Bristol Water's response to the CMA's Provisional Findings: Index of Appendices

Appendix 3.1 – Bedminster Service Reservoir

1 Introduction

1. As set out in Section 3 of our response to the CMA's PFs, we considered it would be helpful to address some of the concerns and questions raised in the PFs in relation to the need for Bedminster Service Reservoir (**Bedminster SR**), and the nature of the proposed solution. In doing so, we have also sought to address some of the specific criticisms raised in the Aqua Report regarding potentially credible alternative options, and the degree to which they have been considered as part of our process.

2. In this Appendix 3.1, we have set out detailed comments in relation to:

   - the need for intervention (see **Section 2)**;
   - identification of the most suitable option (see **Section 3**); and
   - cost estimation (see **Section 4**).

2 Need for intervention

2.1 History of Bedminster SR

3. Bedminster reservoir was first filled in 1907 and has a capacity of 5 million gallons (24,000m^3). It was built with mass concrete floors and walls, with an arched roof and brick columns. The walls are partially supported by earthfill embankments around the perimeter of the reservoir. The design is vulnerable to any movements (including foundation settlement and structural movement) and its lack of reinforcement limits resistance to cracking.

4. The reservoir has had a chequered history with cracks and repairs occurring at regular periods over the last century, and leakage being a major problem. A report back in 1959[1] states that leakage through the west wall was first identified in 1907, and then subsequently in various parts of the reservoir. The first major repairs were undertaken prior to 1912[2] and further work was undertaken at various intervals in 1921, 1938, 1950, 1955 and 1958-59. We have identified further references to repairs, leak sealing and waterproofing being undertaken in 1975, 1986, 1992, 1996, 1997, 2001, 2002 and 2007. A list of repairs and remedial works are included in Appendix A.

5. This demonstrates that we have implemented a strategy of repair and refurbishment over several decades in order to keep the reservoir in a serviceable condition. However, it also shows that additional repairs have consistently been required to either repair previous remedials or to address new defects, with both resulting from movement of the structure.

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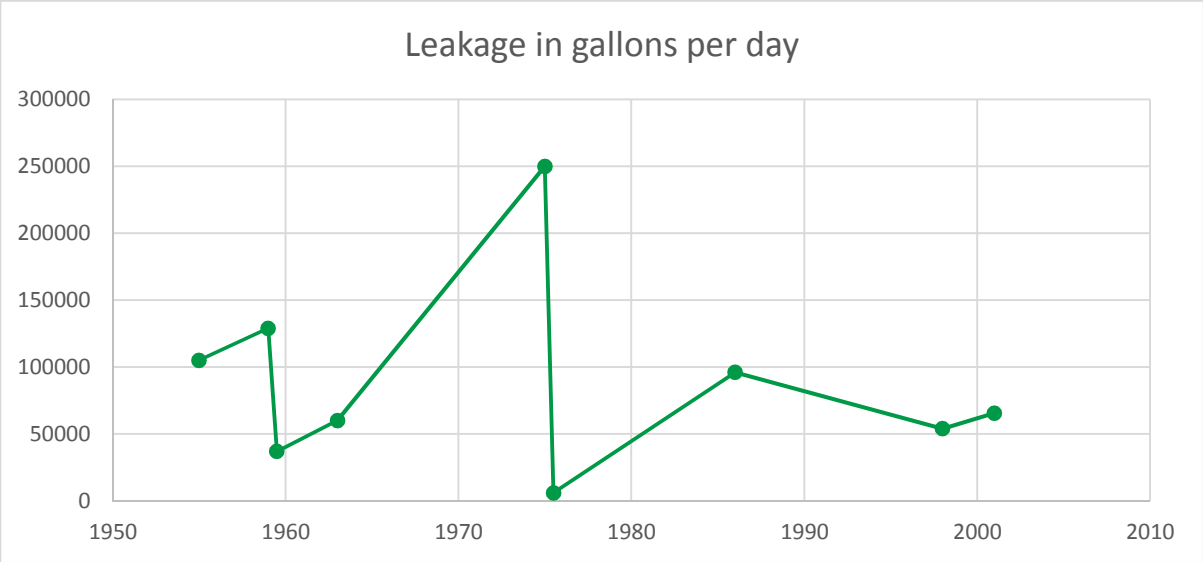
[1] Bristol Waterworks Company. Repairs to Bedminster Down Reservoir. November 1959. (RPF040).

[2] Bedminster reservoir record drawing 01050, 27 Nov 1912 (RPF039).

6. As can be seen in Figure 1 below[3] leakage has also been a long term issue and whilst repairs have reduced leakage in the short term, leakage slowly increases over time. So much so that prior to 2001 a decision was taken to reduce the operating level of the reservoir to 1.5m below top water level to limit leakage (Refer to P2 - Total Capacity - of the 15/16 May 2001[4] report that indicates that this decision was taken before 2001).

Figure 1 Bedminster SR – Leakage in gallons per day



Source: Bristol Water

7. In June 2013 the reservoir was taken out of service after wide cracks were found at the top of the external western wall. The 2013 inspection[5] returned an asset condition and performance grading of 5, driven by cracking in the roof at the junction with the access chamber. There is evidence of further deterioration since the 2007 inspection,[6] including water ingress, and development of a crack over 100mm wide, and deterioration of the coating applied in 1996, plus opening of a gap suggesting settlement of the south east corner of the reservoir. The 2013 report states *"The structure can only be operated to a depth 1.5m BTWL and there is significant leakage of water from the structure when in operation, any remedial work to this structure cannot be guaranteed… the reservoir is beyond economic repair".*[7] The microbiological grade was 4, the sediment grade 5.

