeatedly makes the incorrect leap that if a feature is not in the impacted part of the Pulborough Brooks from the most recent survey then there is no adverse effect on integrity – even though the SAC feature and most of the Ramsar criteria have “restore” objectives indicating they have declined and require expansion to be at favourable conservation status. Impacting part of the designated sites will prevent restoration of conservation status, and this will be exacerbated by climate change.

- No assessment of the interaction of long term trends, cumulative and in combination impacts with climate change has been made. This site is vulnerable and impacted by climate change and requires restoration of resilience to adapt to climate change.
- The draft HRA 2019, and correspondence around the current proposals argues that the predictions of groundwater heads under a semi-naturalised scenario (c4-6m above ground level) are uncertain. However it does not attempt to quantify this uncertainty or review what impact this uncertainty has on other assumptions of the model in terms of resource planning.
- The draft HRA 2019 assumes a modelled 15cm reduction in ditch water levels across the south east corner of Pulborough Brooks due to the new proposed abstraction is not significant but ignores the cumulative impact of the existing abstraction to which this adds.
- The decision of lack of adverse effect is assigned to the small area of the site impacted (<2% of SAC and <5% of the Pulborough Brooks area are the quoted figures) and this is referred to by quoting the ditch management target of minimum standard that 90% of ditches meet the ditch depth. This is the standard for the whole site, and in a dry year there is no assessment of how much of the site would fail this; failure of the standard in combination is an adverse effect. It does not require that a plan or project fails a standard on its own. In any case, due to all the other uncertainties this is not the maximum impact on the site (as it does not include any of the north Pulborough Brooks nor Amberley). Also this standard may not be sufficiently precautionary for the SAC species in any case (as the SACOs note this needs to be investigated).
- Wetland model predictions that impacted ditches would be dry in any case rely strongly on assumptions of seepage rates under a naturalised scenario that appear to be contradicted by the more recent output of the numeric groundwater model.
- The 2019 assessment relies on the conclusion of the AVSS study that groundwater seepage input to the site is insignificant. The wetland model, validated against observed data, estimates that under the historic abstraction, seepage to the site is a relatively small and intermittent component of water supply. Natural England agrees this is probably a realistic assessment of how the site currently functions **in an impacted state**. The AVSS study also makes predictions of seepage rates in a naturalised state. The method relies on assumptions that introduce significant uncertainty and risk understating the natural contribution from groundwater.
- Recent application of the Numerical Groundwater Model (not available in AVSS) to the question of seepage discharge suggests the potential for discharge under a naturalised groundwater regime to be much greater than predicted by the AVSS study. Without abstraction, seepage could potentially be sustained all months of the year and at significantly greater flow rates.
- Assessment of impacts on the functional habitat have not been undertaken though the assessment the impact on flood plain grazing marsh could be used as a proxy for this assessment.

Impacts on habitats of principle importance for biodiversity including nesting wader habitat and flood plain grazing marsh have been undertaken but this is ruled out as being

insignificant because *“it is less than 2% of the relevant habitat in the entire Arun and Western Streams catchment”* though it is unclear how this figure was derived or whether it includes the designated sites. Given this is one of the most ecologically diverse and important floodplains in England this is a spurious statement. The importance of the juxtaposition of these habitats to the high quality Arun Valley designated sites and the Lawton principles (bigger, better more joined up) is completely ignored.

1.5 Hydrological impacts

The hydrogeology of the designated sites is complex. The underpinning geology varies spatially, and is overlain by a range of drift deposits that vary in their permeability across the three designated sites. It is uncertain what the significance of groundwater supply from the [REDACTED] beds to the designated sites would be in a naturalised scenario without the abstraction. The British Geological Survey (BGS) maps and the webmap national peat mapping show there are significant areas of peat on the northern area of Amberley Wild Brooks, on the south Eastern area of Pulborough Brooks and on the eastern margin of the north of Pulborough Brooks. These areas of peat are also reflected by the Amberley citation and by local knowledge. These areas of peat are coincident with areas of the sites underlain by the [REDACTED] beds and potentially permeable superficial deposits that may provide a pathway for groundwater discharge to the edges of the designated sites. The presence of peat suggests considerably wetter conditions than currently and could be indicative of significant groundwater connectivity in the past.

Waltham Brooks

Impacts on Waltham Brooks were ruled out by the assessment on the basis of borehole data [REDACTED] that show that Marehill clay extends further than shown on BGS maps. Based on these bore holes the 2008/9 Arun Valley sustainability study (AVSS) and accompanying Environment Agency Review of Consents assumed this geology underpins the entire Waltham Brooks and therefore the assumption that there is no connectivity with the [REDACTED] Beds. The 2019 draft HRA provides no additional information from these previous studies and states the assumptions and conclusions remain unchanged.

Since then the company has estimated seepage rates for the far western edge of Waltham Brooks under a naturalised scenario using the Numeric Groundwater Model. At Waltham Brooks, the model implied a potential significant difference in seepage rates between historical and naturalised. This could possibly be driven by connectivity with the [REDACTED] beds at the western margin of the site via relatively permeable superficial layer of Arun Terrace deposits. Further bore hole logs have recently been provided to Natural England (12/12/19) show that the clay extends much further than shown on BGS maps and therefore connectivity to the [REDACTED] at Waltham Brooks has been ruled out. Consequently Natural England agrees a likely significant effect on Waltham Brooks part of the international sites has been excluded on the basis of objective evidence.

Amberley Wild Brooks

The 2019 draft HRA refers to the conclusions of the AVSS and accompanying RoC that assumed because Amberley is south of Waltham and south of the Greenhurst anticline that there was no hydrological connection and therefore no likely significant effect on Amberley Wild Brooks. Natural England requested further information in summer of 2019 including if the groundwater model had been used to test the influence of [REDACTED] abstraction on hydraulic heads in the [REDACTED] Beds under the northern part of Amberley Wild Brooks. New information has identified a potential hydrogeological connection between the [REDACTED] Beds north and south of the Greenhurst anticline (see slides from company on 30/9/19). Groundwater model outputs presented in slides provided on (30/9/2019) reflect this connectivity. The model showed a significant potential drawdown in groundwater head in the [REDACTED] Beds under historic abstraction compared with a naturalised scenario in the northern part of Amberley Wild Brooks.

No recent groundwater monitoring of the [REDACTED] Beds has taken place at Amberley Wild Brooks with which to validate the model prediction. The potential for hydrological connectivity between the peat areas at the wetland surface and the [REDACTED] Beds beneath is uncertain. Combined with the evidence of vegetation community changes indicative of drying, the uncertainty of the impact of the proposals and existing abstraction remains and a likely significant effect has not been excluded on the basis of objective evidence. No appropriate assessment has been undertaken so no view on the integrity test can be given.

Pulborough Brooks

The majority of work post RoC and Post AVSS has focussed on the south east corner of Pulborough Brooks. The wetland model used in the AVSS concluded that there was relatively little ground water supply to the site in its current state. Moreover, it concluded that insignificant rates of seepage would occur even under naturalised conditions. Wetland model calibration against observed data (i.e. in an impacted state), became poor when higher naturalised seepage rates were assumed.

These conclusions are substantially relied upon in the most recent 2019 draft abstraction impact assessment report. However, Natural England has raised concerns that these early assumptions underestimate the historical importance of groundwater discharge to the eastern margins of Pulborough Brooks in the absence of abstraction. The permeable windows of connectivity with the [REDACTED] Beds identified in the AVSS are coincident with relic areas of peat deposit suggesting significantly wetter conditions were prevalent in the past, capable of supporting peat formation. The AVSS wetland model was calibrated against an “impacted” baseline, and predictions of naturalised seepage rates involve assumptions about naturalised head in the [REDACTED] Beds and a ‘proportionate relationship’ between drawdown in head in the [REDACTED] beds and seepage rates to the wetland. The detail behind these assumptions are not provided in the AVSS report. Natural England believe significant uncertainty remains in these predictions of groundwater supply to the designated sites from the [REDACTED] beds in a naturalised scenario (we are not aware that abstraction has ever been rested for the 18 -24 months it would take for the basin to fully recharge to naturalised scenario [REDACTED] to enable validation of assumptions).

The 2019 abstraction impact report provides output from numerical groundwater modelling not available to the AVSS report. Fig 14 in the 2019 abstraction impact report suggests a dramatic impact of abstraction on Groundwater head in the [REDACTED] Beds at [REDACTED] in the southeast corner of Pulborough Brooks. Naturalised head is predicted to be 4-6 m above ground level whilst abstraction generates a head that hovers around ground level. This has the potential to make the difference between a significant perennial groundwater discharge without abstraction versus a small and intermittent discharge with abstraction.

In response to a request from Natural England, Southern Water used the Numeric Groundwater Model to predict seepage rates under a naturalised and historical (abstracted) scenario and provide comparison with seepage rates used in the AVSS report. For model cells in the eastern margin of the northern Brooks, the model predicts historical (abstracted) seepage rates similar to those proposed by the AVSS wetland model. Given the latter was calibrated against observed data it probably represents the current impacted state reasonably well i.e. no seepage inputs for half the year, very small volumes at other times. Under a naturalised scenario, the groundwater model suggest significantly enhanced seepage rates over those assumed in the AVSS study. Moreover, it predicts seepage all year round and at rates an order of magnitude (two orders in some months) above historic rates.

For Pulborough Brooks south, the groundwater model predicts small and intermittent seepage across the year under the historic scenario and relatively little change under a naturalised scenario. From the limited information available to Natural England at this stage it appears these predictions are constrained by low vertical hydraulic conductivity assumed for the model cells used. The values appear to be the same as those assigned for the floodplain more widely where there is a significant depth of alluvium and underlying Gault Mudstone both of which are likely to provide significant hydraulic resistance to up-flow of groundwater from the [REDACTED] Beds. Natural England is concerned that this risks misrepresenting and understating the degree of groundwater connectivity that may exist at the wetland margins of the South Brooks, particularly where fringing peat deposits are located. Additional ground investigation would be needed address this uncertainty.

1.6 Conclusions and notes on next steps

This project has highlighted potential risks from the **current** abstraction (actual not licenced) at [REDACTED] to the designated SSSI, SPA, SAC and Ramsar sites of the Arun Valley. The drilling of new production boreholes and revised operating procedures could present a risk of additional impacts. On that basis, further assessment is needed. Even after further assessment and any drilling and test pumping there is no guarantee that the Natural England will be able to advise the Environment Agency the legislative tests are met to enable the Agency to licence the scheme to deliver the output Southern Water Services have planned for.

Before investing in drilling and testing the new proposed boreholes, we recommend that Southern Water Services embarks on a short and focussed programme of further assessment and data gathering to:

- Investigate characteristics of drift deposits in sensitive areas and in the Rother Valley
- Carry out signal / resting tests using existing boreholes to gather information specifically targeted towards the most at risk areas
- Improve modelled assessments of what would happen under naturalised scenarios and improve confidence in model output
- Further outputs from the Groundwater model showing predicted naturalised heads in the [REDACTED] Beds more widely across the [REDACTED] so that the spatial extent of the abstraction impact could be better understood.

