GARD response to Ofwat Consultation on Strategic Regional Water Resource Solutions

Contents

Summary

We strongly welcome Ofwat's initiative in promoting, funding and over-seeing a regional approach to developing strategic water resources. In our opinion, in the past 25 years there has been insufficient regulatory attention to planning of water resources on a regional and national scale. Too much has been left to the water companies who have focused on their own needs, rather than making best use of scarce regional and national water resources.

We are concerned, however, that the programme to reach Gate 2 decisions on selection of major schemes by 2022 will not allow enough time for the detailed investigations needed to ensure that sound decisions are made. The target date of 2022 appears to have been driven primarily by the supposed need of a major new source for Affinity by 2037 and the 15-year lead time for Abingdon reservoir. Our analysis shows that Affinity does not need a major source by 2037. We think a decision on the next major source for the South East can and should be delayed 5 years to 2027.

It is not clear to us from Ofwat's report whether there is an intention to produce regional water resource plans as part of the strategic resource investigations. In our opinion, a regional plan for the South East should form part of the Gates 1 and 2 decision process. The plan should include assessment of the overall regional deficit, combined with evaluation of strategic resource options to produce an adaptable plan that is able to accommodate the large uncertainties in future deficits – providing security of supplies for the region whilst minimising the risk of unnecessary and environmentally damaging projects.

We have major concerns about the risks associated with Abingdon reservoir that we consider have been underplayed by Thames Water in their determination to proceed with the project they were denied at the Public Inquiry into their WRMP09 in 2010. The major risks are failure of the 10km long 25m high earth embankment on a clay and gravel foundation with the consequent catastrophic flood, the lack of resilience of the reservoir in droughts lasting longer than 18 months leading to catastrophic London supply failure, the enhanced risk of flooding from the reservoir's sealing of a substantial area of the flood zone on which it will be built, and the lack of recent major dam construction experience in the UK water industry. The need for proper investigation and evaluation of these risks is a prime reason for delaying the Gate 1 decision by 5 years.

We support the range of options selected by Ofwat for the strategic resource investigations. This response gives brief details of our views on these options, with cross referencing to more detailed comments in our response to Thames Water and Affinity's WRMPs.

The WRMPs of Thames Water and Affinity have not taken account of the returns to London's supplies from Affinity's increased supplies, via effluent returns and enhanced chalk stream flows. This is a major failing, invalidating much of the deficit forecasting and option evaluation in their WRMPs.

Allowance for the returns from enhanced chalk stream flows will allow much more rapid and extensive alleviation of chalk stream low flows than waiting for Abingdon reservoir. GARD's proposed scheme for achieving this should be included in the strategic investigations. Ofwat should resist the recent clamour from chalk stream interests to accelerate construction of Abingdon reservoir to "save the chalk streams".

We are pleased to note reference to stakeholder engagement as part of the gated decision process. We hope that details of planned stakeholder engagement will soon be available and will include opportunities to comment on all stages of the investigations, including their initial terms of reference, as well as regular stakeholder meetings.

In our opinion there has been a total lack of option cost transparency in the WRMP process and we hope this will be rectified in Ofwat's gated decision process.

We welcome the formation of the RAPID unit to oversee the strategic investigations. We hope that details of its organisation and terms of reference will soon be publicly available.

In our opinion, it is essential that RAPID has access to substantial support from technical consultants with a range of expertise and experience that is equivalent to the consultants being employed by the water companies. One of the functions of RAPID should be to arbitrate in areas of dispute between stakeholders like GARD and the water companies – we have identified many such issues which are listed in Section 5.3 of this response.

In our opinion, Ofwat has been very generous with its allocation of about £400 million for the strategic resource investigations. We suggest that it would be reasonable to allocate about 2-3% of the £400 million budget to RAPID and its consultants, ie about £8-£12 million.

1. Introduction

This response gives GARD's views of the programme of strategic water resource investigations described in Ofwat's report "PR19 draft determinations: Strategic regional water resource solutions"[1].

We strongly welcome Ofwat's initiative in promoting, funding and over-seeing a regional approach to developing strategic water resources. In our opinion, since the National Rivers Authority's published water resource strategy for England and Wales in 1994[2], there has been insufficient regulatory attention to planning of water resources on a regional and national scale. Too much has been left to individual water companies and their 5-yearly WRMPs, which have focused on their own needs (including benefits to shareholders), rather than making best use of scarce water resources.

Our response covers:

i) Regional forecast deficits in the South East and the need for the decision on selected solutions by 2022, with selected schemes construction-ready by 2024.

ii) The need for truly independent review of regional deficits.

iii) Risks associated with the proposed Abingdon reservoir.

iv) Some limited comments on the range of solutions proposed, cross-referenced to more detailed comments in our responses to consultations on recent draft WRMPs.

v) The need for stakeholder engagement and regulatory technical supervision.

We hope our views will be taken into account in setting up the programme of intense and costly investigations planned for the next 5 years. Our response takes account of views of our technical consultants, John Lawson and Professor Chris Binnie. Both have over 50 years' experience of water resources engineering, both are among the small number of water resource engineers invited to become fellows of the Royal Academy of Engineering and both have held senior positions in the Institution of Civil Engineers and the Chartered Institution of Water and Environmental Management.

[1] https://www.ofwat.gov.uk/publication/pr19-draft-determinations-strategic-regional-water-resource-solutions-appendix/

[2] Water Nature's Precious Resource – An Environmentally Sustainable Water Resources Development Strategy for England and Wales, March 1994. ISBN 0-11-886523-4

2. Regional deficit forecasts and need for Gates 1 and 2 decisions by 2022

2.1 Ofwat's programme for delivery gates

Table 4.1 of Ofwat's report describes the three main delivery gates:

- By 2021 – Gate 1, initial design work complete and selected solutions carried forward
- By 2022 – Gate 2, detailed design work complete and updated decisions on solutions
- By 2024 – Gate 3, solutions 'construction-ready' with planning permission granted

In our opinion, this is an extraordinarily tight programme for the extent of work envisaged and the wide range and complexity of the potential solutions. We fear that such a rushed programme will lead to botched decision making and potentially disastrous consequences which could include:

- Selection of a large scheme, specifically Abingdon reservoir, that could turn out to be an un-needed, costly and environmentally damaging white elephant like Kielder reservoir, but located in a much less remote and more densely populated part of the country.

- Selection of an option, again specifically Abingdon reservoir, with potentially catastrophic risks of failure due to a) lack of resilience to long duration droughts and failure of London's supplies; or b) "dam break" failure and flooding of the Thames Valley and London, with major loss of life.

We will comment further on the risks associated with Abingdon reservoir in Section 3 of this consultation response.