8. The 2013 report demonstrated a significant deterioration in the structural condition of the reservoir since the 2007 report and surpasses the increase in deterioration seen between previous inspections, despite a long term on-going programme of repairs and refurbishment.

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[3] CH2M Hill Review of Aqua Appraisal of Bristol Water's FBP (RPF014), p.25.

[4] Bristol Water Engineering Directorate Reservoir Inspection Report, 15/16 May 2001, (RPF004).

[5] Bristol Water Engineering Directorate Reservoir Inspection Report, May 2013, (RPF047) May 2013, Section 5.

[6] Bristol Water Engineering Directorate Reservoir Inspection Report, 15/16 May 2001, (RPF004).

[7] Bristol Water Engineering Directorate Reservoir Inspection Report, May 2013, (RPF047), Section 6.

2.2 Causes of the structural movements, cracking and leakage, and current and future behaviour

9. The 1959 report states that leakage is probably the result of settlement-related movement and cracking. The 1975 report states that "*the Reservoir had broken its back early after construction and the asphalt was applied to the cracks in the floor….it is felt that the South half of the Reservoir has hinged about the central floor cracks moving southwards and cracking the column rows 12 to 19 and the south wall*".[8]

10. A 1986 report by Sir William Halcrow and Partners states that "*early settlement of the foundations caused the floor cracking*" and that "*movement of the columns and cracks in the walls and roof result from longitudinal expansion of the roof*".[9]

11. A B&V report from 2013 summarises the position, which is that ground movements have continued over a century, resulting in cracking in the mass concrete floors and walls, and that progressive long-term expansion in the brick roof has led to thrust at the tops of the walls and to the columns, resulting in progressive damage.[10] The form of construction is particularly sensitive to the resulting movements, and cracking in the floors, walls and roof is inevitable.

12. Given that there have been around 15 different repair episodes since 1950 (see **Appendix 3.1.A**), and that leakage from the reservoir has never been successfully addressed (as demonstrated in Figure 1 above) in anything other than the very shortest of terms, it must be concluded that on-going settlement, cracking, leakage, and reduction of water quality is to be expected in an asset of this age.

13. CH2M Hill completes section 4.5.2 of its report by stating that: "*We concur that these (and the evidence of settlement of the foundations to the South East corner of the reservoir) are valid reasons for concern, and in conjunction with failures of previous refurbishments, agree that the proposed reconstruction to modern standards, using reinforced concrete, at a cost six and a half million pounds is a valid proposal.*"[11]

2.3 Reasons for abandonment of the reservoir

14. In addition to the comments from CH2M Hill, the BV report states on p.2 *"It is probable that concrete here is beyond manageable and economic repair to restore integrity.."* which supports the view of the BW 2013 inspection and the report from CH2M Hill that the reservoir is now beyond economic repair.

15. The latest inspection has identified that this is indeed the case and the west wall has a significant crack of around 100mm at its junction with the roof, (see **Appendix 3.1.B** below) which coincided with excessive leakage when the roof was flooded in this location. Horizontal displacement was also evident. A substantial gap was also observed at the south east corner upstand (see **Appendix 3.1.C** below), in addition to longitudinal movement of

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8 Bristol Waterworks Company Report on Bedminster Reservoir, Nov 1975, (RPF042) p. 4.

9 Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary (RPF043)

10 B&V Structural Commentary on the Bedminster Reservoir, 122157, June 2013 (RPF044), p.2.

11 Bristol Waterworks Company Report on Bedminster Reservoir, Nov 1975, (RPF042) p. 4.

the roof, indicating settlement and movement of the structure. These defects were not present at the time of the 2007 report. When considered with a depression in the west wall embankment (identified in various reports), leaning columns and considerable cracking in the floors and roof, none of which have been rectified by previous remedials, a decision was taken to take the reservoir out of service as there is no confidence in the continued structural stability or watertightness of this reservoir which is over 100 years old.

16. The 2013 report by B&V also concluded that "*Due to its age, the extent of crack defects present and the inherent and residual structural damage it is considered, from an initial engineering appraisal for PR14 assessment, that the reservoir structure has exceeded its expected life span*."[12] This supports our decision to take the reservoir out of service.

3 Options for addressing the issue

17. Having decided to take Bedminster SR out of service, consideration has to be given to what to do next. There are four main options to be considered, each of which is looked at in more detail in the following sections:

- do nothing (see **Section 3.1**);
- refurbish the existing reservoir (see **Section 3.2**);
- replace the reservoir on the existing site (see **Section 3.3**); and
- replace the reservoir at an alternative location (see **Section 3.4**).

3.1 Do Nothing

18. If this option is pursued we will not restore valuable storage for Bristol and increase the risk of customers losing supplies in the event of an asset failure in the Bristol area.

19. A paper produced in November 2012 identified benefits in keeping Bedminster SR in service.[13] Although the reservoir will provide local storage it also contributes to the city wide zonal storage requirements. Recent investment to provide resilience for Bristol provides flexibility in the operation of our assets to better meet our obligations to customers. Bedminster SR can now be used to support supplies to the whole city in the event of asset failure in areas of the city outside Bedminster SR's local area of supply.