Borehole [REDACTED] is high risk and even after testing it may not be possible to conclude with certainty that there is no adverse effect. There is a high risk that Natural England will be unable to advise the Environment Agency that adverse effects are not excluded and the Agency would be unable to licence this new bore hole. Boreholes [REDACTED] are closer to existing boreholes but the Natural England would still need to be assured that the legislative tests are met for all the designations, we do not currently have that assurance.

Before any licence variation application is made, Southern Water Services should demonstrate how they can abstract sustainably from the [REDACTED] – this may mean looking for opportunities to reduce overall demand from [REDACTED] and exploring variations in daily abstraction to meet peak demands. Ultimately Natural England needs to be assured that not only there are no unacceptable impacts on the local environment – but that the abstraction does not undermine the statutory requirements to restore the SAC, SPA Ramsar sites to favourable conservation status and restore favourable condition on the SSSIs.

Annex 2

European Protected Species

The following is the generic DAS advice on licencing however we are aware there are potentially a range of protected species in the project area including a range of bat species (not just the bat SAC species), dormice, great crested newts and other species including the SAC species for the Arun Valley which is a protected species. This letter does not cover protected species licencing issues *per se* and additional advice should be sought where necessary.

A licence is required in order to carry out any works that involve certain activities such as capturing the animals, disturbance, or damaging or destroying their resting or breeding places. Note that damage or destruction of a breeding site or resting place is an absolute offence and unless the offences can be avoided (e.g. by timing the works appropriately), it should be licensed. In the first instance it is for the proponent to decide whether a species licence will be needed. The proponent may need to engage specialist advice in making this decision. A licence may be needed to carry out mitigation work as well as for impacts directly connected with a development. Further information can be found in Natural England's ['How to get a licence'](#) publication.

If the application requires planning permission, it is for the local planning authority to consider whether the permission would offend against relevant regulations in the Conservation of Habitats and Species Regulations 2017, as amended and if so, whether the application would be likely to receive a licence. This should be based on the advice Natural England provides at formal consultation on the likely impacts on favourable conservation status and Natural England's [guidance](#) on how the three tests (no alternative solutions, imperative reasons of overriding public interest and maintenance of favourable conservation status) are applied when considering licence applications.

Natural England's pre-submission Screening Service can screen application drafts prior to formal submission, whether or not the relevant planning permission is already in place. Screening will help applicants by making an assessment of whether the draft application is likely to meet licensing requirements, and, if necessary, provide specific guidance on how to address any shortfalls. The advice should help developers and ecological consultants to better manage the risks or costs they may face in having to wait until the formal submission stage after planning permission is secured, or in responding to requests for further information following an initial formal application.

The service will be available for new applications, resubmissions or modifications – depending on customer requirements. More information can be found on [Natural England's website](#).

Appendix 6530-01/14:

Extract from paper 'Spatial and temporal vegetation analysis of Amberley Wild Brooks over two decades' Hicks 2019

Spatial and temporal vegetation analysis of Amberley Wild Brooks over two decades

D. Hicks, F. Abraham, L. Bardsley*, M. Cousins, E. Webster & J. Whitman.
Natural England, Worthing, UK BN11 1LD

***Corresponding author:** Louise Bardsley louise.bardsley@naturalengland.org.uk

This pdf constitutes the Version of Record published on 14th December 2019

Abstract

Plant species presence data from 170 ditches at Amberley Wild Brooks in 2017 were compared to those of 1998. Overall functional changes are apparent, and spatial interpolation by Inverse Distance Weighting suggests that areas of the site are exhibiting varying character in space and time. Vegetation traits suggest a response to drier, more saline and more open conditions since 1998. Stress-tolerating species now dominate ruderals and competitors, and the site supports a similar number of hydrophytes and a greater number of species overall. Site-wide nutrient input was not observed in either Ellenberg N or LEAFACS2 metrics although there are local patterns which warrant investigation. Using these data there appears to have been no decrease in overall presence of the rare and scarce species of the 1998 survey except *Sium latifolium* L. In terms of plant climatic optima the site has shifted southwards, to warmer and drier conditions, which correlates to the change in 25-year averages of climate to 1998 and to 2017 at the closest Met Office weather station. These patterns are applicable to site management and flood risk management proposals, giving potential for spatial modelling to predict outcomes under different management scenarios.

Keywords

spatial interpolation; flood plain; wetland; aquatic; plant community; climate change

Introduction

Occurring naturally in every continent, wetlands are characterised by vegetation that is adapted to its saturated and frequently anoxic substrate. These systems perform stabilising ecological functions at the transition between land and water, though are subject to pressures from drainage, eutrophication and invasive species.

Amberley Wild Brooks is a managed wetland in the flood plain of the River Arun, north of the village of Amberley and within the South Downs National Park. Along with other sections of the Arun Valley it is designated as a Special Area of Conservation (SAC), Site of Special Scientific Interest (SSSI), Important Plant Area (IPA), Special Protection Area (SPA), Important Bird Area (IBA), and Ramsar site. Over half of all the British species of aquatic plants are represented here, as well as many rare invertebrates and nationally significant wintering and breeding wildfowl.

The site is an extensive area of grazing marsh dissected by drainage ditches. Historically the banks of the rivers have been raised and sluices installed in the ditches to speed drainage of water during winter floods, indeed tithe ditches and

Discussion

Table 1 presents compelling evidence that there have been functional changes in the vegetation community of Amberley Wild Brooks from 1998 to 2017, in particular towards plants which favour a more open, drier and more saline habitat. Stress-tolerating species now dominate ruderals and competitors, and the site supports a similar number of hydrophytes and a slightly increased species richness overall.

In line with other analyses of plant trait values (Bartelheimer & Poschlod 2015; Smart & Scott 2004; Schaffers & Sykora 2000) we interpret plant indices to be robust to surveyor effort when averaged to the scale of ditch vegetation. The assertion is that any differential finding (addition or omission) of a few species is unlikely to have a large effect on the overall weighted mean, and in the case of Ellenberg or Grime values the differential species are likely to be of similar index value. Indeed a similar two-decade study (Woodcock *et al.* 2011) concluded that functional traits of grassland vegetation could be used to test the success of EU agri-environment policy interventions, which in the current UK political climate suggests demand for this method.

Site management

The significant overall differences, for instance of Ellenberg moisture and Ellenberg salinity, at Amberley Wild Brooks between 1998 and 2017 may be of particular relevance both to habitat management of the site and to flood risk intervention within the wider Arun Valley. The largest abstraction for public water supply in the greensand aquifer near here is near the confluence of the Arun and its main tributary the Rother, and though the abstraction impacts do travel under the river they are not believed to impact Amberley due to the Greenhurst anticline in the geology of the greensand. Further investigation is being sought to confirm this. Likewise the marked increase in mean Ellenberg light in the northeast section of the site (Fig. 4) may reflect that this area was bought into conservation ownership part way through the period. We suggest that management at ditch level is likely to be pivotal to the plant and animal species for which the site is designated. It seems likely also that some adverse outcomes across the two decades could be attributed to alterations in management, including overall under-grazing and the recent reduction of early-season grazing, and there may be highly localised effects (e.g. reduction of the open mud habitat along ditch margins, shading and/or coarsening of marginal vegetation) which are not detected by the spatial resolution of these surveys.

The future management of the river valley in which Amberley sits is under discussion. At present the river embankments along Amberley Wild Brooks largely prevent the saline tidal waters from entering this freshwater site. The embankments, which currently run all the way down the valley to the coast, push the saline wedge higher up the river valley than a more naturally functioning estuarine system, an effect which would be expected to exacerbate under climate change.

Scenario modelling

It will be possible to build on the work in this paper to model predicted botanical changes under different scenarios of future climate change and flood defence bank management as outlined by Wheeler *et al.* (2004). Elsewhere Lang *et al.* (2014) concluded that with effective restoration in a floodplain, turning overall conditions

Appendix 6530-01/15:

Correspondence from Environment Agency dated 26 April 2022

Mr A Aitken
FortRidge Consulting Limited
Stonehouse Business Centre
Market Place
Chipping Norton
OX7 5NH

Our ref: 14257/FBNSx/SM
Your ref: 10270
Date: 26 April 2022

Dear Mr Aitken

Re: Water Neutrality - Natural England's Position Statement for Applications within the Sussex North Water Supply Zone September 2021 - Interim Approach

Thank you for your letter dated 4 April to our Chief Operating Officer, Lucy Hunt. As Area Director for Solent and South Downs Lucy has asked me to respond on her behalf. In your letter to which you attached Natural England's position statement you asked two questions of us which I address in turn below.

1 Does the Environment Agency accept Natural England's allegation that "it cannot be concluded that the existing abstraction within Sussex North Water Supply Zone is not having an impact on the Arun Valley (European site)"

The Environment Agency does agree with Natural England that "it cannot be concluded that the existing groundwater abstraction at Hardham is not having an impact on the Arun Valley site." I have set out the reason for this below.

The abstraction licence held by Southern Water for abstraction from groundwater at Hardham in Sussex was originally issued as a Licence of Right in January 1966. The Environment Agency reviewed the impact of all relevant permissions, including this abstraction licence, on the Arun Valley Special Protection Area (SPA). At that time, it was concluded that the abstraction licence could be affirmed as it was concluded that there was no adverse effect on site integrity.

In 2016 the Arun Valley was designated as a Special Area of Conservation (SAC) and further new information came to light which suggested that there could be a pathway for the groundwater abstraction at Hardham to impact on the designated site. It is for this reason that we agree with Natural England's view.

2 Does the Environment Agency accept that the Hardham groundwater licenses authorise a level of abstraction that cannot be excluded from having adverse effect on the European sites? We note that the current levels of abstraction are significantly lower than the licensed maximum levels.

The Hardham groundwater licence is not time limited. Where there are concerns about the sustainability of a permanent abstraction licence there are two options for changing the licence. Under Section 51 of the Water Resources Act 1991 a licence holder can apply to change their abstraction licence or under Section 52 of the Water Resources Act we can take action to impose licence changes.

In exercising our powers, we have to take account of our legal obligations when undertaking this action – these include our duties and obligations to protect the environment as well as any legal duties regarding the impact of our action on the licence holder and any duties they may have to provide public water supply.

Where new information suggests that a permanent Water Company abstraction licence may be having an impact on a designated site, and before taking action to change an abstraction licence we would usually require an investigation to be carried out. This would provide evidence of the nature of the impact and determine what measures may be necessary to protect or restore the site. We use the results of the investigation to determine any changes to the licence which may be necessary. When doing so we would look to Natural England for their views before we come to any decisions on what, if anything, we would do about the abstraction.

In line with this procedure, I can inform you that Southern Water is carrying out an investigation into the impact of the Hardham groundwater abstraction licence which will conclude in 2025 after collection of a range of hydrological and ecological data. Whilst this work is being carried out, Southern Water has made commitments to minimise use of the Hardham groundwater abstraction.

I trust that this information provides you with the answers to the questions you were seeking from us.