The need for schemes to be selected by 2022 and construction-ready by 2024 appears to be driven by:

- Firstly, the quoted National Infrastructure Commission findings that there is a need for 1300 Ml/d in new supply solutions by the 2030s in the South East Region to maintain drought resilience, growing to an extra 3000 Ml/d by 2050[3]

- Secondly, Affinity Water's reported need for up to 100 Ml/d, but only starting to arise in 2037 – if the need is to be met by Abingdon reservoir with its 15-year lead time, a decision on Abingdon reservoir is needed by 2022.

- Thirdly, Southern Water's needs for a relatively modest new source, 50 Ml/d, by 2027.

Regarding the first of these statements, it seems to be a misinterpretation of the statements

[3] Ofwat report, op cit, page 10

in the NIC's report '*Preparing for a Drier Future*'[4], which identifies that 4000 Ml/day of extra supply is needed over the *whole of England* by 2050, but recommends that only 1/3 of this (1300 Ml/day) should come from new supply infrastructure (the rest from Leakage Reduction and Efficiency measures). The overall English figure is, moreover for resilience to extreme drought, defined by the NIC as a 1:500 year probability, so is beyond the current guidelines required in the Water Resource Management Plans (WRMPs). This loose interpretation of the recommendations tends to build in over-provision of new infrastructure and should, we believe, be avoided at this stage. In our opinion, neither the NICs forecast, nor either of the two remaining drivers justify the need for an irrevocable decision on all selected schemes by 2022, with construction starting in 2025 (AMP8).

It would be much preferable for Ofwat to delay any decision on major scheme selection until 2027, allowing an additional 5 years for investigations. There can be an interim objective of identifying by 2022 some modest sized (say less than 100 Ml/d total), low risk, easily implemented schemes to meet the needs of Southern Water and Affinity Water, including the need to reduce abstraction from chalk streams.

We have expanded our views of these drivers of future needs in Sections 2.2 to 2.4 below.

2.2 The regional needs of the South East

The NIC's deficit forecasts

The National Infrastructure Commission's estimates of future needs of the South East Region are *"based on data from Water UK, water companies and the Environment Agency"*[5]. Water UK's estimates were based on data from their water company members. Therefore, it appears that the NIC's estimates of need are essentially the sum of water company estimates, as per their draft WRMP19s.

GARD has commented extensively on the deficit forecasts of Thames Water and Affinity Water, the two companies claiming biggest needs, in our responses to their original and revised WRMP19s [6] [7] [8]. These responses can be seen on GARD's website at http://www.abingdonreservoir.org.uk/downloads.html. We will not repeat the detail of our criticisms and supporting evidence here, but in summary:

[4] National Infrastructure Commission, Preparing for a Drier Future, pp 9-10, April 2018 https://www.nic.org.uk/publications/preparing-for-a-drier-future-englands-water-infrastructure-needs/

[5] National Infrastructure Commission, op cit, page 19.

[6] GARD response to Thames Water's Consultation on Draft WRMP19, pages 22-57, April 2018. http://www.gard-oxon.org.uk/downloads/GARD%20response%2029.04.2018.pdf

[7] GARD response to Thames Water's Consultation on Revised Draft WRMP19, pages 20-52, November 2018http://www.gard-oxon.org.uk/downloads/GARD%20%20response%20to%202nd%20Consultation%20on%20TW%20draft%20WRMP%20Rev%2029.11.18.pdf.

[8] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 16-52, April 2019http://www.gard-oxon.org.uk/downloads/GARD%20response%20to%20Affinity%20final%20-v3-23-04-19.pdf.

i) We consider the population forecasts to be grossly over-stated due to unrealistic assumptions of future fertility rates, immigration growth (post-Brexit) and rates of housing development, which have been invariably over-estimated in local authority plans.

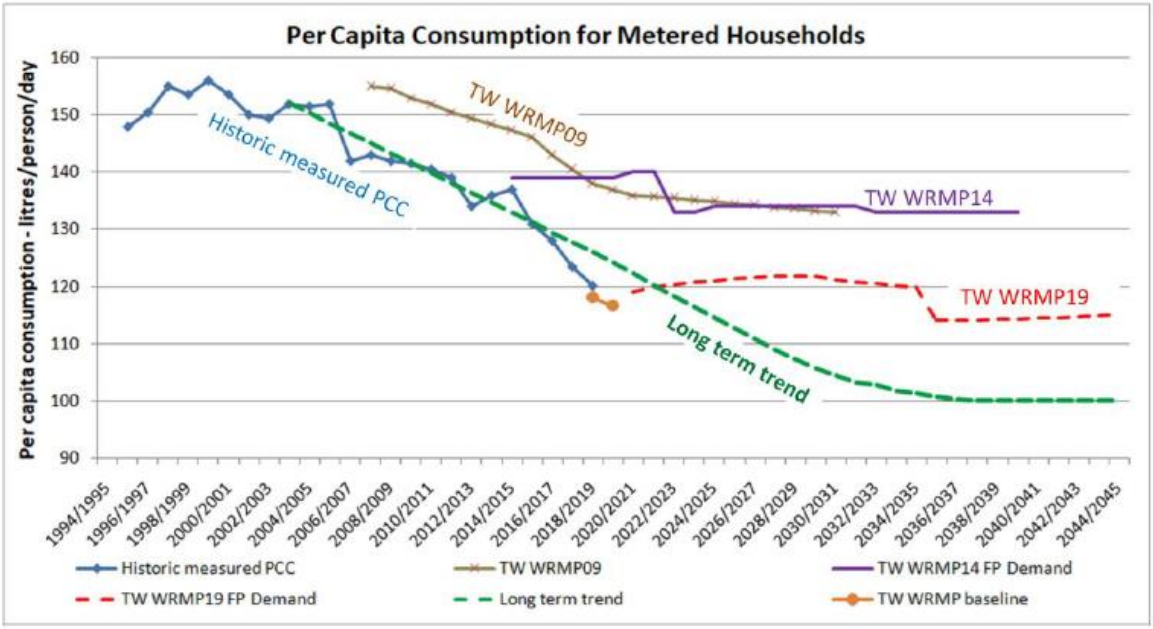
ii) Thames Water and Affinity's population growth forecasts have not been coordinated to allow for movement of people out of Central London into Affinity's supply areas in outer London and the Home Counties.

iii) Although complying with the Government target of reducing leakage by 50% by 2050, Thames Water start with much the worst leakage of any water company, so their target should be for a more than 50% reduction.

iv) Although Affinity plans to comply with the Government's 50% reduction target by 2050, a lot of the reduction is after 2038, the date at which it says it will need water from Abingdon reservoir.

v) Neither Thames Water nor Affinity have allowed for the greater reduction of PCC that will come from widespread introduction of smart metering and tariff structuring – their forecast PCCs in the range 120-140 l/h/d are much higher than the 100 l/h/d targeted by more progressive companies with forecast deficits.

vi) Thames Water has a history of persistently over-forecasting their PCCs in their WRMPs, failing to recognise the benefits of its own planned demand reduction measures. This is shown in Figure 1, taken from GARD's response to Thames Water's revised WRMP19:



Plot copied from Figure 2-5 of GARD's response to TW's revised dWRMP19 [ref 6]

Figure 1 - Thames Water historic predicted and measured PCCs

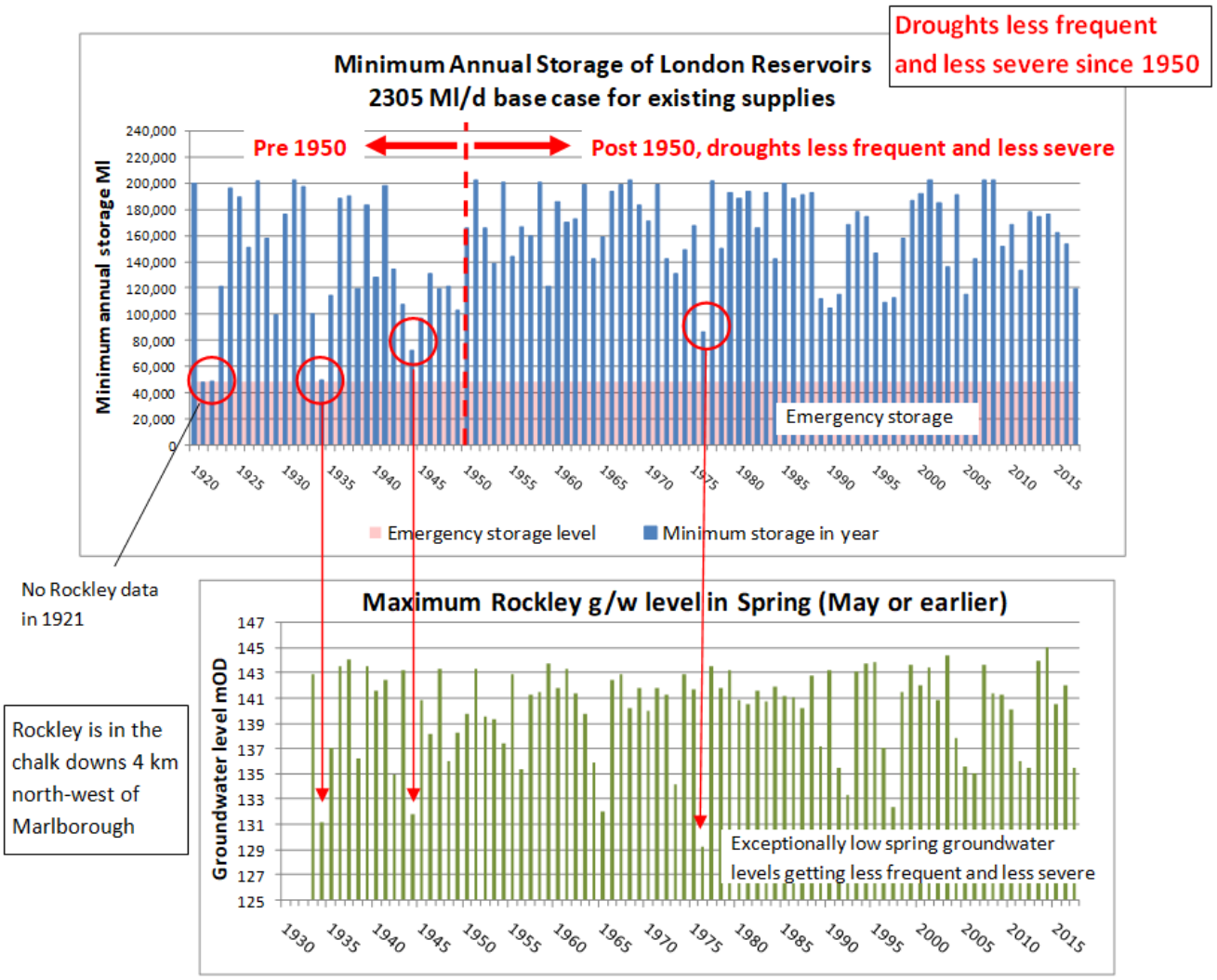
As can be seen in Figure 1, the WRMP09 forecast was consistently about 10-15 l/h/d above the actual measured PCC, failing to recognise the extent of actual reduction. There was a similarly poor forecast of future reduction in WRMP14. The WRMP19 forecast shows minimal planned reduction in PCC, despite the long term trend and the increase in smart metering.

vii) Thames Water's forecast of a 250 Ml/d loss of supply capacity due to climate change fails to recognise that the existing large storage capacity in their London reservoirs is well able to cope with the more intense short duration summer droughts that are forecast with climate change, or that wetter winters due to climate change will improve winter refill of their reservoirs and provide a stronger base flow in summer.

The impact of climate change to date on London's supplies

The evidence of the operation of London's supply system at present levels of demand in the actual climate since 1920 suggests that climate change could actually be increasing the output of London's existing supplies. GARD's evidence for this is shown on Figure 2, taken from GARD's response to Thames Water's revised WRMP19[9]:

[9] GARD response to Thames Water's Consultation on Revised Draft WRMP19, pages 36-40, November 2018



Note: Minimum London storages up to 2010 from WARMS2 modelling of 2305 Ml/d base case, using historic river flows from the actual climate since 1920. Post 2010 storages from CEH monthly hydrological summaries

Figure 2 - Evidence of lack of climate change impact on London's supplies since 1950

Figure 2 provides the following evidence of the susceptibility of London's supplies to droughts and how supplies might have been affected by climate change:

i) The summer droughts that stretch London's supplies are those following exceptionally dry winters, resulting in low groundwater levels in spring and reservoirs not full at the start of summer.

ii) If the dry winter is then followed by a summer drought, subsequent summer flows in the River Thames (largely fed by groundwater) and reservoir storages become exceptionally low – see the examples of 1934, 1944 and 1976.

iii) Despite the widely acknowledged climate change that has occurred since 1950, there is no evidence that the long duration droughts that most affect London's supplies are becoming more frequent or more severe.

iv) If anything, the wetter winters, as evidenced by increased flooding in the Thames

valley, appear to be causing the deployable out of London's supplies to rise. If the performance of London's existing supplies is assessed using only the climatic data of the past 75 years (which include the severe drought of 1976), the deployable output of London's supplies increases by over 200 Ml/d[10].