20. When the zonal storage requirements are considered it can be seen that based on predicted demand and sub-regional spatial strategy, there will be a storage deficit in 2016 in the Bristol city zone if Bedminster SR is not replaced.[14]

21. If there was to be a failure of a major trunk main in the city then rezoning would allow Bedminster SR to remove the risk of interruptions to a significant number of customers. As experienced during the recent burst main at Kingswood it can take a considerable amount of time to return supplies to customers and additional storage provides mitigation against loss

[12] B&V Structural Commentary on the Bedminster Reservoir, 122157, June 2013 (RPF044), p.3.

[13] Bedminster Reservoir Current and Future Requirement 2012 (SOC213).

[14] Bedminster Reservoir Current and Future Requirement 2012 (SOC213), Figure 3.

of supplies. Our cost exclusion cases from our Business Plan[15] explain that under normal operation over 30,000 customers are supplied from Bedminster reservoir.[16]

22. We experienced lengthy disruptive burst event 'incidents' in 2001 (Bridge Valley Road) and 2007 (Hotwells) so even a 1 in 10 year risk is likely to be a conservative estimate. Taking account of this risk and that the benefit per customer is £337[17] for avoiding a 6-12 hour interruption to supply then the benefit is over £1.0 million per annum:

    0.1 x 30,000 x 337 = £1,011,000 p.a.

23. This is to be compared with an annualised cost (assuming a 100 year life) for building a replacement reservoir of £0.31 million.

24. Comparison of the two values shows that that the benefit exceeds the cost by a factor greater than 3.

25. Although we have not experienced an incident since the reservoir was taken out of service, this is only a two year period and it is not possible to predict when another burst main will occur. However, as illustrated above we have experienced two major trunk main bursts in the last 14 years.

26. Based upon the benefit of this emergency storage the Cross Asset Optimiser supported this decision to keep the storage.

3.2 Refurbishment of the existing structure

27. In Aqua's Technical Report for the CMA (**Aqua Report**)[18] Aqua has stated that "*The structure around the major crack reported in 2013, at the top of the wall, could have been rebuilt. The other reported defects could have been rectified, as is generally done by other water companies, in accordance with recognised guidelines*."[19] This is followed by a list of measures that we could take. All these measures have been undertaken in the past. Our response to each of the measures proposed by Aqua is set out in **Appendix 3.1.D** below.

28. It should also be noted that the January 1986 report states *"it must be concluded that the reservoir has reached the end of its useful life and steps should be taken for its replacement".*[20] Rather than react to this and undertake replacement in 1986, Sir William Halcrow and Partners were appointed to carry out an independent inspection. This inspection recognised the poor condition of the structure and recommended more short term repairs. As a result further targeted repairs were implemented until 2007. This demonstrates that a decision to continue repairing the reservoir rather than replace was taken over 20 years ago. Whilst of limited success (evidenced by the result of subsequent inspections) the decision did delay the need for replacement until now.

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15 Cost Exclusion Cases (SOC006), p.24.

16 June Cost Exclusion Cases (SOC006), p.139.

17 June Company Wide Plan (SOC005).

18 Aqua Report, Appendix H, p.1.

19 Aqua Report, p.32.

20 Bristol Water Engineering Directorate Reservoir Inspection Report, Feb 1986, (RPF045), p.5.

29. Refurbishment was not initially considered as part of the AMP6 strategy because of our understanding of the progressive structural deterioration of the structure and the continued failure of repairs and refurbishment to date (see **Section 2** above) following the earlier decision to increase the life of the structure through a programme of repair and refurbishment.

30. Internal coating of the roof has proved to be of limited success and is now falling off and ingress of water through the roof needs to be addressed from the external face. To do this up to 1m depth of clay and soil will have to be removed from the top of the reservoir. The CIRIA report warns of the engineering difficulty associated with stress relief that will result from removal of insulating material from a reservoir roof,[21] and this contributed to the decision in 1996 to waterproof the roof internally. Clearly significant strengthening work would be required before undertaking this activity. Similarly, until the longitudinal movement of the roof is controlled, repairs to cracks in the end walls will continue to fail and the end walls will be displaced even further than they currently are. Rebuilding the west wall to seal the large (100mm) crack would only be successful if movement in the roof is addressed. On a reservoir of this size modifications to the roof would require significant and costly structural alterations and this view is supported by the report by Sir William Halcrow and Partners in 1986 that states *"…. and works to relieve compression in the roof are judged uneconomic and structurally undesirable".*[22]

31. Even if movement of the roof is addressed there is evidence of other movement as demonstrated by the settlement of the south east corner and cracking in the walls and floor. Consequently, lining of the structure would be extremely difficult as this would require covering of 'live' cracks. A targeted approach has been unsuccessful over many decades and CIRIA report R138 advises that 'live' cracks should be sealed individually and that surface coatings will not readily bridge cracks.[23]

32. The settlement in the south east corner would require extensive investigation to establish the cause of the settlement followed by potentially expensive under-pinning, grouting or rebuilding of the south east corner.