Yours faithfully,



**Area Director
Solent and South Downs Area**

Appendix 6530-01/16:

Correspondence from Southern Water dated 14 April 2022



AlistairAitken@fortridge.co.uk

Date

14th April 2022

Contact

Tel 0330 303 0368

Dear Mr Aitken

**The Environmental Information Regulations 2004
Request for Information
EIR reference 1105**

Thank you for your request for information which we received on 24th February 2022. We have dealt with your request under the Environmental Information Regulations 2004. This letter provides the response to your request, as follows:

Thank you for your response to our enquiry. Further to our enquiries concerning Sussex North WRZ you kindly provided us with a response under your reference 'EIR reference: 990', we would like to make a further request in respect of other water supply boreholes in and around the Sussex North WRZ.

We would be grateful for information you can provide relating to Abstraction Licences and operational records within the Sussex North WRZ including those held by Southern Water that could affect the Aquifer and the Wetlands at Amberley Wildbrooks / Pulborough Brook.

The information we are seeking is:

1. A list of borehole abstractions in the Sussex North WRZ.
2. A list of boreholes close to the Sussex North WRZ, including Steyning.
3. An explanation of how water from Hardham is used during periods of maintenance in the Steyning water supply network and any other local networks (for example: Is water from Harham ONLY used at Steyning for maintenance purposes and does not feed directly into the water supply for Steyning?)
4. How is the water level in the Lower Greensand Aquifer monitored?
5. Are there records of the water level in Lower Greensand Aquifer?
6. Are the groundwater abstractions that are being made by Southern Water causing the wetlands at Pulborough to dry out? Any reports that are held showing this has been properly considered.

If you have any questions please do not hesitate to contact us.

We can confirm that Southern Water does hold information of the type you have requested as follows:

1. *A list of borehole abstractions in the Sussex North WRZ.*
- &
2. *A list of boreholes close to the Sussex North WRZ, including Steyning.*

Please find enclosed the file entitled “220412.... frmCatalogue_redacted.xls”, giving a listing of all our boreholes in our Sussex North, Sussex Worthing and Sussex Brighton water resource zones. The context of these zones is explained further in answer to question 3.

3. *An explanation of how water from Hardham is used during periods of maintenance in the Steyning water supply network and any other local networks (for example: Is water from Harham ONLY used at Steyning for maintenance purposes and does not feed directly into the water supply for Steyning?)*

The current licensed abstraction volumes include some ‘headroom’ relative to current normal demands, especially when in the context of the other licences we have elsewhere within the overall Sussex North, Sussex Brighton, and Sussex Worthing water resource zones. To a reasonable but not a complete extent, the sources within each zone can be used interchangeably; the company water resources management plan assumes, though in practice some of the inter-change is operationally easier and is some complex and/or inefficient. During dry years and higher demand periods, and especially during droughts, when resource availability may become limited (the licensed amounts are not necessarily available for abstraction during dry and drought years), the Sussex North supply area is forecast to become stressed. In this case the new resource developments will have to be promoted. Our longer-term Water Resource Management Plan (WRMP) aims to account for forecast drought year resources and future dry year demands and set a plan of appropriate demand management and new resource development to maintain the supply-demand balance. The supply area is currently additionally stressed during dry periods because our other strategic source for the area the Weirwood Reservoir Water Supply Works (WSW) is currently out of service and will be until April 2024. Our current WRMP envisages a new resource based on water recycling becoming available to Hardham WSW from 2027. We are in the early (internal) stage of progressing this.

Regarding practical real-time supply demand balance management, we have some connectivity between our Sussex North, Sussex Worthing, and Sussex Brighton Zones, such that temporary shortfall or maintenance outages of individual sources can be covered by inter-zonal transfers, subject to the constraints outlined above. However, we would normally revert to within-zones sources first. **Furthermore, we have committed to minimise our Hardham groundwater abstraction and, minimise use of transfer within or out of Sussex North that could provoke increase in that abstraction.**

4. *How is the water level in the Lower Greensand Aquifer monitored?*
- &
5. *Are there records of the water level in Lower Greensand Aquifer?*

General groundwater monitoring information is available from the EA. The reports referred to below include some groundwater level information, modelling as well as indicating our commitment to collect more data between now and 2025 at and around Hardham.

6. *Are the groundwater abstractions that are being made by Southern Water causing the wetlands at Pulborough to dry out? Any reports that are held showing this has been properly considered.*

All our abstraction licences, as existing at the time, underwent assessments with respect to the Habitats Regulations 'review of consents' undertaken between 2005 and 2008. Our Hardham groundwater licence passed through that assessment without any required alteration. Our River Arun (tidal) abstraction licence was issued in 2010 without requiring a Habitats Regulations assessment.

Most of our abstraction licences are due to undergo "No Deterioration" assessment in respect of the Water Framework Directive within the next few years. This includes the Hardham groundwater abstraction licence, with assessment due by the end of March 2025. Growth in abstraction may be challenged and, possibly, new constraints may be added to the licences. **We are also working to a commitment to the Environment Agency and Natural England to complete a renewed full sustainability assessment (HRA) of our Hardham groundwater licence by the end of March 2025. This will consider the impact of the existing groundwater abstraction on designated sites' features.**

Natural England is promoting a policy for Local Authorities to require new development to be water neutral because it believes existing abstractions are unduly impacting on the Arun valley's environmentally designated sites.

We made two related abstraction licence applications to the EA in December 2021: -

- (i) Hardham groundwater abstraction licence (no. 10/41/431002)
 - application to amend to clarify currently used points of abstraction (boreholes) and remove those existing but unused. Also, including additional (volunteered) constraints and, to modernise the licence document.
- (ii) River Arun surface water abstraction licence (no. SO/041/0024/001)
 - application to renew. (Original version expiring 31st March 2022) – the EA has granted permission to continue using the licence pending the full EA determination of the application.

Both applications were made in the context of the environmental assessment commitments and issues summarised above. HRA and WFD No Deterioration assessments were provided, without prejudice to the full review intended by 2025. We have just agreed to make some updates to the submitted reports in response to EA and Natural England feedback on the submissions. Once we update the documents, we expect the EA to commence formal determination of the applications.

The "Environmental overview" and "Commitments" documents we submitted with the licence's applications are attached. We should be able to provide the HRA and WFD reports once amended, which we expect to be in 2 – 3 months, though note they will still be without prejudice to the complete review intended by 2025. We don't expect the amendments to materially alter the position summarised in the environmental overview and commitments documents.

We are entitled to make a reasonable charge for information provided under the Regulations. Details of our charging scheme can be found on our website: <https://www.southernwater.co.uk/water-for-life/protecting-the-environment/environmental-information>. In this case we have decided to waive our charge.



If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. Internal review requests should be submitted within forty working days of the date of receipt of this response and should be addressed to Head of Legal, Southern Water Services Ltd, Southern House, Yeoman Road, Worthing, West Sussex BN13 3NX or you can email EIR.Internal.Review@southernwater.co.uk.

If you are dissatisfied with the outcome of the internal review, you can apply, without charge, to the Information Commissioner, who will consider whether Southern Water has complied with its obligations under the Regulations, and can require Southern Water to remedy any problems. You can find out more about how to do this, and about the Regulations in general, on the Information Commissioner's website at: www.ico.org.uk. Complaints to the Information Commissioner can be made via the "report a concern" section of the Information Commissioner's website.

Please do not hesitate to contact us if you have any queries.

Yours sincerely

EIR Officer

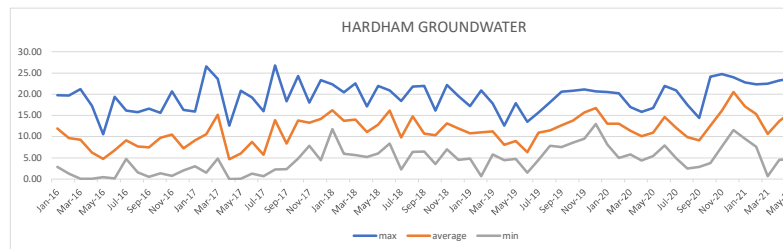
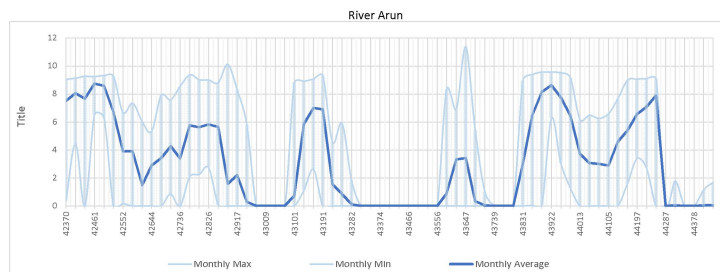
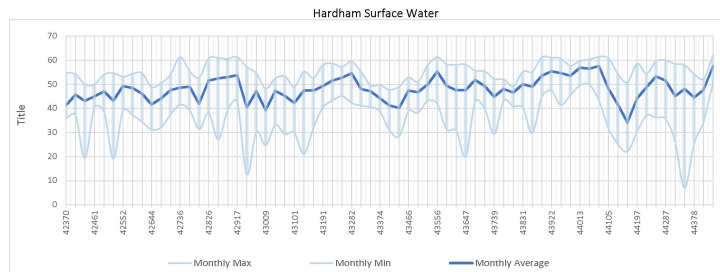
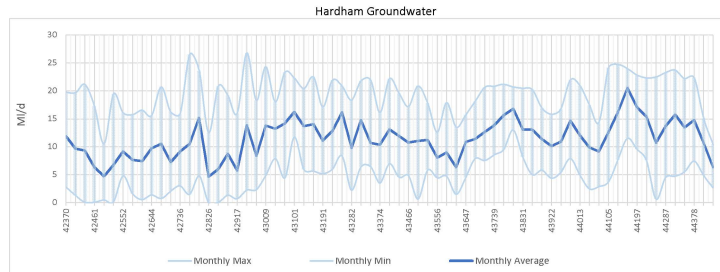
Appendix 6530-01/17:

Data on Hardham abstraction point supplied by Southern Water

Date	Hardham Groundwater			Hardham Surface Water			River Arun		
	max	average	min	max	average	min	max	average	min
Jan-16	19.77	11.94	2.82	54.92	41.30	35.91	9.06	7.51	0.36
Feb-16	19.68	9.65	1.30	54.29	45.66	37.20	9.14	8.07	4.43
Mar-16	21.19	9.32	0.09	50.07	43.12	19.29	9.27	7.67	0.00
Apr-16	17.25	6.31	0.07	50.04	45.06	40.52	9.25	8.74	6.52
May-16	10.56	4.73	0.47	54.18	47.06	38.59	9.32	8.59	6.29
Jun-16	19.42	6.75	0.13	54.74	43.24	19.05	9.27	6.73	0.00
Jul-16	16.13	9.14	4.77	53.13	49.27	39.24	6.69	3.91	0.17
Aug-16	15.76	7.69	1.59	54.39	48.44	37.21	7.36	3.91	0.00
Sep-16	16.57	7.46	0.56	54.73	46.09	34.45	6.07	1.49	0.00
Oct-16	15.62	9.74	1.38	48.86	41.63	31.23	5.32	2.89	0.00
Nov-16	20.70	10.52	0.74	50.62	44.14	32.14	7.91	3.43	0.00
Dec-16	16.30	7.25	2.03	54.05	47.72	37.45	7.58	4.26	0.86
Jan-17	15.89	9.14	3.01	61.40	48.67	41.60	8.54	3.40	0.01
Feb-17	26.53	10.54	1.49	55.50	49.10	39.29	9.38	5.76	2.10
Mar-17	23.59	15.16	4.79	52.88	41.92	31.39	9.03	5.63	2.26
Apr-17	12.55	4.66	0.02	60.83	51.63	37.99	9.01	5.83	2.74
May-17	20.80	6.02	0.06	60.99	52.52	27.03	8.81	5.64	0.09
Jun-17	19.21	8.75	1.32	60.59	53.14	39.53	10.13	1.58	0.00
Jul-17	15.99	5.77	0.72	61.42	53.85	42.82	8.30	2.21	0.00
Aug-17	26.82	13.89	2.25	57.25	40.49	12.57	5.82	0.29	0.00
Sep-17	18.31	8.39	2.34	54.63	47.22	30.29	0.00	0.00	0.00
Oct-17	24.33	13.80	4.83	48.27	39.26	24.68	0.00	0.00	0.00
Nov-17	18.04	13.25	7.89	52.53	47.33	33.16	0.00	0.00	0.00
Dec-17	23.34	14.19	4.45	53.40	45.35	29.15	0.00	0.00	0.00
Jan-18	22.35	16.26	11.74	48.96	42.36	29.95	8.82	0.73	0.00
Feb-18	20.43	13.72	5.96	55.37	47.41	21.06	8.92	5.85	1.10
Mar-18	22.52	14.06	5.67	52.69	47.46	32.08	9.07	7.01	2.62
Apr-18	17.13	11.09	5.19	58.04	49.34	40.36	9.33	6.91	0.00
May-18	21.94	12.87	6.01	58.63	51.50	43.22	4.58	1.57	0.00
Jun-18	20.87	16.16	8.37	57.29	52.74	45.09	5.90	0.85	0.00
Jul-18	18.38	9.81	2.26	59.55	54.68	42.32	1.89	0.12	0.00
Aug-18	21.79	14.78	6.41	55.24	48.16	41.18	0.00	0.00	0.00
Sep-18	22.00	10.73	6.46	49.65	47.10	40.61	0.00	0.00	0.00
Oct-18	16.13	10.37	3.54	49.67	44.14	38.79	0.00	0.00	0.00
Nov-18	22.18	13.13	6.98	47.82	41.19	30.95	0.00	0.00	0.00
Dec-18	19.56	11.93	4.54	49.07	40.28	28.45	0.00	0.00	0.00
Jan-19	17.21	10.77	4.86	52.86	47.43	38.89	0.00	0.00	0.00
Feb-19	20.90	11.04	0.67	51.17	46.77	38.14	0.00	0.00	0.00
Mar-19	17.81	11.24	5.83	57.90	49.96	43.20	0.00	0.00	0.00
Apr-19	12.63	8.06	4.42	61.31	55.28	41.91	0.00	0.00	0.00
May-19	17.90	8.96	4.76	58.40	49.37	31.31	8.33	0.89	0.00
Jun-19	13.52	6.34	1.50	58.20	47.55	30.78	6.89	3.34	0.00
Jul-19	15.73	10.90	4.52	58.32	47.75	20.00	11.39	3.41	0.00
Aug-19	18.10	11.43	7.88	55.69	51.89	42.92	5.46	0.35	0.00
Sep-19	20.63	12.67	7.53	55.48	49.35	39.77	1.04	0.04	0.00
Oct-19	20.84	13.83	8.57	52.22	44.92	29.30	0.00	0.00	0.00
Nov-19	21.18	15.68	9.52	52.17	48.10	43.16	0.00	0.00	0.00
Dec-19	20.71	16.80	12.99	49.23	46.70	40.86	0.00	0.00	0.00
Jan-20	20.49	13.05	8.15	55.37	50.04	40.43	8.98	3.03	0.00
Feb-20	20.25	13.03	5.01	55.22	49.07	29.74	9.40	6.48	0.05
Mar-20	16.98	11.39	5.80	61.29	53.62	44.83	9.57	8.16	0.04
Apr-20	15.84	10.14	4.37	61.12	55.53	47.46	9.58	8.64	6.27
May-20	16.77	10.97	5.41	60.74	54.61	41.41	9.52	7.74	3.08
Jun-20	21.96	14.65	7.91	57.79	53.67	45.52	9.17	6.45	1.28
Jul-20	20.94	12.06	4.92	59.80	56.88	49.51	6.18	3.73	0.00
Aug-20	17.53	9.90	2.49	60.30	56.55	49.89	6.49	3.07	0.00
Sep-20	14.40	9.15	2.87	61.52	57.66	43.30	6.26	3.00	0.00
Oct-20	24.14	12.63	3.75	60.88	48.15	31.69	6.60	2.90	0.00
Nov-20	24.75	16.16	7.69	54.26	41.59	25.24	7.68	4.59	0.00
Dec-20	24.00	20.54	11.52	50.88	34.22	22.14	8.99	5.40	1.61
Jan-21	22.81	17.12	9.56	58.63	44.23	30.28	9.07	6.57	3.39
Feb-21	22.33	15.32	7.59	54.36	48.84	37.05	9.09	7.09	2.74
Mar-21	22.50	10.69	0.63	59.62	53.27	36.21	9.10	7.90	0.00
Apr-21	23.27	13.67	4.51	59.97	51.49	35.60	0.00	0.00	0.00
May-21	23.73	15.76	4.74	58.51	45.20	26.08	1.79	0.06	0.00
Jun-21	22.22	13.48	5.52	58.04	48.08	7.01	0.00	0.00	0.00
Jul-21	22.40	14.78	7.42	54.22	44.59	25.53	0.00	0.00	0.00
Aug-21	15.06	10.80	4.84	52.49	47.66	34.75	1.16	0.04	0.00
Sep-21	10.51	6.38	2.68	62.06	57.62	50.77	1.69	0.06	0.00

167.32
13.94308
5089.224

564.94
47.07833
17183.59



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The logo for Aspect Ecology, featuring the word "aspect" in a white, lowercase, sans-serif font. A thin, light blue diagonal line is positioned above the "t", extending from the top of the letter to the right.

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Annex 6530/2:

Correspondence from the Environment Agency dated 11 July 2023

Mr A Aitken
FortRidge Consulting Ltd
Stone House Business Centre
Market Place
Chipping Norton
OX7 5NH

Our ref: WNSxN/SM/Jul23
Your ref: 10281
Date: 11 July 2023

Dear Mr Aitken

**Water Neutrality - Natural England's Position Statement for Applications within the
Sussex North Water Supply Zone September 2021 - Interim Approach**

Thank you for your letter dated 21 June 2023 with enclosed Annexes A, B, C and D in which you reaffirm that FortRidge is acting for HBF/Croudace and that you have written to Southern Water in a similar manner.

I have addressed each point raised in your letter in turn below:

Point 1 Does the EA agree with NE that there is currently no known level of groundwater abstraction at Hardham that can be excluded from having significant effects on the European Protected sites?

Subject to the outcome of the sustainability investigation that is underway and due to complete in 2025, we agree with NE that there are no known levels of abstraction that can be excluded from having likely significant effect at this time. This means we need to investigate fully to decide what appropriate action should be taken because, although we agree likely significant effects cannot be ruled out, that does not indicate what action may need to be taken in relation to abstraction up to, and including, the potential revocation of abstraction licences.

Point 2 Does the EA continue to be of the view that what (if any) abstraction whose effect can be so excluded will only be established after the investigations currently being undertaken by Southern Water (scheduled for completion in March 2025)?

As a result of our response on Point 1 set out above, our view continues to be that the investigation will determine what level of abstraction, if any, is sustainable.

We will then be able to take appropriate action to address this. We consider this to be a reasonable approach and in line with the Harris judgment.

Point 3 Does the EA continue to be of the view (expressed in its letter of 13 January 2023) that, pending the licence review in the light of Southern Water's investigations, a voluntary reduction by Southern Water to abstraction of 4.2 Ml/day does not discharge the EA's duties under the Habitats Regulations?

As we stated in our letter dated 6 June 2022 and confirmed in our letter dated 13 January 2023, Southern Water's voluntary reduction in abstraction does not discharge the Environment Agency's duties under the Habitats Regulations.

We would discharge our duties securing the protection of the SAC by making any necessary changes to the abstraction licence. This would be done following the outcome of the Investigation.

We welcome Southern Water's voluntary action to reduce their abstraction; such a reduction will be providing environmental protection that would otherwise not be occurring. This level of reduced abstraction is determined by Southern Water as part of the operational conditions in which they can meet public water supply demands with the sources of water available to them.

On the second page of your letter dated 21 June 2023 you refer to the Harris judgement. We do not accept that we are in breach of our Habitats Regulations duties in relation to Hardham abstraction. The Harris judgment found that Environment Agency's approach to dealing with damaging abstraction in north Norfolk was insufficient in that we were only taking action in relation to some SSSIs and not all the SSSIs that made up the Broads SAC. The judgment said we had to do more and our response, which was accepted by the court, and the Harris who brought the judicial review, was the production of the Broads Sustainable Abstraction Plan in which we detailed what further investigation and modelling we would be doing over the next few years on those other SSSI components and once completed the actions we would take on licences.

This is a different situation to what we are doing in relation to the Hardham abstraction where we are already undertaking the investigation of impacts of licences thus fulfilling our Habitats Regulations duty so long as we then take action depending on the outcome of investigation.

The Harris judgment does not mean we must immediately revoke the Hardham licence but rather, so long as we are addressing the issues of effects on the SAC and have a plan to act once the extent of the effects is known, then we are taking appropriate steps as per the Harris judgment.

Point 4 If the answer to (3) is yes, will the EA secure a cessation of abstraction from Hardham, pending the licence review?

For the operational reasons set out above, we continue to welcome Southern Water's voluntary action in reducing their abstraction, at the same time as balancing their operational needs to supply water. The licence review will determine whether the licence should be revoked or not but we cannot prejudge the outcome of that review before we know the extent of effects of abstraction and whether revocation is the only action available to ensure no adverse effects on the SAC.

Point 5 If the answer to (3) is 'no' , will the EA secure that, pending the licence review, Southern Water does not increase its abstraction above 4.2 Ml/day?

We will continue to work closely with Southern Water regarding their voluntary action to reduce abstraction taking into account their operational supply and investigation needs until the investigation concludes and the appropriate course of action is taken.

Yours sincerely



Simon Moody
Area Director - Solent and South Downs

Tel: 07768 900660

Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West
Sussex BN1 1LD

Annex 6530/3:

Correspondence from Southern Water dated 07 July 2023



Alistair Aitken
FortRidge Consulting Limited
Stone House Business Centre
Market Place
Chipping Norton
OX7 5NH

Date
7th July 2023

Contact

Tel 0330 303 0368

Dear Mr Aitken,

**Planning reference DC/19/2015 - Land North of Downsview Avenue Storrington RH20 4LU
Outline planning application for the erection of up to 62 residential units and the creation of
a new vehicle access, all matters reserved except for access**

Thank you for your letter dated 21st June 2023 regarding your concerns related to Water Neutrality in Sussex North Water Resource Zone (WRZ). I understand you are representing Home Builders Federation (HBF) and Croudace Homes Limited in respect to their development site 'Land North of Downsview Avenue Storrington RH20 4LU' – Planning reference DC/19/2015.