In its Statement of Response to the second WRMP19 consultation, Thames Water has dismissed GARD's suggestion that climate change could be having no adverse impact on London's supplies and might actually be increasing the output[11]:

> *GARD's statement that climate change over recent history has led to an increase in Deployable Output is essentially based on the fact that more severe droughts (in terms of water resource impact) occurred in 1920/21 and 1933/34 than later in the historical period (Figure 2-7 in GARD's response). The fact that droughts as severe as these didn't occur later in the period is not due to the impact that climate change had over this period. Severe droughts are, by their nature, rare events, and so their occurrence is dependent on trends (e.g. the impact of climate change), but also on a great deal of chance. As such, it is perfectly possible for the likelihood of severe drought to increase without a drought occurring. It is true that, during the first half of the 20th Century, droughts that would impact London's supplies of water occurred more often than during the second half of the 20th Century and the beginning of the 21st Century, but this does not mean that the chance of a severe drought occurring was lower during the latter period, and it does not mean that the impacts of climate change going forward will increase London's Deployable Output.*

We do not accept Thames Water's outright rejection of the possibility that climate change is having no adverse impact on London's supplies, or could lead to a substantial increase in their deployable output. The inference which can be drawn from the data is admittedly limited as, for instance, if we divide it into 2 periods of 50 years, to obtain a sample size where the conditions for Poissonian statistics of rare events is approached, we have only two measurements of extreme event probability (3 events for 1920-1970 and a single event for post-1970). Even on this limited data however, the probability of an *increasing* frequency of extreme events, when the only data shows the reverse, is several times lower than the likelihood that the frequency is *decreasing* with time.

Whilst this evidence is not sure proof of the absence of any adverse impact from climate change to date on London's supplies, it presents evidence to the contrary that climate change to date has not led to any loss of deployable output. Noting that flows in the rivers of the South East Region are dominated by groundwater flow, which is largely dependent on winter rainfall and relatively unaffected by summer droughts, the widely acknowledged and evidenced[12] wetter winters are likely to be having a much greater influence on water supplies than more frequent or severe summer droughts.

At the very least, regional water resource planning for the South East should recognise the

[10] GARD response to Thames Water's Consultation on Revised Draft WRMP19, pages 39-40, November 2018
[11] TW Statement of Response to the revised dWRMP19 consultation, Appendix H, page 131, April 2019
[12] State of the UK climate 2017, Volume: 38, Issue: S2, Pages: 1-35, First published: 30 July 2018, DOI: 10.1002/joc.5798. Royal Meteorological Society

high degree of uncertainty around the impact of climate change and the need for an adaptable approach to avoid unnecessary resource development. Thames Water's justification for early construction of Abingdon reservoir depends on a climate change loss of London's supplies of 150 Ml/d by 2030 and 250 Ml/d by 2100[13]. In our opinion, it would be irresponsible to proceed on such an unsure basis with a £2 billion investment in a reservoir with irreversible environmental impacts and major disruption to a local community.

2.3 Need for independent review of regional deficit forecasts

In view of the high degree of uncertainty around deficit forecasts for the South East region, as we have described in Section 2.2, we propose that Ofwat or RAPID should commission an independent review of the regional deficits, to be carried in parallel with the Gate 1 resource investigations for completion by 2021. The review of deficit forecasts for all the water supply companies in the South East should cover:

i) The population projections taking account of the need for consistency in data use and assumptions by different companies and allowance for movement of population between company supply areas (eg between Thames Water and Affinity supply areas).

ii) The assumptions for PCC, taking account of best practice in the UK and abroad, including the introduction of smart metering with associated tariff structuring.

iii) The assumptions for leakage reduction, taking account of best practice in the UK and abroad, and reviewing the latest technology worldwide for leakage management.

iv) The determination of deployable output of existing supplies, focusing on the consistency of assumptions, data and methodologies used by the water companies. This aspect of the review should consider the appropriateness and consistency of the use of stochastic data in determining deployable outputs. In GARD's response to the Thames Water's WRMP consultations, we have identified major concerns over the use of stochastic data, particularly the reliability of modelling to convert stochastically generated rainfall data into river flows used in water supply simulation modelling[14] [15].

v) Review of the climate change assumptions focussing on the consistency of methodologies and data, including the use of stochastically generated river flow data and a review of actual impacts of climate change on water supplies in the past 100 years (ie addressing the concerns that GARD has raised about Thames Water's climate change allowances).

[13] GARD response to Thames Water's Consultation on Revised Draft WRMP19, page 36, November 2018
[14] GARD response to TW's Consultation on dWRMP19, pages 86-91, April 2018
[15] GARD response to TW's Consultation on Revised dWRMP19, pages 19-21, 89-91, 102-104, November 2018

vi) Review of the allowances for increased river flows and supply outputs arising from a) increased treated sewage effluent returns from rising demands and b) increased chalk stream flows from past and future Sustainability Reductions. This review should take account of individual water companies' own demand increases and Sustainability Reductions and the equivalent activities of upstream water companies. In GARD's response to Affinity's revised dWRMP19, we identified the failure to allow for increased flows in the lower Rivers Thames and Lea being available for London's supplies[16]. In their Statement of Response to GARD's consultation response Affinity have acknowledged that there has been no detailed assessment of increasing river flows available for Thames Water's London supplies[17].

vii) Consistency of target headroom allowances – in GARD's response to Affinity's revised dWRMP19, we identified inconsistencies in Affinity's headroom allowances in Affinity's supply zones and generally much higher headroom allowances than for other water companies[18]. This concern is shared by Ofwat.[19]

We emphasise the need for the regional review of deficit forecasts to be truly independent of the individual water companies or joint water company organisations like WRSE or Water UK. In our opinion, the water companies and their consultants are now too committed to deficit forecasts in the WRMPs and the plans for Abingdon reservoir for any unbiased reassessment of the regional deficit. We think that, to avoid interference by the water companies, the review should be financed and procured by Ofwat or RAPID, with a substantial budget allowance, probably coming out of the c.£400 million allowance for the regional resource investigations.

2.4 Affinity's stated need for 50 Ml/d by 2038 and 100 Ml/d by 2054

Affinity's Final WRMP assumes an import of 50 Ml/d from Abingdon reservoir by 2038 and another 50 Ml/d tranche from Abingdon by 2054. Affinity's needs are the main driver for Thames Water's supposed need to construct and commission Abingdon reservoir by 2038 – Thames Water do not need Abingdon reservoir for their own supplies until 2045, even accepting their own deficit forecasts[20] (which GARD certainly does not).

Even accepting Affinity's deficit forecast (which GARD does not), the overall deficit in their Central Region only starts to arise in 2050, assuming that surpluses in some zones of their Central Region are transferred to their Central Region deficit zones using their 'Supply 2040' network enhancements[21].

[16] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 56-62, April 2019
[17] Affinity Statement of Response to GARD, Appendix 22, Sections 1.6 and 1.7, June 2019
[18] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 43-46, April 2019
[19] https://www.ofwat.gov.uk/publication/affinity-water-revised-draft-wrmp19-consultation-response/
[20] GARD response to TW's Consultation on Revised dWRMP19, pages 41-42, November 2018
[21] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 46-51, April 2019

Therefore, Affinity has no need for a supply from Abingdon reservoir or another major source before 2050 at the earliest. Affinity's needs do not require a decision on the next major regional source by 2022 (even allowing for a 15 year lead time for Abingdon reservoir).