33. Consequently, based upon this understanding of the history of the structure and its significant deterioration at the time of the 2013 inspection, supported by advice from several consultants' reports (Sir William Halcrow and Partners 1986[24], B&V 2013[25] and 2015[26]) it was decided that there was no merit in undertaking significant investigation work to establish the cause of movement so that an extensive refurbishment option could be priced up. Even after extensive investigation work it is unlikely that any designer would be able to guarantee the success of refurbishment based upon the condition, extent of movement and history of the structure.

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[21] Underground Service Reservoirs: Waterproofing and repair manual:1995, CRIRA R138 (RPF053) Section B3.1.3 .

[22] Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary. (RPF043).

[23] Underground Service Reservoirs: Waterproofing and repair manual:1995, CRIRA R138 (RPF053), p.A19 and p.A42.

[24] Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary. (RFP043).

[25] B&V Structural Commentary on the Bedminster Reservoir, 122157, June 2013 (RPF044).

[26] B&V Bedminster Reservoir Refurbishment Proposal July 2015 (RPF008).

34. To support this engineering judgement a subsequent report has been commissioned by B&V to consider a possible refurbishment option in some more detail.[27] The report reinforces the view that extensive investigation is required to determine an appropriate refurbishment solution. The cost of the most likely form of refurbishment is estimated at £7.1 million compared with a new build of £6.8 million but with much less confidence that it would be successful in addressing the serviceability issues being experienced. Assuming that some further refurbishment would be required in around 20 years time then on an NPV basis replacement is the preferred option.[28]

3.3 Replace the structure on the existing site

35. The B&V June 2013[29] report suggests two replacement options on the existing site: a complete demolition followed by rebuild and partial demolition and new build making use of some of the existing structure. Having identified that refurbishment is not a feasible option, B&V produced another report[30] in September 2013 as part of our Business Plan submission which considers not only replacement of the structure on the existing site but also construction of a reservoir at a slightly different location at Bedminster and 2 partial demolition options along with construction of a new reservoir at Barrow water treatment works.

36. The B&V report of September 2013 recommends a partial demolition (keeping only the existing west wall and embankment) and construction of a new reservoir on the footprint of the existing at an estimated cost of £6.8million.

3.4 Replace the structure at an alternative location

37. An alternative location for a replacement service reservoir is at Barrow Water Treatment Works (**Barrow**)[31].

38. Although there is land available at the Barrow site it is at too high a level at which to position a service reservoir as, to avoid the significant expense of installing pumps, the reservoir will need to be lower than the exit of the works so that water can flow by gravity. A service reservoir would have to be built after the treatment process and the contact tank, the last part of the treatment process, has a top water level of 82.3m.[32] Construction of a reservoir at this location would involve significant and expensive excavation, even if built inside one of the abandoned slow sand filters (**SSF**). This is because the base of the SSF is only 600mm lower than the contact tank at 81.7m.[33] An alternative location is alongside the existing service reservoir at Barrow but this would be on private land and would involve land purchase.

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[27] B&V Bedminster Reservoir Refurbishment Proposal July 2015 (RPF008).

[28] B&V Bedminster Reservoir Refurb/Replacement Costing Calculations, NPV analysis, 2013 (RPF003).

[29] B&V Structural Commentary on the Bedminster Reservoir, 122157, June 2013 (RPF044).

[30] B&V report. NIM – Bedminster Service Reservoir Preliminary Design Report (RPF052).

[31] B&V Bedminster Reservoir Replacement at Barrow Proposal July 2015 (RPF002).

[32] BW Record drawing 13241 (RPF055).

[33] BW Record drawing 31350 (RPF054).

39. In addition more excavation will be required at Barrow than at the Bedminster site leading to another increase in cost. This increase is balanced, however, by there being no need to demolish an existing reservoir at Barrow in the short term. As such, the cost of building a new reservoir at Barrow is similar to the costs projected for replacement at Bedminster. The report from BV supports this view and estimates the construction of a new reservoir at Barrow at £7.0 million.[34]

40. Construction of a service reservoir provides most benefit if constructed close to customers. If positioned at Barrow the service reservoir will be over 2 miles away from its area of supply. The trunk main between Barrow and the existing Bedminster site was laid around 1847 and consequently must be at greater risk of failure than the renovated trunk mains from the existing Bedminster reservoir site to the city of Bristol. Although the non renovated length of trunk main between Barrow and Bedminster does not have a history of bursts this does not mean that it will not burst in the future. The 2012 report into the current and future requirements of Bedminster reservoir mentions on p1 that *"A pipe sample has been taken on this main and the structural condition was found to be very poor"*.[35] It seems sensible to construct a new reservoir at its original location at which point the old trunk mains leading into the city have been sliplined, thus reducing risk at no extra cost when compared with a new reservoir positioned at Barrow.

4 Pre –efficiency Cost Estimates

41. Table 1 below sets out the cost estimates, and NPV, for the refurbishment, replacement at Bedminster and new build at Barrow options.

Table 1 Pre-efficiency cost estimates for the Bedminster SR options

Column 1	Capital cost (£)	NPV (5%) (£)
Refurbishment	7,101,281	7,252,317
Replacement at Bedminster	6,825,372	6,409,181
New build at Barrow	7,044,450	6,618,915

Source: Bristol Water

42. It demonstrates that whether judged by reference to capital cost, or NPV, replacement of the reservoir at the existing Bedminster site is the lowest cost option.