From reviewing the planning applications, we note that the outline planning application was approved on 15th May 2020, and you currently have two live reserved matters application pending a decision (reference DC/21/0749 and DC/23/0290).

In response to the points made in your letter to us dated 21st June 2023 regarding the bulk supply transfer from Portsmouth Water, we can provide the following further clarity. The bulk supply agreement with Portsmouth Water provides for a minimum daily water supply capacity to Southern Water of 1 MI/d 'sweetening flow'. The bulk supply agreement enables Southern Water to request adjustment of the minimum daily import up to a maximum daily supply of 15 MI/d. Notification and implementation of the adjustment to the daily water supply capacity (between the minimum 1 MI/d and maximum 15 MI/d limits) is subject to the terms of the bulk supply agreement. In accordance with Southern Water's Water Resource Management Plan (WRMP19) and Drought Plan 2019, during drought conditions, Southern Water would seek to maximise the import under the bulk supply agreement to the full 15 MI/d capacity and Portsmouth Water's WRMP makes provision for that supply to be available under that circumstance.

Please note that in drought conditions it is possible that Portsmouth Water could however seek to reduce the available supply under the bulk supply agreement. This reflects the different impacts that a drought of different severity or duration can have on different supply areas which have different mixes of water sources and demand pressures. As a drought situation develops (in either company's supply area) the companies will hold discussions to agree the volume of available bulk supply under the bulk supply agreement. There is uncertainty with regards to the availability of the bulk supply in an extreme (1 in 500 year) drought event. Southern Water has assumed supply availability may reduce by 50% in an extreme drought event based on a best estimate of resource



availability. Although currently Southern Water is not experiencing drought conditions, we have been able to agree on a best endeavors basis with Portsmouth Water, the import of greater than 1 MI/d to support the reduction in use of the groundwater source at Hardham.

Please find our response to your specific questions raised in your letter dated 21st June 2023:

1. Does Southern Water agree with NE that there is currently no known level of groundwater abstraction at Hardham that can be excluded from having significant effects on the European Protected sites?

In September 2021 Natural England (NE) issued a Position Statement for applicants of new development within Sussex North Water Resource Zone (WRZ) (the NE Position Statement). This confirmed that it cannot be concluded that the existing abstraction within Sussex North Water Supply Zone is not having an impact on the protected sites in the Arun valley. Natural England has advised that new developments within this zone must not add to this impact and making development 'water neutral' is one way of preventing any further negative impact. This position has been adopted by the relevant local planning authorities who require that any development in the Sussex North WRZ must demonstrate water neutrality. The Position Statement defines water neutrality as "the use of water in the supply area before the development is the same or lower after the development is in place."

Currently we are carrying out an environmental investigation (sustainability study) of the potential impacts of our groundwater abstractions at Hardham, with the key objectives to scientifically inform the potential water supply mechanisms to the Arun valley protected sites and determine any hydrogeological linkages to our groundwater abstraction at Hardham. Until the investigation is completed, which is expected at the end of March 2025, and the scientific information is available, we cannot confirm what level of groundwater abstraction (if any) might be having an impact.

2. Does Southern Water agree that what (if any) abstraction whose effects can so be excluded will only be established after the investigations currently being undertaken by you at the EA's request (scheduled for completion 2025)?

Yes, that is correct. There is uncertainty over the cause of the wildlife decline at the Arun valley protected sites. NE believe that Southern Water's groundwater abstraction activity at its Hardham Water Supply Works (WSW) could be contributing to this impact. As mentioned above, we are undertaking a full sustainability study of our Hardham groundwater abstraction and the extent of its impacts on the protected sites to understand any links and to ensure that it is sustainable in the long term. This investigation is due to complete in 2025. Meanwhile we have voluntarily reduced our Hardham groundwater abstraction volumes. We commenced a reduction in autumn 2021, with a target rolling average of 5 MI/day, representing approximately 40% reduction from previous typical levels (average daily abstraction groundwater abstraction from 1/1/19 to 31/7/21 was 12.7 MI/d; or, since 1/1/02, was 11.7 MI/d). This commitment extends at least to the completion of the sustainability review of the licence in 2025.



We are investigating NE's concerns further to ensure that our abstraction is not causing an impact and is sustainable in the long term. This could mean we take less from the Hardham groundwater source in future; however, our position will be informed by the completion of our sustainability study in 2025.

3. Does Southern Water agree that, pending the licence review in the light of Southern Water's investigations, a voluntary reduction by Southern Water to abstraction of 4.2 MI/day does not discharge its duties as statutory undertaker under the Habitats Regulations?

We are not entirely clear what is meant / what you are asking by this question but provide the following comment:

Southern Water takes its duties and statutory obligations as a statutory undertaker very seriously including those set out under The Conservation of Habitats and Species Regulations 2017 (The Habitats Regulations 2017).

Our Water Resource Management Plan (WRMP) sets out our strategy for how we intend to achieve a secure supply of water for our customers and a protected and enhanced environment, which includes Hardham and the Arun valley protected sites. The WRMP is a statutory plan which must be accompanied by a Habitats Regulations Assessment (HRA).

In response to the Position Statement issued by Natural England in September 2021 we have voluntarily reduced our ground water abstraction to a rolling average of 5 MI/d, which is significantly lower than our licensed abstraction limit and approximately 40% reduction from previous typical levels of this abstraction. We are hopeful that this will minimise any potential environmental deterioration which may be linked to our abstraction of ground water. Our position on this will be confirmed once the results of the sustainability study are available in 2025.

Please note that our voluntary agreement to reduce our abstraction is to target a rolling average abstraction rate of 5 MI/day as opposed to 4.2 MI/day as stated in your correspondence to us dated 21st June 2023.

4. If the answer to (3) is 'yes', will Southern Water commit to a cessation of abstraction from Hardham pending the license review, and will utilize alternative sources available to them?

Again, we are not entirely clear what is meant / what you are asking by this question but provide the following comment:

Our position is that in most water resource conditions Southern Water has a sufficient supply available to meet demand in the Sussex North WRZ and that we have some flexibility in where water is sourced from, thereby enabling the commitment to reduced abstraction from the Hardham groundwater source while the sustainability study is ongoing.



However, when dry periods are experienced and these become more severe, the output of several other sources in Sussex North WRZ become constrained by water availability, placing more reliance on the Hardham groundwater source. In the scenario of a severe drought or major operational supply outage we would potentially need to increase our groundwater abstraction to a higher rolling average, including potentially up to the full licensed abstraction limit for short periods, to ensure the expected supply to our existing customers in the Sussex North WRZ. For this reason, we would not be in a position to commit to a cessation of abstraction from Hardham or to a fixed limit of 5 MI/d (or 4.2 MI/d as quoted in your letter of June 21st)

5. If the answer to (3) is 'no', will Southern Water commit that, pending the license review, it will not increase its abstraction above 4.2 MI/day and will utilize alternative sources available to it?

As previously stated, we are committed to continue to abstract a target rolling average of 5 MI/d from our groundwater source at Hardham, whenever conditions are favorable to do so. We also require the flexibility of potentially abstracting up to our full licensed amount during extreme events to ensure resilience in our supply of water to existing customers. Our daily abstraction will at times be over the 5 MI/d and there will be times when abstraction is below this amount. The variation in our ground water abstraction is dependent on factors such as demand, network flexibility and availability of water from other sources. For these reasons, we are not in a position to agree to a fixed daily limit of abstraction less than our licensed daily limit.

I note your request for the Habitat Regulations Assessment (HRA) and Water Framework Directive (WFD) 'No Deterioration' assessment which we referred to in our response dated 14th April 2022. This request for information will be processed by our Environment Information Regulations Team (EIR) under a separate cover, reference EIR 1964. Please note this will take up to 20 working days.

In conclusion, Southern Water recognises that water is a precious resource and is dedicated to meeting the challenge of securing sustainable long-term water supplies in a way which protects the environment. In response to the NE's Position Statement and to further our protection of the environment we have commenced a sustainability study which is due for completion at the end of March 2025. The sustainability study will look to determine what/if any impact groundwater abstraction is having on the Arun Valley Arun Valley Special Area Conservation (SAC), Arun Valley Special Protection Area (SPA) and Arun Valley Ramsar Site. In the meantime, development proposals with the Sussex North WRZ that would lead to an increase in water demand will need to demonstrate 'water neutrality'. This can be achieved through water efficiency devices, water recycling and offsetting any new demand within the WRZ. Please see our [website](#) for further information and for some useful links, including to resources from Waterwise.

We note your reference to your clients reserving their right to taking legal action against Southern Water as per *R (Harris) v Environment Agency [2022]*. We note that case this was a judicial review case brought against the Environment Agency (EA) which found that the EA were too restrictive in



their review of numerous water abstraction license in a protected site (the Norfolk Broads) and that this breached The Habitats Regulations 2017.

You will no doubt be aware that this case was brought against the EA, and not the individual abstraction license holders, and in light of your comment, we kindly ask that you clarify the basis of any proposed legal action against Southern Water?

We trust you will find our response satisfactory to your expectations and to reiterate that we would welcome a discussion if you have further questions.