2.5 The needs of chalk streams

In recent months there has been a campaign by chalk stream interests to promote the early construction of Abingdon reservoir to enable reduction in abstraction of chalk groundwater in the Chilterns and consequent damage to chalk streams[22]. This has led to a parliamentary debate on chalk streams on 22nd July 2019, at which there was strong advocacy for early construction of Abingdon reservoir.

In our opinion, the needs of the Chilterns chalk streams can be met earlier and more effectively than by waiting for Abingdon reservoir by connecting Affinity's supplies to Thames Water's London system at Queen Mary reservoir and transferring water using Affinity's planned 'Supply 2040' network enhancements. There would be only a small impact on London's supplies because most of the transferred water would be returned to London's supplies via the enhanced chalk stream flows. This is all explained in some detail in GARD's response to Affinity's consultation on their revised WRMP19[23].

We propose that GARD's proposal for meeting the needs of chalk streams and Affinity's deficits should be part of the Gate 1 resource investigations, and should be considered in the independent regional review of deficits that we have proposed in Section 2.3.

2.6 The needs of Southern Water

We understand that supplying Southern Water's needs by a transfer from Thames Water supported by Abingdon reservoir is one of the possible drivers for a Gate 1 decision on major sources by 2022. In our opinion, Abingdon reservoir should not be considered as a potential source for Sothern Water for the following reasons:

i) Southern Water need a new source to be in operation by 2027, or ideally earlier to reduce impacts on the Rivers Test and Itchen as soon as possible – it would be impossible to commission Abingdon reservoir by 2027.

ii) The fundamental problem for Thames Water and other water companies in the Thames valley is the shortage of water in the densely populated Thames basin. Therefore, it makes no sense to export water out of the Thames basin with no effluent returns to the River Thames, especially in a timeframe when Thames Water

[22] Chalk Streams in Crisis, Angling Trust et al, June 2019
[23] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 59-73, April 2019

are supposed to be moving to a drought resilience level of 1 in 200 years[24].

We propose that the option of supplying Southern Water from Abingdon reservoir or another Thames valley source should be abandoned.

2.7 Need for a regional water resource plan for the South East

In GARD's discussions with Ofwat[25], we were told of the intention to produce regional water resource plans. We understood this to mean assessments of overall regional deficits combined with evaluation of strategic resource options to produce adaptive plans that were able to accommodate the large uncertainties in future deficits – providing security of supplies for the region whilst minimising the risk of unnecessary and environmentally damaging projects.

In Ofwat's report there appears to be no mention of regional water resource plans, but we still feel that these will be essential. Therefore, we hope that it is still Ofwat's intention that regional water resource plans will be part of the Gate 1 process for decisions on strategic resource developments.

A key part of regional water resource plans should be the investigations of inter-regional transfers. In our opinion, something has to change in the way that inter-regional transfer investigations are carried out. If these investigations are left entirely in the hands of the water companies, who have failed to investigate them properly so far, it is inevitable that Ofwat's very generous allocation of funding of the investigations will be expended on "proving" that the inter-regional transfers are not viable.

[redacted]

Therefore, we propose the following as key principals for implementation of the inter-regional transfer investigations and production of regional water resource plans:

1. Responsibility for inter-regional transfer investigations and regional plans should rest with formally established regional groupings rather than individual companies. The groupings should receive part of the £400 million funding which should not be channelled through the individual companies – "he who pays the piper calls the tune".

[24] Indeed, the Ofwat report identifies Thames Water as '*predominantly an importing company*' , op cit, pp18-19.
[25] Meeting between GARD and Ofwat (John Russell and Steven StPier) in London, 3rd April 2019

2. Consultants should be employed by the regional groupings not individual companies.

3. Part of the £400 million allocation, perhaps 2-3%, should go to the regulators, maybe the RAPID organisation, to ensure that there is adequate truly independent scrutiny of regional plans.

4. Part of the regulators' budget should be for them to employ technical consultants for detailed supervision of the regional investigations, with a comparable level of expertise to the consultants working on the investigations themselves (see also later comments in Section 5.3 of this response).

5. There should be full transparency of the inter-regional planning process and stakeholder engagement. This should be continuous as the work proceeds.

We hope that regional water resource plans are still part of Ofwat's gated decision making process and that the above points will be addressed.

3. Risks associated with the proposed Abingdon reservoir

We are concerned that neither Ofwat nor the water companies concerned are giving sufficient attention to the major risks associated with the proposed Abingdon reservoir:

i) Risk of dam failure and consequent catastrophic flood
ii) Lack of resilience to long duration droughts and consequent London supply failure
iii) Loss of flood plain and increase in local flood risk
iv) Lack of recent UK water industry experience in major dam construction

3.1 Risk of dam failure and consequent catastrophic flood

Abingdon reservoir will be formed by a 10 km long 25 m high earth embankment dam, on a clay foundation interspersed with gravels. Dam failure could result from:

- Internal erosion (piping) through the embankment
- Erosion through the foundations
- Slope stability failure (as occurred at Carsington dam – see Section 3.4)
- Downstream slope stability failure
- Failure of crest wave wall or upstream wave protection in severe storm conditions

Although all these modes of failure are common to all earth embankment dams and addressed by standard design procedures, the Abingdon reservoir's unusually long 10km perimeter and near constant 25 m embankment height makes it more vulnerable to these types of failure than a typical earth dam in a V-shaped valley with a , say, 1 km crest length. The exceptionally long perimeter will make it more vulnerable to variations in the embankment fill materials or in the underlying 10 km length of foundations.

However good the dam design, there will be a finite residual risk of failure. The risk can be reduced by comprehensive geotechnical investigations for the embankment fill materials, including construction of a trial embankment (normal practice for large earth dams) and ground investigations along the entire length of the 10km of foundations. These investigations will be expensive and time consuming, requiring consents and land access.

We are concerned that the rushed programme of investigations to reach a Gate 1 decision by 2022 will allow insufficient time for the extent of geotechnical investigations required. That is one of the reasons why we are proposing the Gate 1 decision on the next major source can and should be delayed for 5 years until 2027.

Regardless of the quality of the dam design and construction, the residual risk of dam failure and catastrophic flooding should be assessed through a dam-break analysis, taking account of the high population and potential economic damage downstream in the Thames valley. The conceptual design for Emergency Drawdown for the 150 Mm^3 reservoir allows for a

reduction in the surface level of 1000mm per day.[26] At this rate, in an emergency, the water level would take up to 25 days to reduce to the level of the surrounding plain. The mass evacuation of the 'fault facing' local towns/villages (which could be anywhere around the perimeter) would be a major undertaking, dwarfing what has recently taken place at the Toddbrook (Whaley Bridge) Dam. At this emergency drawdown rate, the outflow, from the 675 ha surface area of the dam (ref [27], op cit) would entail an initial flow of 78 m^3/sec into the Thames[27]. For the Thames at nearby Sutton Courtenay, this is a huge flow, only exceeded about 5-7% of the time[28], so constitutes a potential flood risk in itself. Given that the lifetime of the proposed reservoir has to be viewed in terms of several centuries, evaluation of these risks in comparison with other major supply options should be part of the Gate 1 decision process. It is notable that the delivery of 'adequate' emergency drawdown facility for one of the two recent very large dams in the UK, Rutland Water (built in 1975) is still a matter of discussion and future project work over 40 years later.[29] It should be the concern of the government and regulators to settle such issues early in the Strategic Study process, and learn the lessons of recent reservoir construction history.