4.1 Conclusion

43. The history of continual repair and refurbishment and progressive structural deterioration of the 110 year old Bedminster SR means that the reservoir has now finally reached the end of its serviceable life.

44. Having identified this and having demonstrated that a reservoir will provide a benefit to customers, it is concluded that rebuilding a new structure on the site of the existing reservoir is the most cost effective solution at an estimated capital cost of c.£7 million.

[34] B&V Bedminster Reservoir Replacement at Barrow Proposal July 2015 (RPF002).

[35] Bedminster Reservoir Current and Future Requirement 2012 (SOC213).

Appendix 3.1.A – Repairs and remedials since 1950

1. In 1950 the inspection report states that 94 of the 169 columns supporting the roof showed some signs of distress, and some works were subsequently undertaken.

2. In 1955 leakage from the reservoir was measured 105,000 gallons per day (**gpd**).

3. In 1959 the problems were increasingly persistent, with tests showing a loss of 129,000gpd. Inspection revealed cracks to the floor and walls. Major repairs had a positive effect with reduction in leakage by 72% to 37,000gpd, but the post-repair leakage test report states that it was unlikely that these repairs were going to have genuine long term effectiveness.

4. In 1963 another survey was undertaken finding that up to 60,000gpd were being lost and that cracks were appearing again after the 1959 remedial work.

5. In 1975 a full survey of the reservoir showed many cracks were appearing and although some were hairline and not having any significant impact on the water levels there was a major crack found at 1.2m above floor level in the south wall. This was filled in with a sand and cement repair mix and secured with resin. The leakage loss was over 250,000 gpd (around 5% of the total volume of water present) prior to repair. Repairs were undertaken and regular future leakage monitoring and inspections planned to identify and assess any deterioration in cracking and leakage. The 1975 repairs successfully reduced the leaks rate to only 6,000 gpd immediately after the work was completed.

6. The 1986 inspection report highlighted distress and fractures in many of columns which support the roof of the reservoir. The eastern row of columns had moved eastwards at the top (by up to 91mm) and the western row moved to the west by up to 60mm. This had increased significantly since the report in 1950 to 150 of the columns in 1986. Tell-Tales were installed over some of the cracks for future comparisons. Leakage was measured at about 96,000 gallons per day in 1986. The report concluded that repairs should be undertaken and condition further monitored. The major crack in the wall was repaired using a hypalon strip.

7. In 1989, inspection confirmed that the hypalon strip crack repair had failed, although there was little confirmation from the tell-tales that movement had occurred in the structure.

8. By 1992, the repair to the south wall had completely failed.

9. In 1996, a cementitious waterproofing was applied to the internal surface of the roof and some column cracks were coated. Water testing subsequently demonstrated the roof still leaked.

10. In 1997, there were some depressions in the embankment around the reservoir indicative of wash-out resulting from leakage. Further repairs were undertaken, including in relation to major cracking along the length of the roof, exposed in excavations through the overburden. Repairs were also undertaken to 3 of 4 leaking upstands on the roof, and the north wall was coated. Repairs were undertaken to the south wall.

11. Prior to 2001, Bristol Water decided to reduce the top water level of the reservoir to prolong the life of the structure and reduce the amount of leakage; subsequent operation was at 1.5m below top water level giving a capacity of approximately 17,000 m^3.

12. The Reservoir Inspection Report, from 2001, shows new cracks in the floor, new cracks in the walls (new cracks in the south wall, and leakage noted at 2 previous combiflex bandage repairs on the west wall) and roots growing through the roof of the outlet chamber. There were no water quality failures in 2000 or 2001, despite leakage through roof vents and numerous pinholes in the roof. The report returned an overall asset condition grade of 3, and concluded the reservoir was in 'reasonable structural condition', though the standing test indicated leakage through the structure had increased (in Feb 1998 leakage was 245,050l/d (53,903gpd) and 2001 297,950l/d (65540gpd)). The report recommended sealing at the vents and repairs to the south wall. Repair works were subsequently undertaken including application of a combiflex hypalon strip to seal the defects in the walls.

13. In 2002, leaks were sealed in six different areas.

14. In 2007, our inspection concluded the reservoir was in reasonable structural condition, but the roof continued to leak. Swabs showed good bacterial quality in spite of heavy sediment and roof leakage, one showed that soil had entered the reservoir. However, no failures had been reported in water quality samples from 2006 to 2011. Repairs were undertaken to the leaks on the north wall and north east corner, and also to the damaged coating at the junction of the west wall and the outlet chamber.

Appendix 3.1.B – Cracks on North west corner

Large crack showing displacement of the structure.

Close up of crack showing width in the order of 100mm.

Appendix 3.1.C: Displacement of structure at South East upstand

This shows the inside of the south east access upstand. The coating that was applied in 1996 is clearly shown as having come away and the gap displayed demonstrates how the roof has sunk in relation to the upstand wall.

Appendix 3.1.D: Response to Aqua's Review

1. The Aqua Report suggests that the following refurbishment works to be considered for Bedminster SR include:

   - pressure grouting and under floor voids;
   - structural repair;
   - internal coating wall and floor;
   - application of externally applied flexible water membrane and replacing gravel;
   - drop test; and
   - roof leakage test (wetting for 6 hours).[36]

2. Given the time available to carry out its review, Aqua has not been able to take proper account of the history of Bedminster SR as described above. Repairs have been undertaken over the past several decades, but have continually failed and have had to be repeated. It is evident that whilst the structure continues to move this will continue to be the case.