Yours sincerely,

Simon Parker

Director of Asset Management

Annex 6530/4:

UK Centre for Ecology and Hydrology blog entitled “why we are still in drought despite recent rain” 13 October 2022



Why we are still in drought despite recent rain

[Home](#) > [News and media](#) > [Blogs](#) > Why we are still in drought despite recent rain

13.10.2022

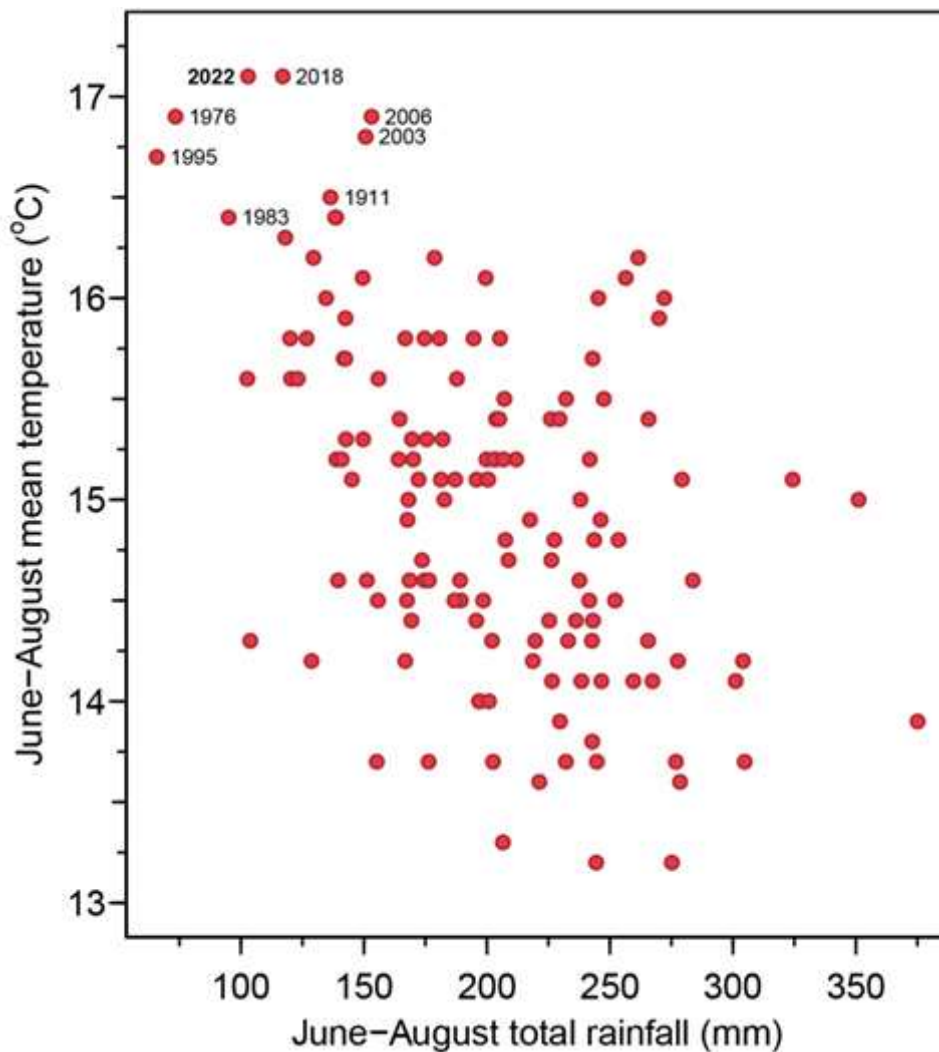
Steve Turner, hydrologist at the UK Centre for Ecology & Hydrology, reflects on this year's record-breaking heatwave and long period of dry weather and looks at the status of the UK's water resources as we move into autumn and winter...

The UK experienced a prolonged period of dry weather in 2022 which culminated in a severe summer heatwave and record-breaking temperatures, posing challenges for water resources as we move into the autumn. Impacts of the protracted dry weather and low river levels included environmental stress in aquatic ecosystems, challenges for farmers in terms of irrigation, harvesting and drilling seeds, stressed terrestrial habitats and severe wildfires.

So, what happened?

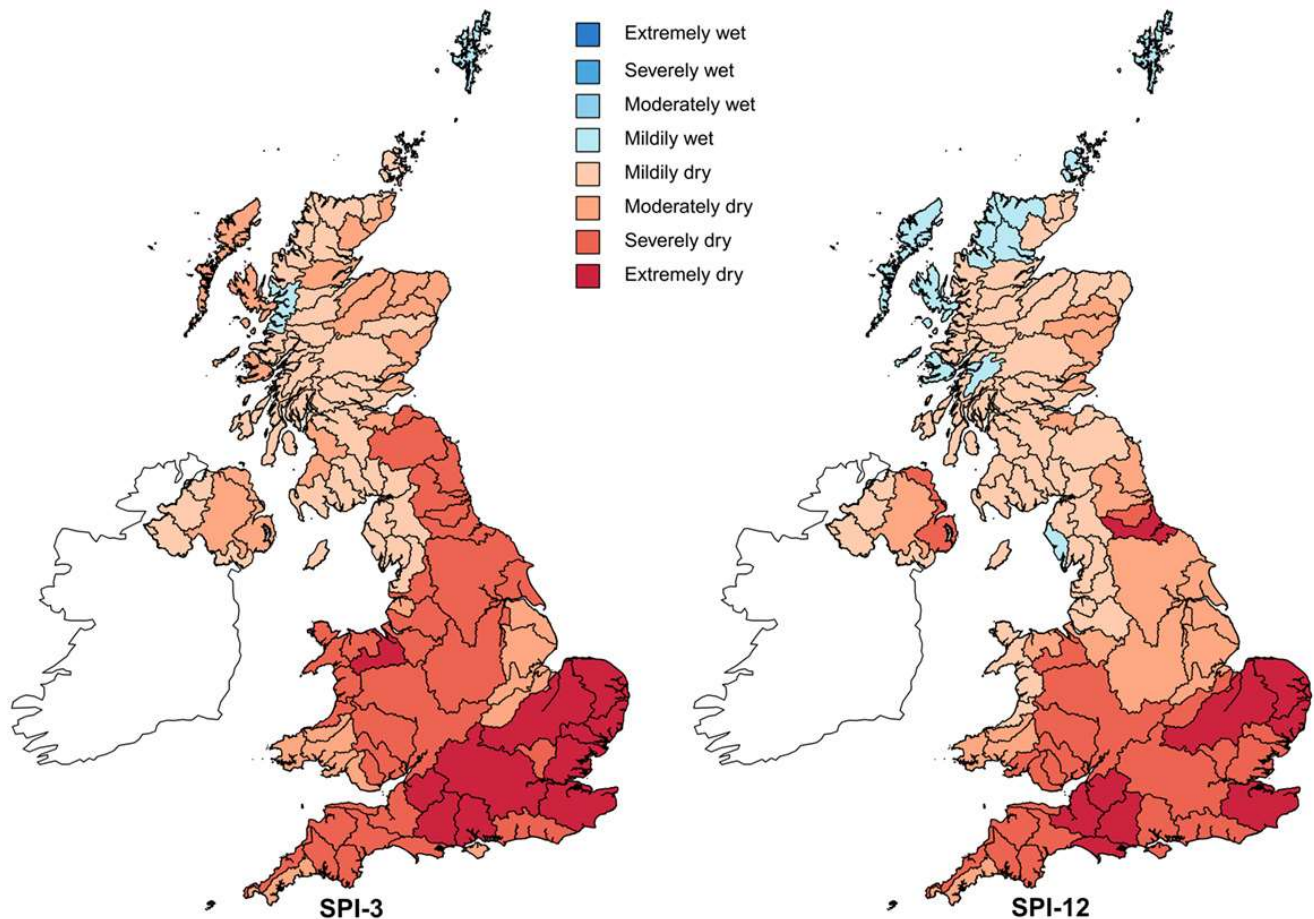
The summer was notably hot, with maximum temperatures far above average across much of England, and new record highs for Wales and Scotland. A new UK record temperature of 40.3°C at Coningsby, Lincolnshire was recorded on 19 July and the season was generally settled with

little rain during most of July and August. Summer 2022 (June-August) registered as the fifth driest for England & Wales in a series from 1836. This combination of dry and hot weather meant that June-August in England joined an exclusive club of exceptionally hot and dry summers (eg 1976, 1995, 2018) in a series from 1884 (shown in the plot below).



June-August rainfall totals and mean temperatures for England

Rainfall for the summer period across the whole of the UK was low, with less than two-thirds recorded compared to the 1991-2020 average. Many regions, particularly in England, received less than half the average rainfall, including Severn Trent, Yorkshire, Anglian, Thames, Wessex and South West. The Anglian, Thames and Wessex regions all recorded their fifth driest summer in records since 1836. Rainfall deficits can also be compared using the Standardised Precipitation Index (SPI), a widely-used drought index. The map below shows the rainfall deficits over the three-month period ending in August (SPI-3) during which the majority of England, Wales and south-east Scotland were in the 'severely dry' and 'extremely dry' categories. Taking a longer view, the SPI-12 period (September 2021-August 2022) also highlights the severe duration and magnitude of the event.



June-August 2022 Standardised Precipitation Index (SPI-3) for the UK (left) and September 2021-August 2022 Standardised Precipitation Index (SPI-12) for the UK (right)

By the end of summer, daily river flows were among the lowest ever recorded for some catchments in southern and eastern England, rivalling and sometimes eclipsing those of droughts in 2018, 1995 and 1976. As of 31 August, 51 per cent of the 836 gauging stations on our UK Water Resources Portal were in the notably or exceptionally low category. Summer river flows across the UK were notably to exceptionally low across much of England, southern Scotland and south Wales. There were new record summer minima recorded on the Yscir, Waveney and Yorkshire Derwent, which all have records of 48 years or more.

Using the most recent river flow data up to the end of September we have assessed the severity of these low flows on a few selected rivers. The table below shows the ranking of various low flow minima for different periods of time. For example, the 7-day minima refers to the lowest 7-day average river flow of all such periods within a year.

NRFA Station Number	Name	Length of flow record (years)	Rank of annual minima for accumulated river flows				Return period
			7-day	30-day	60-day	90-day	7-day
27041	Derwent at Buttercrambe	49	4	5	6	5	10
28082	Soar at Littlethorpe	51	2	2	2	2	40
33034	Little Ouse at Abbey Heath	54	1	2	1	1	50
39020	Coln at Bibury	59	1	1	1	2	>100
40011	Great Stour at Horton	58	5	4	4	6	10
50001	Taw at Umberleigh	64	2	2	2	3	80
56013	Yscir at Pont-Ar-Yscir	50	1	1	1	1	>100

Note: analysis assumes homogeneity in gauging records, but in actuality hydrometric data quality and artificial influences in a catchment can change over time

The table also provides the return periods for 7-day minima using the Wallingford HydroSolutions Hydro Tools package (with default options set). Note these minima were estimated using time series extending up to the end of September 2022 but, in some catchments, flows were still decreasing, so it's possible that the ranks may change. These are provisional early assessments and will be updated later when full time series are available.

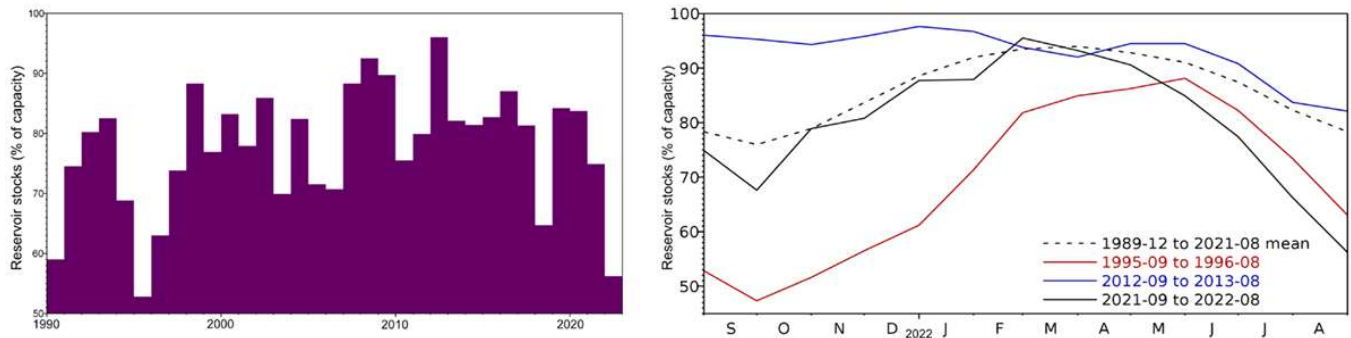
The analysis shows the 7-day minima at these sites were all in the lowest five years on record, and the lowest on record in both responsive rivers (eg Yscir, south Wales), as well as less responsive rivers (eg Coln, Gloucestershire). It's interesting that these rankings don't change a great deal when looking at the longer 30- to 90-day minima, which highlights the severe nature of the extent and duration of this year's drought. Further analysis suggests that 2022's 7-day minima at some sites have a return period of around 50 to over 100 years. This equates to around a two per cent chance of happening in any given year (eg on the Little Ouse and Taw) and around a one per cent chance of happening in any given year for the Coln and Yscir.