3.2 Lack of resilience of Abingdon reservoir in long duration droughts

In our response to Thames Water's first dWRMP consultation we highlighted the lack of resilience of Abingdon reservoir to long duration droughts, ie droughts longer than the 18-month duration of the worst historic droughts for London's supplies of the past 100 years[30]. We pointed out that, in exceptionally dry winters, there is virtually no water available in the upper River Thames to refill the reservoir – if droughts continue into a third year the reservoir could be empty.

Following our response to the first consultation, Thames Water undertook a further resilience analysis which formed part of their justification for Abingdon reservoir in the revised WRMP. We had more criticism of their analysis in our response to the second consultation[31], which can be summarised as:

- GARD did not agree the methodology used by their consultants in their latest assessment of the drought resilience of the reservoir – our comments on the methodology and proposals for its improvement were ignored. Therefore, we did not agree the findings of the revised resilience assessment.

[26] Thames Water WRMP19 Resource Options: Reservoir Feasibility Report, July 2017, page 250.
[27] Of course, this flow would reduce over the 25 day period, but any sensible estimation of the conditions would show that the maximum initial rate would persist for several days.
[28] https://nrfa.ceh.ac.uk/data/station/meanflow/39046
[29] https://britishdams.org/2016conf/presentations/Session%206%20-%20Drawdown%20&%20Discontinuance%20Considerations.pdf – slides 44 et seq.
[30] GARD response to TW's Consultation on dWRMP19, pages 134-140, April 2018
[31] GARD response to TW's Consultation on Revised dWRMP19, pages 111-117, November 2018

- The latest resilience assessment identified more droughts that would lead to catastrophic failure of London's supplies, if they were dependent on Thames Water's planned yield of 290 Ml/d from Abingdon reservoir. The likelihood of such events was not estimated in the revised assessment.
- Thames Water in effect ignored the low yield of the reservoir in the long duration droughts identified by "averaging" the yield for in the 60 droughts assessed. In our opinion averaging of the yields was meaningless, actually undermines the level of rigour of the already insufficient analysis, and was a cynical ploy to avoid the inconvenient fact that Abingdon reservoir would be unable to supply London in some long duration droughts.
- Thames Water has made insufficient allowance for emergency storage in Abingdon reservoir and has given insufficient attention to the long periods during which the reservoir could be drawn down to shallow depths during which there could be major problems due to algal growth and water quality in the large shallow lake.

We consider the lack of resilience of Abingdon reservoir to long duration droughts to be a major risk which could lead to catastrophic failure of London's supplies. In view of the history of our dispute with Thames Water on this subject, we have no confidence in its ability to address the matter in an unbiased way.

Therefore, we propose that Ofwat or RAPID should commission a truly independent review of drought resilience of the Abingdon reservoir option. This review should be procured and managed by Ofwat/RAPID and funded out of the allocation of strategic investigation funding for Thames Water and Affinity. In our opinion, it would be naive to think that a truly independent analysis could be procured and funded directly by Thames Water. GARD would like the opportunity to comment on the terms of reference for the assignment.

3.3 Loss of flood plain and increase in local flood risk

The proposed Abingdon Reservoir will be built on land which includes over 1.2 sq miles of Flood Zone. Thames Water has failed to complete adequate investigations of the impact of constructing the reservoir partially on the flood plain that protects local villages, and hence the increased flood risk remains a key concern for residents. The proposed Abingdon Flood Relief scheme makes non-interference with the floodplain even more important. Planning guidance rules out development over functional floodplain, since this must be expanded and enhanced.

The TW flood alleviation plan makes no assessment of the potential effects of climate change and how this might increase future flood risk; it removes any future ability to develop additional flood relief schemes that may be needed in the area due to climate change. TW's own assessments show that the area would be unable to meet statutory requirements to reduce flood risk, create sufficient space for flood storage, expand, and

enhance the floodplain. Flood alleviation measures would require access to space outside the reserved area.TW has failed to appreciate how recent housing developments have affected the reserved area, leaving no room for proposed buffers, landscaping and flood alleviation.

In GARD's view the assessment of the Flooding risks from the reservoir project should form part of the work completed before Gate 1, and the assessment should be carried out by the Environment Agency or RAPID.

3.4 Lack of recent UK water industry experience in major dam construction

The last major dam constructed in the UK was Severn Trent's Carsington Water, completed in 1991. Carsington dam failed during construction in 1984 due to geotechnical failure of the earth embankment. The reservoir had not started to fill at the time of failure, so there was no ensuing flood, but there was a 7 year-delay in completing the reservoir.

Without wishing to be alarmist, the lessons from Carsington do illustrate the risks associated with major dam construction. Although the UK water engineering profession has a long and successful history of major dam construction worldwide, it has no recent experience of dams of this size in the UK and only limited recent experience overseas. The present All Reservoirs Panel Engineers under the UK's 1975 Reservoirs Act, have only limited experience of new dam design and construction. Thames Water's most recent experience of new dam construction was Farmoor reservoir (much smaller than Abingdon reservoir), completed in 1976[32].

It is also worth noting that, following inspections under the Reservoirs Safety Act 1975, Thames Water have been required to place restrictions on the rate of filling of their London reservoirs to reduce the risk of slope stability failure. The filling restrictions have significantly reduced the deployable output of London's supplies. This is another example of the potential risks of earth dam construction and the significance of Thames Water's lack of relevant experience.

Therefore, we propose that Ofwat should ensure that all of the investigations of Abingdon reservoir, through Gates 1, 2 and 3, are supervised by an independent panel of reservoir engineers with appropriate international experience of major earth dam construction.

[32] Even this is a generous interpretation. The second phase of Farmoor, built to the same design as the first phase (which was by Binnie and Partners for Oxford City Council) was performed under the Thames Water Authority, and organisation totally unrelated to the present company.

4. Comment on the strategic options for investigation

4.1 The range of strategic options proposed by Ofwat

In our opinion Ofwat has proposed a comprehensive and wide ranging list of options for investigation in Table 3.2 of the report. We have no proposals for additions or deletions .

4.2 Some comments on individual strategic options

Abingdon reservoir

We have already commented on various aspects of the Abingdon reservoir in Section 3 of this response.