3. A strategy of inspecting the structure and targeting repairs was adopted many years ago based upon a report by Sir William Halcrow and Partners written in February 1986 which stated that *"…and works to relieve compression in the roof are judged uneconomic and structurally undesirable".*[37] Even before the publication of CIRIA report R138 – 'Underground service reservoirs: waterproofing and repair manual' repairs were in accordance with the recommendations of that report. Since the publication of the report in 1995 it has been used to assist in determining repair techniques.

4. As such, the suggestions made by Aqua with respect to refurbishment options should be seen in the context of the long history of repair and maintenance of Bedminster SR. To assist the CMA, we have provided comments on each of the specific suggestions put forward by Aqua in the paragraphs below which demonstrate that all of the activities Aqua believes should be considered are already being actively used.

Pressure grouting and under floor voids

5. Pressure grouting has been undertaken in the past and has failed to improve the structural integrity or the watertightness of the structure. Pressure grouting is referred to in the 1986 report by Sir William Halcrow and Partners[38] and recorded on record drawings.[39]

Structural repair

6. Comments in the 1986 report by Sir William Halcrow and Partners[40] and the 2013 report by Black & Veatch[41] both refer to structural repairs being uneconomic and undesirable. Another report by Black &Veatch in 2015 confirms this view.[42]

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36 Aqua Report, para. 118.

37 Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary. (RPF043).

38 Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary. (RPF043).

39 Drawing 048621 (RPF072).

Internal coating wall and floor

7. Internal coatings of the floor and walls have been applied many years ago and have failed to seal leakage. In line with the strategy of a targeted approach, crack repairs that utilise a preformed strip sealer were used on the major cracks.[43] Reference to CIRIA report R138 informed a decision not to apply a full internal lining as any spray applied lining would not bridge cracks and would be susceptible to failure from continued movement of the structure.[44] Application of such a lining would be expensive and not guaranteed to be successful. The latest Black & Veatch report confirms this view.[45]

Application of externally applied flexible water membrane and replacing gravel

8. An internal spray applied coating was applied in 1996. A decision to apply an internal membrane was taken partly on the grounds of cost and partly because of the risk of structural movement associated with stress relief following removal of the insulation on the roof.[46] After 19 years the coating has failed and is dropping off the roof in several locations.

Drop test

9. Drop tests have been carried out regularly.[47] A decision to lower the operating top water level was taken following drop tests.

Roof leakage test (wetting for 6 hours)

10. The roof is flooded at every inspection.

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[40] Sir William Halcrow and Partners, Bedminster Down Service Reservoir, Report of an Inspection – February 1986, Summary. (RPF043).

[41] B&V Structural Comments on Bedminster Reservoir 2013 (RPF011).

[42] B&V Bedminster Reservoir Refurbishment Proposal July 2015, (RPF008).

[43] Figure A3.2 Methods of sealing moving cracks – CIRIA R138 (RPF053) pA20.

[44] Underground Service Reservoirs: Waterproofing and repair manual: 1995, R138 (RPF053) A4-2-4 pA42.

[45] B&V Bedminster Reservoir Refurbishment Proposal July 2015 (RPF008).

[46] Underground Service Reservoirs: Waterproofing and repair manual:1995, R138 (RPF053) Section B3.1.3.

[47] Bristol Water Engineering Directorate Reservoir Inspection Report, March 2007 (RPF004).

Appendix 3.2 – Maintenance Non Infrastructure

1 Introduction

1. As set out in Section 3 of our response to the CMA's PFs, we considered it would be helpful to provide more specific technical responses to the issues around MNI in a separate appendix.[48]

2. In this Appendix 3.2, we have set out detailed comments in relation to:

   - use of named schemes and deterioration modelling for identifying water treatment works expenditure (see **Section 2)**;
   - chlorination and the move to OSEC (see **Section 3**);
   - Named environmental schemes (see **Section 4**);
   - Treatment works media costs (see **Section 5**);
   - Management and general (see **Section 6**); and
   - Cost efficiency for bulk chemical storage tanks (see **Section 7**).

2 Use of Named Schemes and deterioration modelling for identifying water treatment works expenditure

3. Our approach to intervention modelling is set out in detail in our submitted business plans and supporting evidence.[49]

4. The Asset Level Model (ALM) for water treatment works processes identifies the performance of individual processes at specific sites based on the use of deterioration curves, which are derived from historic asset performance using Weibull analysis or linear regression. This is a performance assessment.

5. The industry moved away from the use of condition assessments for mechanical and electrical equipment during AMP3 when the Capital Maintenance Planning Common Framework (CMPCF) became standard practice. The CMPCF suggests different approaches depending on the level of sophistication and availability of data. The use of deterioration modelling is considered the most sophisticated approach.[50]

6. The main features of the water treatment works ALM are as follows:

   - details of historic failure and cost data at a water treatment works process level are taken from SAP. End of life (**EOL**) analysis is based on Weibull distributions from assessments from expert judgement using a Delphi approach with validation;

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[48] Issues related to Bedminster Service Reservoir are presented in Appendix 3.1.