Groundwater levels also continued to fall during August and ended the month mostly below normal to exceptionally low. Levels were exceptionally low in the Chalk of southern England and in the Carboniferous limestone of south Wales, where the borehole at Pant y Lladron saw its third successive month of record low levels (in a series of 27 years).

At the end of July, soil moisture data from UKCEH's COSMOS-UK network showed that soils were generally dry across the UK, and exceptionally dry in southern England following the heatwave conditions. By the end of August many soils further north and west also became notably dry for the time of year. Due to the large soil moisture deficits even sites which received rain during the month experienced only a short-lived increase in soil moisture before drying again.

The rainfall deficit and increased water demand spurred on by hot weather meant by the end of August reservoir stocks in southern England were exceptionally low - around 40% below average at Colliford, Cornwall and Ardingly, West Sussex. The end of August reservoir stocks for England & Wales (shown in the plot below) were the second lowest on record (since 1990) after the 1995 drought which particularly affected northern England – an area where reservoirs are more

common. The low status of water resources has led to Temporary Use Bans (previously known as hosepipe bans) being implemented by eight water companies in England and Wales. Eleven of the Environment Agency's 14 operational areas are now in official drought status. At the start of September, drought status was also extended to all areas by Natural Resources Wales.

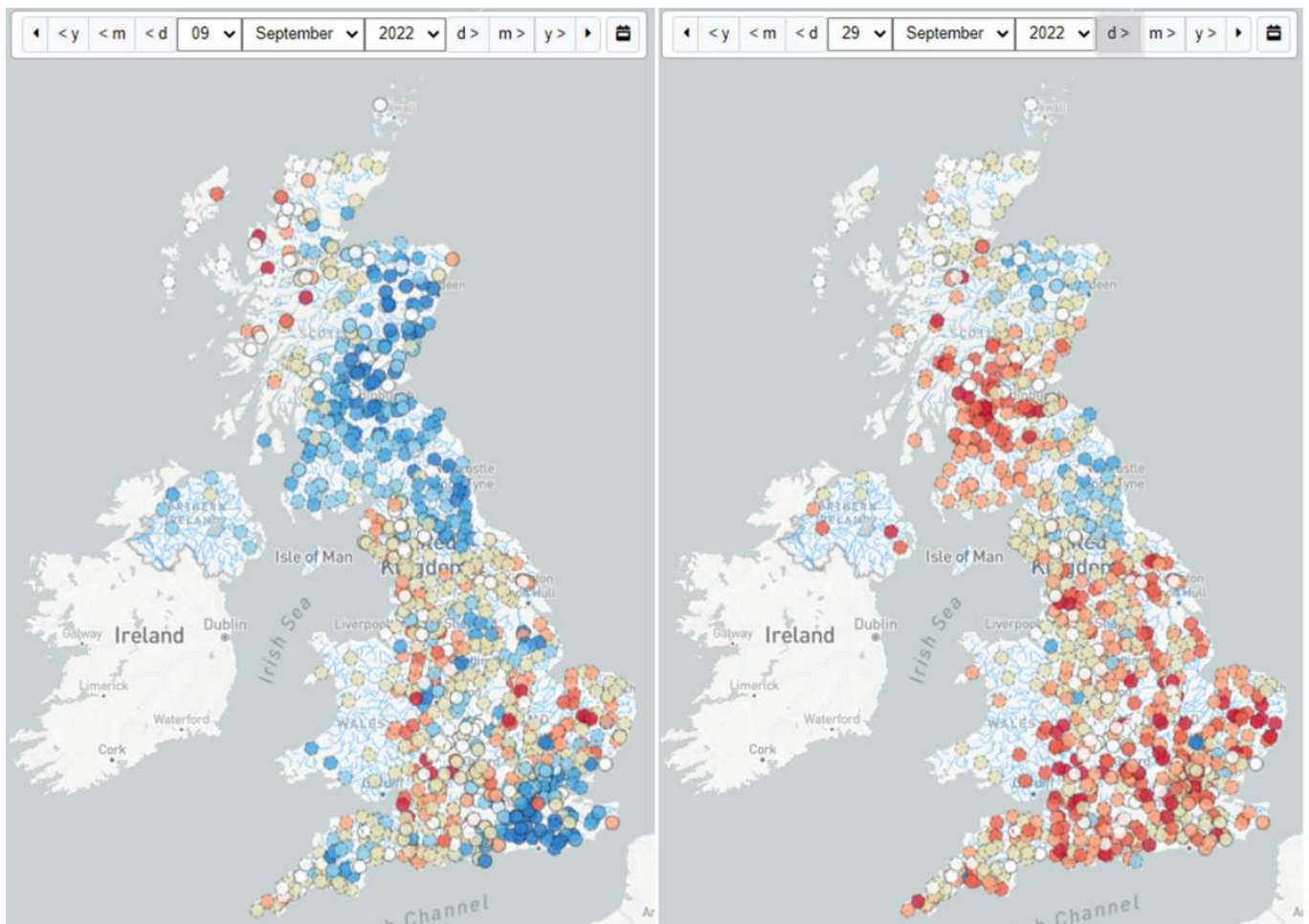


End of August reservoir stocks for England & Wales (left) and September 2021 to August 2022 reservoir stocks compared to average and notable drought (1995-1996) and flood years (2012-2013) (right)

What has happened since summer?

At the start of September, we saw unsettled conditions with showery and occasionally very wet weather, particularly in northern and western areas of the UK, but also in southern England. Low pressure systems moved in from the Atlantic bringing, at times, some notable rainfall totals eg 63mm at Tiree (Inner Hebrides) on the 2nd September, 41mm at Plymouth (Devon) on the 3rd, 58mm at Garnewllt Sewage Works (Dyfed) on the 4th and 76mm at Balmoral (Aberdeenshire) on the 5th.

The unsettled conditions inevitably led to increases in river flows during the first 10 days of the month, and daily river flows were in some cases exceptionally high (left below) in northern Britain and south-east England.

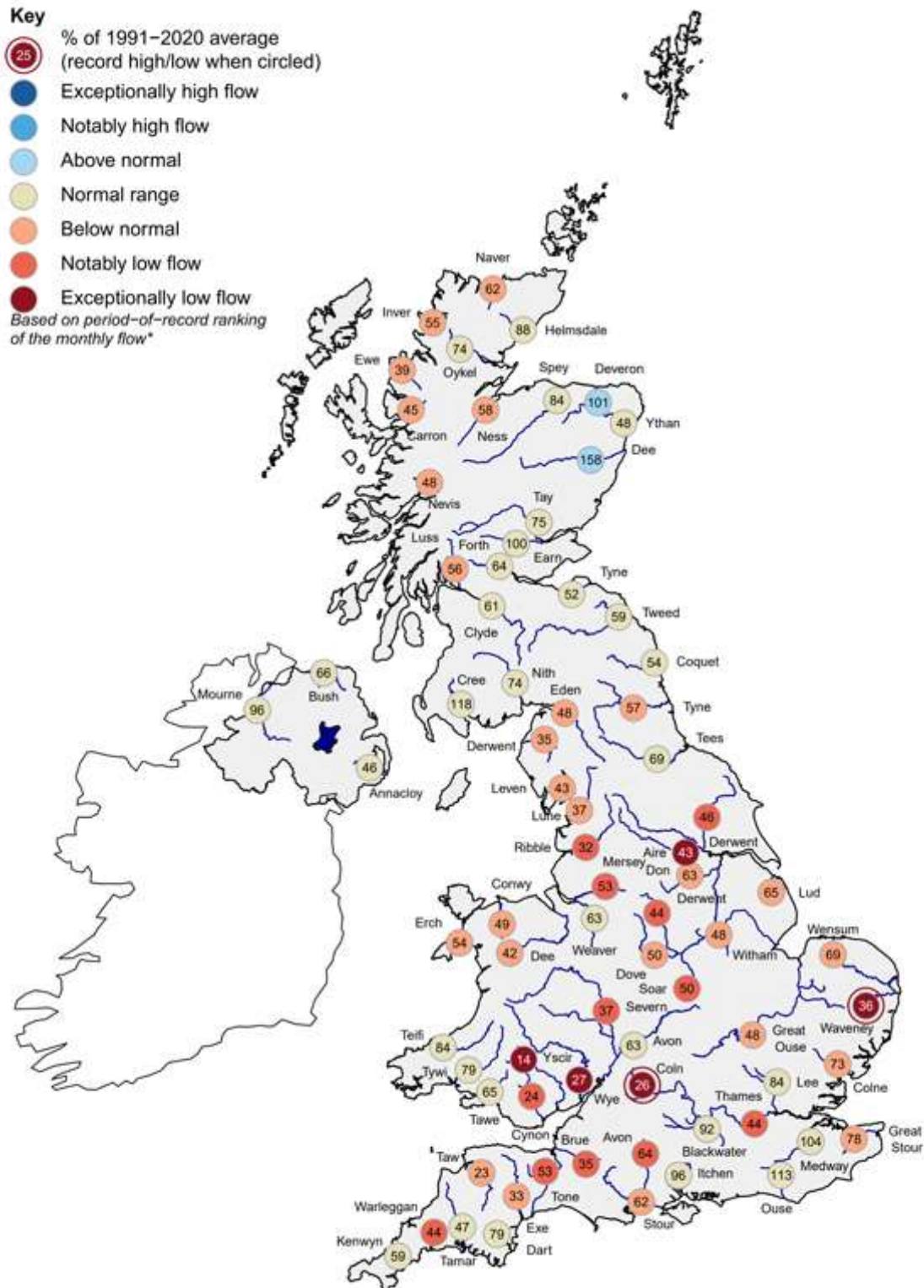


Screenshots from the UK Water Resources Portal showing daily river flow data on 8 September 2022 (left) and 29 September 2022 (right)

The last two thirds of September generally saw a return to more settled conditions with more modest rainfall totals, and the increase in river flows at the start of the month was short-lived, with flows returning to notably and exceptionally low across the country by the 29th (above right). However, on 30 September frontal rain swept across the UK, heaviest in the north and west, and 100mm of rain fell at Seathwaite and 94mm at Honister (both Cumbria). Flash flooding in the Lake District resulted in transport disruption and loss of livestock.

For September as a whole, rainfall for the UK was above average (111 per cent of 1991-2020 average), the first month of above average rainfall since May. Despite this, some regions still recorded less rainfall than average, including the Anglian and Highland regions which saw less than 85 per cent, compounding the effects of the previous dry months.