We note that Table 3.2 of Ofwat's report proposes consideration of the interaction of Abingdon reservoir with other strategic solutions like the Severn-Thames transfer. We agree that this is worth considering, but would point out that our simulation modelling has shown that there is little additional benefit of combining Abingdon reservoir with the Severn-Thames transfer. The STT with support from either Vyrnwy reservoir or Minworth effluent provides a substantial benefit without Abingdon reservoir and almost no additional benefit when used conjunctively with Abingdon reservoir.

Thames Water to Affinity transfer

Table 3.2 of Ofwat's report describes this option as:

> *"A transfer of water from the River Thames for treatment at a new treatment works or through expansion of a current treatment works. Solution capacity ranges from 50 to 100 Ml/d."*

In our opinion, it would be better for this option to be a transfer of raw water from Thames Water's Queen Mary reservoir, as described in our response to Affinity's revised dWRMP19[33]. There would be a link to Affinity's already planned Iver water treatment works extension via the 'Supply 2040' enhanced trunk mains. The link to Queen Mary reservoir would allow Affinity to take a continuous transfer from Thames Water without any adverse impact on River Thames flows at Sunnymeads – at times of low river (or even at all times), Affinity would take their transfer from the reservoir, rather than the river.

Affinity would then 'piggy-back' on Thames Water's London supplies and make use of whatever resource developments are needed for London – enhanced leakage reduction, more meter penetration and a combination of supply-side sources which will probably include the Didcot power station licence re-allocation (18 Ml/d), the Oxford canal transfer (11 Ml/d), Deephams STW effluent reuse (45 Ml/d) and, possibly later, a major scheme like Beckton reuse, Severn-Thames transfer, South Lincolnshire reservoir or Abingdon reservoir.

When the returns from Affinity's supplies to the lower Rivers Thames and Lea are taken into

[33] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 59-73, April 2019

account, only about 20% of the water transferred from Thames Water would have an impact on London's supplies. For example a 50 Ml/d continuous transfer to Affinity would only cause a 10 Ml/d loss in deployable output for London.

This arrangement would enable much faster and larger chalk stream low flow alleviation than waiting for Abingdon reservoir (see Section 2.5 of this response).

We propose that this option should be subject to full investigation as part of the Gate 1 decision making.

London effluent reuse

We note that these options include the previously named Teddington Direct River Abstraction option which uses effluent from Mogden reservoir. We are pleased to see that Ofwat has reinstated this option after its previous rejection by Thames Water on grounds of temperature impacts on the Thames estuary. We commented extensively on this option in our response to Thames Water's revised dWRMP19[34]. We concluded that the output from the scheme could be considerably more than the upper limit of 250 Ml/d stated in Ofwat's Table 3, while restricting temperature increases to acceptable levels. We made some recommendations for matters to be considered in further investigations (pages 78/79 of our consultation response). We hope our findings will be taken into account in planning further investigations of this option.

We also commented on other reuse options on pages 80-83 of our second consultation response to Thames Water. We hope that these comments will be taken into account in planning the strategic investigations.

Minworth effluent reuse via the Grand Union Canal

This option would bring up to 115 Ml/d into Affinity's supply area. In our response to Affinity's revised dWRMP19, we pointed out that about 75-80% additional water transferred to Affinity from whatever source would be returned to the lower Rivers Thames and Lea via increased sewage effluents or enhanced chalk stream flows[35]. This option would therefore provide a double benefit giving large increases in deployable output to <u>both</u> Affinity and Thames Water. We understand that the double benefit was not taken into account in Affinity's economic assessment of the option and it was not considered at all by Thames Water.

The double benefit of this option for Affinity and Thames Water should be evaluated in the comparative assessment of all the strategic options at Gate 1.

[34] GARD response to TW's Consultation on Revised dWRMP19, pages 69-71, November 2018
[35] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 56-62, April 2019

Transfer from Anglian Water via South Lincolnshire reservoir

As for the Minworth GUC option, economic evaluation of this option should take account of the double benefit to both Affinity and Thames Water arising from this option, due to the return flows to the lower Rivers Thames and Lea via increased sewage effluents and chalk stream flows.

Severn-Thames transfer options

In our response to Thames Water's revised WRMP19 we were heavily critical of their assessment of all STT options[36]. These criticisms can be summarised as:

- TW has only paid lip service to the concept of strategic inter-regional transfers – their investigations of STT options have largely focused on reasons not to develop them, rather than finding ways to overcome any problems identified. TW has not addressed the national strategic need to bring new water into the South East.

- By proposing the Abingdon reservoir in their preferred plan, before completing key investigations of STT options, TW has failed to follow one of the primary outcomes of the 2010 Public Inquiry.

- The stochastically generated River Severn flow data are a poor fit with gauged records, underestimating available flows, and are not fit for the purpose of assessing deployable outputs of STT options. Historic flow records should be used in appraising these options, with realistic allowance for climate change loss, ie 5-10% as per other water companies dependent on River Severn Flows.

- The allowance of 20% losses in water transferred down the River Severn is not justified by the historic flow records; the allowance should be 10% for option appraisal.

- The first stage of a phased STT development should include only about 50-100 Ml/d of support to meet the all-year needs of Affinity and chalk streams; such an option would also provide about 200 Ml/d for London.

- Subsequent stages of phased development of the STT should have a capacity increased to at least 400 Ml/d with the capability of providing well in excess of 300 Ml/d for London.

- Thames Water's proposal for multiple support sources from United Utilities and Welsh Water is unnecessarily complex and costly; instead the primary source of support should be at least 300 Ml/d from Vyrnwy reservoir, with replacement of United Utilities' lost supplies selected from their many feasible options that have AIC costs that are much lower than any of Thames Water's.

[36] GARD response to TW's Consultation on Revised dWRMP19, pages 84-108, November 2018

- Thames Water has still provided no transparency of its STT option costs; until properly detailed cost breakdowns are supplied, GARD will have no confidence that selection of Abingdon reservoir ahead of the STT has been done fairly and without bias.

- The STT options should be reappraised with GARD's proposed assumptions for losses and river flows, with a first phase specifically to meet the needs of Affinity and chalk streams.

On page 108 of our second consultation response to Thames Water, we made some specific recommendations for reappraising all the STT options in producing the Final version of WRMP19. As far as we can see, these recommendations were ignored by Thames Water in their Final WRMP. We therefore propose that these recommendations should now be included in the scope of the scope of the strategic investigations for Gate 1.

In view of Thames Water's extremely negative attitude to STT options, failing to complete the investigation recommended by the 2010 Public Inquiry, we propose that Ofwat should give the independent supervision of these options a high priority during the Gate 1 investigations (see also our comments in Section 5.2 of this response).