[49] See Index of Supporting Documents.

[50] CMPCF Review of Current Practice (RPF084).

- the ALM evaluates the relationship between repairs, failures and the time to impact on service;
- a single intervention to improve performance is considered;
- major inputs are asset data relating to physical characteristics (e.g. age), operation, maintenance and performance;
- deterioration is based on linear regression of asset related data based at process level; and
- the sub processes covered are:

Adsorption - Granular Activated Carbon (GAC)
Adsorption - Powder Activated Carbon (PAC)
Advanced Oxidisation (hydrogen peroxide)
Bromate Reduction - (sulphuric acid)
Chlorination
Chlorination - Dechlorination (sulphur dioxide)
Chlorination - On Site Electro-Chlorination
Coagulation
Coagulation - Actiflow
Coagulation - Dissolved Air Flotation
Disinfection - Hypochlorite
Effluent Treatment
Filtration - Mechanical Screens
Filtration - Microstrainers
Filtration - Pressurised Membranes (aka Crypto)
Filtration - Rapid Gravity Filters (RGF)
Filtration - Slow Sand Filters (SSFs)
Filtration - Submerged Membranes
ICA
Interstage - Low Lift (LL) Pumps
Manganese Removal
Ozone
pH Correction
Plumbosolvency - Phosphoric Acid
Ultra Violet

7. The main features of the operational structures ALM are as follows:

- the asset investment is based on inspections and Weibull distributions relating to refurbishment and end-of-life estimates of the earliest, most likely and oldest age that the structures will reach before intervention is required;
- the interventions considered are replacement and refurbishment;
- major inputs relate to an asset's physical data, operation, maintenance, performance and service impact;
- deterioration is based on Weibull parameters;
- costs are based on a mixture of historical costs, third party costs and engineering judgements; and
- asset groups covered are:
    - civil structures;
    - culverts;
    - pressure vessels;
    - sewage structures;
    - springs, wells and boreholes; and
    - tanks. 51

[51] The full list of assets covered within these groups are: Boreholes, Brick Culvert, Brick Structure, Catch Pot, Clay Structure, Compressor, Concrete Culvert, Concrete Flume, Concrete Structure, Earth Structure, Evaporator, Fuel Tank, Iron Culvert, Large Carbon Steel Tank, Large GRP Tank, Large Plastic Tank, Large Steel Tank, Medium GRP Tank, Medium Plastic Tank, Medium Polypropylene Tank, Medium Steel Tank, Plastic Cesspit, Plastic Tank, Polypropylene Tank, Pressure Vessel, Septic Tank, Small Chromium Nickel Alloy Tank, Small GRP Tank, Small Plastic Tank, Small Polypropylene Tank, Small Polyvinylchloride Tank, Small Steel Tank, Springs, Steel Tank, Stone Culvert, Stone Brick Culvert, Surge Vessel, Tank and Wells.

8. Table 2 provides a breakdown of all the named schemes in the water treatment asset MNI category[52] that were presented to the CAO alongside an explanation of the reason why each named scheme was not covered by the ALM.

Table 2 MNI related named schemes

Scheme Name	Post-Efficiency Costs (£m)	Reason not covered by model
Barrow TW outlet + inlet main replacement (54" & 60") assessment	£0.045	Asset type not covered in the models
Various Sites: Chlorine - Electrochlorination /OSEC (Phase 1)[53]	£3.695	Policy decision to move to OSEC to manage health and safety risk so not modelled
Purton TW Washwater Recovery and Densadeg	1.501	Currently only one Densadeg, additional process needed to manage risk (not modelled)
Various Sites: Chlorine safety (chlorguard /drum weighing /super and D gas flow measurement)[54]	1.296	Needed to manage health and safety risk against current standard at specific sites where OSEC is not planned during AMP6 (not modelled).
Various Sites: Environmental compliance upgrades (SERA) 55	1.800	Needed to manage environmental risk at specific sites (not modelled)
Various Sites: Water reg improvements treatment works cat 4-5	0.225	Upgrade specific sites to meet current water fittings regulations (driver not modelled)
Banwell TW Chemical Storage Improvements	0.090	Current level of storage does not meet our 30 day requirement (driver not in ALM)
Barrow Primary screening at the Inlet works	0.450	Efficiency improvement at the works and better control of fish fry entering the works (not modelled)
Littleton TW land drainage assessment	0.045	Initial study for possible future work(driver not modelled)
Littleton TW Reposition of chemical offloading points	0.090	Needed to manage health and safety risk (not modelled)
Purton TW HL PS - refurbishment[56]	1.395	Efficiency and power management improvement at the works (not modelled). Current operation of the plant is constrained by capacity of power lines. This change will increase flexibility
Various Sites: Environmental compliance upgrades (Oil Containment) 57	1.800	Needed to manage environmental risk (not modelled)
Barrow SSF decommissioning	0.360	Decommissioning costs not included in deterioration models
	12.792	

Source: Bristol Water

9. Table 3 provides a breakdown of the named schemes which were excluded from the CAO because they were deemed to be included within the ALM. For example, there was a named scheme to "Replace chemical storage tanks", which was costed by our consultants (Atkins)

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52 The operational structures named scheme was an individual named scheme for the operational structures which was excluded once the operational structures model was developed as this captured necessary (lower) investment; see next table 2.