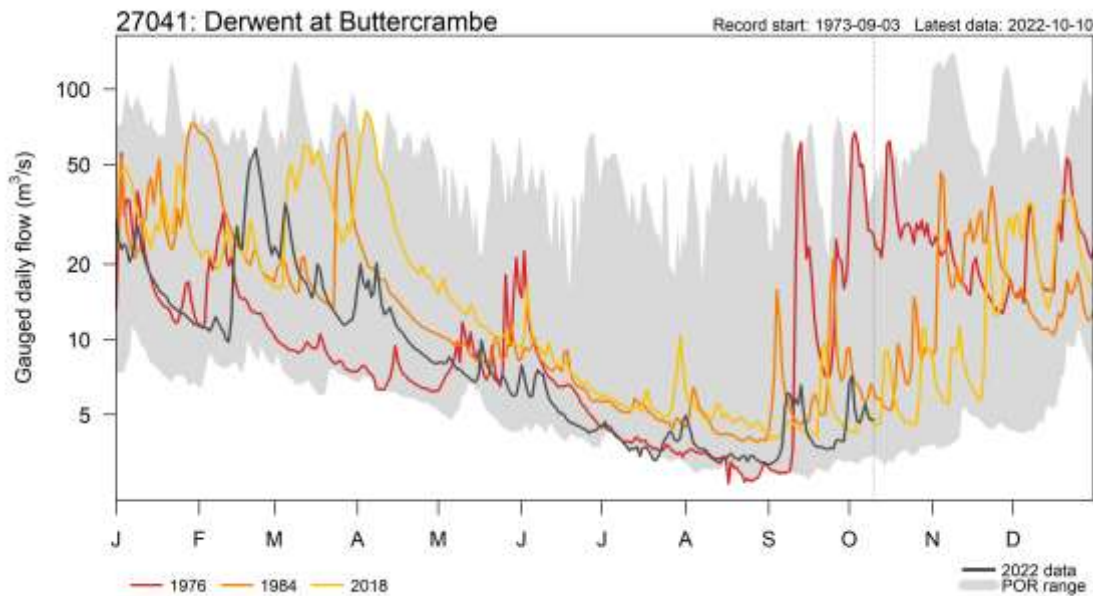
Despite the rain, September monthly river flows remained low; the majority of sites were below normal across most of England and Wales. Record low September flows were recorded on the Waveney and the Coln, while many rivers in England and Wales registered less than a third of the September average. Further north in Scotland and Northern Ireland, September average monthly river flows were in the normal range.



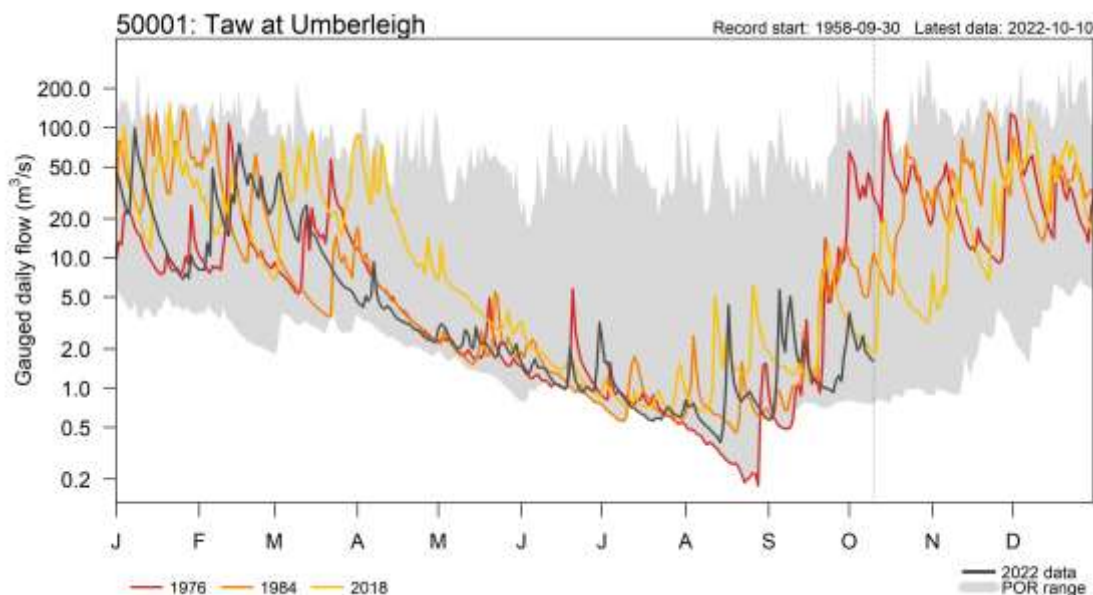
Map of average September river flows from UKCEH's September 2022 Hydrological Summary for the UK, showing current flows as a percentage of the long-term average.

River flows have generally been somewhere in between the 2018 and 1976 droughts for most of the year. For much of spring 2022, flows in catchments across England and Wales remained higher than those in 1976. During the summer, in some catchments such as the Derwent, the 1976 (red line in the plots below) and 2022 (black line) flows tussled for the lowest. In the south-west, 2022 flows on the Taw were among the lowest during spring and summer, but, responding to recent rainfall in September, they increased, departing from similar drought years. However, there was a remarkable transformation for both these catchments in 1976 and river flows in the

autumn of that year increased sharply in response to very wet weather, as signified by the steepness of the red lines in the graphs below. This was in common with many catchments in the country – the autumn of 1976 was exceptionally wet, and the drought recovery was abrupt (more details in our 1976 drought report).



Graphs showing river flow data to 10 October 2022 (black) alongside 1976 (red) and 2018 (orange) for the Yorkshire Derwent (left) and Taw (right).



Although we had some wet weather in September, the upturn in flows has not been near the same magnitude as 1976. The most recent data at the start of October shows the 2022 flows are now a lot lower than at the same time in 1976 and also lower than the 1984 and 2018 droughts (in the case of the Taw). This is very important as autumn is when we normally start to see water resources being replenished. This narrows the window where rainfall has the most significant impact on the longer-term water resources outlook. In many parts of the country, all eyes will be on the late autumn and winter – healthy rainfall will be needed to avoid drought persisting and potentially causing further impacts next year.

At the start of October, we had further typically autumnal weather in places, which has increased river flows (particularly in northern and western areas of the UK). However, the rainfall has not been persistent and has been interspersed by spells of more settled weather, which means that river flows often remain in the below normal range – particularly in central, southern, and eastern England. In northern England and Scotland flows are healthier as many catchments return to the normal range or above.

What can we expect over the coming months?

Despite this occasionally very wet weather, the October-December Outlook suggests that total rainfall over the next three months is unlikely to be above average. Furthermore, the average rainfall we are expecting will likely be heaviest and most widespread in northern and western areas. There is little suggestion at the moment that the prolonged wet weather needed to reverse the current situation in southern England will be forthcoming.

If the UK receives below average rainfall over the rest of autumn and winter, it is very likely that drought conditions will continue into 2023. The Hydrological Outlook for October-December found that in some areas such as the Wessex, Thames and Anglian regions the rainfall required to return to normal by December would be associated with a 10–25 year return period, which equates to a 4 to 10 per cent chance of happening in any given year. Over the three-month period, the Outlook suggests river flows are likely to continue below normal in southern England, while elsewhere flows return to the normal range. Groundwater levels are also likely to be below normal in the far south, tending towards normal elsewhere. However, this is dependent on rainfall and the timing of the start of the recharge season, which is already delayed.

A new Hydrological Outlook will be published in early November. The winter months (December-February) are when seasonal forecasts are most accurate, and it will be this period which will be crucial to determine the water resource situation going into 2023. In the meantime, you can access the latest information on the drought as it evolves through the UK Water Resources Portal, updated daily with near-real-time data on soil moisture and river flows (in England and Scotland), alongside monthly rainfall and groundwater level data.

Steve Turner

With contributions from: Tracey Haxton and Jude Jeans from Wallingford HydroSolutions, and Lucy Barker, Jamie Hannaford, Alannah Killeen, Eugene Magee, Simon Parry, Catherine Sefton, Maliko Tanguy, Isabella Tindall (UKCEH).

Annex 6530/5:

Data extract of Hardham borehole abstraction volumes June –
August 2022

Hardham Abstraction data
Supplied by Southern Water

Date	Abstraction (MI)	Date	Abstraction (MI)
Summer 2022	Hardham Ground	Summer 2022	Hardham Ground
01/06/2022	0.51	20/07/2022	15.39
02/06/2022	3.59	21/07/2022	8.25
03/06/2022	6.95	22/07/2022	7.52
04/06/2022	1.65	23/07/2022	13.04
05/06/2022	0.29	24/07/2022	17.53
06/06/2022	0.01	25/07/2022	13.12
07/06/2022	0.01	26/07/2022	9.62
08/06/2022	0.01	27/07/2022	5.93
09/06/2022	0.01	28/07/2022	4.37
10/06/2022	0.77	29/07/2022	9.14
11/06/2022	2.75	30/07/2022	8.47
12/06/2022	6.45	31/07/2022	9.90
13/06/2022	1.13	01/08/2022	7.04
14/06/2022	3.28	02/08/2022	10.63
15/06/2022	0.05	03/08/2022	10.54
16/06/2022	0.69	04/08/2022	6.72
17/06/2022	9.81	05/08/2022	11.95
18/06/2022	4.76	06/08/2022	12.24
19/06/2022	0.01	07/08/2022	5.67
20/06/2022	2.71	08/08/2022	1.93
21/06/2022	5.67	09/08/2022	7.66
22/06/2022	4.27	10/08/2022	7.09
23/06/2022	4.35	11/08/2022	7.87
24/06/2022	3.60	12/08/2022	7.68
25/06/2022	0.31	13/08/2022	11.16
26/06/2022	0.73	14/08/2022	10.11
27/06/2022	2.84	15/08/2022	3.23
28/06/2022	4.49	16/08/2022	7.35
29/06/2022	5.05	17/08/2022	4.53
30/06/2022	2.38	18/08/2022	0.42
01/07/2022	9.13	19/08/2022	1.03
02/07/2022	3.81	20/08/2022	0.37
03/07/2022	6.29	21/08/2022	2.08
04/07/2022	10.08	22/08/2022	2.16
05/07/2022	4.33	23/08/2022	1.68
06/07/2022	0.53	24/08/2022	3.37
07/07/2022	2.28	25/08/2022	3.95
08/07/2022	4.24	26/08/2022	3.64
09/07/2022	4.76	27/08/2022	4.71
10/07/2022	6.55	28/08/2022	3.78
11/07/2022	5.27	29/08/2022	1.78
12/07/2022	5.83	30/08/2022	0.91
13/07/2022	9.72	31/08/2022	3.34
14/07/2022	10.79		
15/07/2022	11.90		
16/07/2022	9.29		
17/07/2022	10.08		
18/07/2022	9.87		
19/07/2022	8.38		

Average

5.45 MI/d

ecology • landscape planning • arboriculture

The logo for Aspect Ecology Ltd features the word "aspect" in a white, lowercase, sans-serif font. A thin, light grey diagonal line is positioned above the "t", extending from the top of the letter to the right.

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