5. Stakeholder engagement and regulatory technical supervision

5.1 Stakeholder engagement

We are pleased to see that pages 31 to 33 of Ofwat's report make reference to stakeholder engagement during Gates 1, 2 and 3 of the investigations. However, the report gives no indication of the extent and nature of stakeholder engagement. We hope that GARD will be considered to be a stakeholder and that the engagement process will include:

- the opportunity to comment on the detailed scope of all the investigations before commencement of work, for all strategic options and at all Gate stages
- the opportunity to comment on all interim reports and progress reports as the investigations proceed
- regular stakeholder meetings as the investigations proceed, with the opportunity to discuss interim findings in open forums
- if requested by GARD, the opportunity to meet with those undertaking the investigations for detailed discussion of technical matters that are not suitable for discussion at large stakeholder meetings
- formal consultation on draft overall reports at each Gate stage

On paper, this would be similar to the stakeholder engagement adopted by Thames Water during development of WRMP19. However, in our opinion, Thames Water used stakeholder engagement as an opportunity to "sell" their proposals and there was little attention given to understanding or acting upon the views of stakeholders. The one-sidedness of the engagement should be apparent from the contents of this response and the numerous references to aspects of the WRMP consultation process where we feel that our views were ignored by Thames Water or brushed aside with minimal justification.

We very much hope that Ofwat will ensure a more even-handed approach to stakeholder engagement during the strategic investigations.

5.2 Transparency of cost estimates

One of our major criticisms of the WRMP19 process has been the lack of transparency of cost estimates[37] [38] [39]. Clearly, cost estimates are going to be a major factor in the strategic investigations, particularly at Gates 1 and 2. In our opinion, it is highly unsatisfactory and unacceptable for the water companies to use "commercial confidentiality" as an excuse to prevent any scrutiny of the cost estimates that lie at the heart of option selection.

[37] GARD response to TW's Consultation on dWRMP19, pages 17-18, April 2018
[38] GARD response to TW's Consultation on Revised dWRMP19, pages 16-19, November 2018
[39] GARD response to Affinity Water's Consultation on Revised Draft WRMP19, pages 14-15, April 2019

The lack of transparency of cost estimates potentially allows the water companies a high degree of scope to manipulate costs towards solutions that suit the company shareholders or in favour of "vanity projects" long desired by water companies or the individuals or consultancy companies concerned.

We fervently hope that Ofwat will now put a stop to this blatant and undemocratic lack of cost transparency.

5.3 Regulatory technical supervision by RAPID

We welcome the establishment of the RAPID unit establish as *"a new way of working and a route for addressing significant 'barriers and gaps' in the regulatory processes to ensure the solutions are developed in a consistent, timely and co-ordinated way".* However, we note that Ofwat's report contains no detail of how RAPID will be organised, its objectives and its terms of reference. We hope that this information will soon be publicly available.

In our opinion, it is essential that RAPID has access to substantial support from technical consultants with a range of expertise and experience that is equivalent to the consultants being employed by the water companies. In the aftermath of the WRMP19 process, there are still numerous areas where GARD disputes the Final WRMPs of Thames Water and Affinity. Many of these matters have already been mentioned in this response. They include:

1. The use of local authority housing and population forecasts, without reality checks to recognise that such growth has invariably been over-forecast in the past.[40] [41]

2. Assumptions about smart metering and per capita consumption that do not match best practice of other water companies with forecast deficits, and fail to recognise a history of over-forecasting PCC in previous dWRMPs.[42] [43]

3. In determining deployable output of existing and future supplies, the use of river flow records generated by converting stochastically generated rainfall data using unreliable rainfall/run-off models.[44] [45]

4. The allowances for dead and emergency storage in Abingdon reservoir and the acceptability of poor quality water released into the River Thames from emergency storage.[46] Also the validity of Thames Water's response to GARD on this matter.[47]

5. The resilience of Abingdon reservoir to long duration droughts and the validity of the

[40] GARD response to TW revised dWRMP, pages 21-28
[41] GARD response to Affinity revised dWRMP, pages 17-25
[42] GARD response to TW revised dWRMP, pages 29-35, Figure 2-5 and 48-52
[43] GARD response to Affinity revised dWRMP, pages 26-34
[44] GARD response to TW 1st dWRMP, pages 19-21
[45] GARD response to TW revised dWRMP, pages 86 to 90
[46] GARD response to TW 1st dWRMP, pages 119-120
[47] TW Statement of Response to 1st dWRMP consultation, Appendix F, pages 394-395

methodology used by Thames Water allegedly to rebut GARD's challenge.[48]

6. Thames Water's excessive allowance for climate change impacts on London's supplies, which has ignored the evidence that actual climate change of the past 75 years has led to wetter winters that have substantially increased the deployable output of London's supplies.[49]

7. The feasibility, deployable output and resilience of the unsupported Severn-Thames transfer which GARD maintains is a flexible first phase of an incremental development of inter-regional transfers, well suited to meeting uncertain future deficits in the South East.[50]

8. TW's excessive allowances for transfer losses in the River Severn that have reduced the deployable output and cost-effectiveness of all supported Severn-Thames transfer options.[51]

9. The failure of TW and Affinity's revised dWRMPs to allow for effluent returns from Affinity's extra supplies to customers and increased chalk stream flows from sustainability reductions, both of which would increase the water available for TW's London supplies (about 80% of Affinity's increased supplies being returned to London).[52] In view of the Environment Agency's strong support for chalk stream relief, which we endorse, it is particularly important the to recognise that most of the water supplied for chalk stream relief will come back to London and still be available for London supplies.

10. GARD's proposal for meeting Affinity's need for extra supplies to customers (in the unlikely event of the need arising) and for providing much greater and faster relief to chalk streams, making use of the high proportion of Affinity's additional supplies returned to London.[53]

These are all matters that have been raised by GARD repeatedly in correspondence with Thames Water and Affinity, at stakeholder meetings and in our WRMP consultation responses. Our views have been rejected by those water companies, in our view without valid justification and supporting evidence.

In our opinion, these are all matters that should be independently reviewed by RAPID and its technical consultants at a level of detail that gives confidence that RAPID's "verdicts" have been based on comprehensive independent evaluation by appropriately qualified experts. If that is the case, it is likely that GARD will accept RAPID's views on these matters.

[48] GARD response to TW revised dWRMP, pages 111-117
[49] GARD response to TW revised dWRMP, pages 36-40
[50] GARD response to TW 1st dWRMP, pages 89-95 and response to revised dWRMP, pages 94-95
[51] GARD response to TW 1st dWRMP, pages 91-93 and Appendix B
[52] GARD response to Affinity's revised dWRMP, pages 56-62
[53] GARD response to Affinity's revised dWRMP, pages 63 to 74

In our opinion, Ofwat has been very generous with its allocation of about £400 million to the water companies for the strategic resource investigations. However, there is no mention in Ofwat's report of any allocation of funding to RAPID and the technical consultants that we believe are essential for RAPID's effective functioning. We suggest that it would be reasonable to allocate about 2-3% of the £400 million budget to RAPID and its consultants, ie about £8-12 million.