53 See section 3 of this appendix for details.

54 See section 3 of this appendix for details.

55 See section 4.1 of this appendix for details.

56 High lift pumps are included in the totals consistent with Ofwat's definition of the treatment works business unit.

57 See section 4.2 of this appendix for details.

at £7m. However, the operational structure model identified fewer structures as requiring intervention, so we adopted the modelled cost of £4m.

Table 3 Named schemes excluded from CAO as included within ALMs

Scheme Name	Capex Total (£m)	Site	Allowance in modelling (£m)	Notes
Replace chemical storage tanks	7.011	Various	4.200	Modelling identified a lower level of spend than site based assessment as a result of balancing risk
Membrane (pressurised) replacement	0.700	ALL	1.432	Model identified more membranes needing replacement than early estimate
Treatment Works Boll Filters[58]	0.200	Chelvey TW/ Oldford TW	n/a	Costs not modelled down to this level. Assumed to be covered by the model allowance.
Barrow TW Sulphuric Acid dosing improvements	0.100	Barrow TW	0	Spend not selected for AMP6
Cheddar TW Static Mixer	0.060	Cheddar TW	0	Spend not selected for AMP6
Clevedon TW Pump Control	0.080	Clevedon TW	n/a	Costs not modelled down to this level. Assumed to be covered by the model allowance
Littleton HL Pumps – refurbishment	0.180	Littleton PS	0	Relates to pump sump costs; therefore included in the operational structures model; spend not selected for AMP6
Purton TW Sulphuric Acid Dosing Plant replacement	0.070	Purton TW	0.250	The initial named scheme identified partial replacement but using a risk based approach the ALM identified a full replacement; this was confirmed by operational site assessment[59]
Purton TW Caustic Dosing Plant replacement	0.070	Purton TW	0	Spend not selected for AMP6
Littleton TW Caustic dose rig replacement	0.080	Littleton TW	0.075	
Littleton TW GAC	0.600	Littleton TW	0	Spend not selected for AMP6
Littleton TW replacement of HL starters[60]	0.300	Littleton TW	0	Spend not selected for AMP6
Littleton TW Supernatant Pump upgrade	0.030	Littleton TW	0	Costs not modelled down to this level. Assumed to be covered by the model allowance
Purton ozone tank refurbishment	0.060	Purton TW	0	Included in £4.2m above (replace all chemical storage tanks)
Tetbury Replacement of No 2 BH Pump and Controls	0.150	Tetbury TW	0.100	
Banwell replace final filtrate	0.100	Banwell TW	n/a	Costs not modelled down to this level.

[58] Boll filters are a type of automatically flushing filter, widely used in the water industry as pre-filters to reduce the solids loading going onto subsequent treatment processes.

[59] The Purton sulphuric 'cabinets' were replaced approximately 2 years ago but the pumping kit, dose lines and ancillaries are all original and the bund/floor is assessed as condition 5, requiring new concrete and coating. There is an expectation that we will need to replace tank pipework and paint tanks.

[60] Included within the pumping station model.

Appendix 3.2: Maintenance Non Infrastructure

Scheme Name	Capex Total (£m)	Site	Allowance in modelling (£m)	Notes
main				Assumed to be covered by the model allowance

Source: Bristol Water

3 Chlorination

10. In this section we provide detail to explain our policy on the adoption of OSEC including:

- Our options for sourcing chlorine for use in disinfection (**Section 3.1**
- The progress we have made installing OSEC during AMP5 and our plans for AMP6 and beyond (**Section 3.2)**
- The interactions between the various chlorination interventions (**Section3.3)**

3.1 Sourcing chlorine for use in disinfection

11. The use of chlorine gas for disinfection presents a health and safety risk to both employees and local residents living near our sites. Chlorine gas poisoning can be fatal.

12. There is also a resilience risk given that there is only one supplier of chlorine gas in the UK.

13. We are, therefore, looking to minimise the risks associated with chlorine handling and use by installing OSEC across our region in a phased approach commencing with those sites at which we use cylinders.[61]

14. In most cases, where OSEC is adopted, the existing chlorine production process (e.g. cylinders) will be removed.[62] This means that the part of the existing chlorination equipment involved in the conversion of the gas to solution will be abandoned; the delivery process itself, including the delivery line and dosing points, will retained.

15. Thus where OSEC is installed, we would expect the chlorination system to be a less significant driver of expenditure than where there was gas based chlorination.

3.2 Progress with the installation of OSEC in AMP5 and plans for AMP6

16. OSEC was introduced at three sites during 2010 and 2011 (Avonmouth pumping station, Victoria pumping station and Maesbury. During AMP5, we decided that the adoption of OSEC should be rolled out to all sites as funding allowed, but based on the priorities associated with:

[61] The Business Case for the replacement of OSEC at Purton identified that the costs efficient solutions for chlorine disinfection were bulk supplied chlorine cheapest (but with the greatest H&S risk), drum supplied chlorine and OSEC on a par, cylinder supplied chlorine most expensive.

[62] Although OSEC has been installed at Purton, due to the nature of the treatment processes (linked to Littleton) drum chlorine will always be required. Chlorine gas is used on the Littleton intake to control zebra mussel infestation in the raw water main to Littleton. OSEC hypochlorite contains bromate; the works configuration at Littleton means that there is an increased risk of bromate at this site compared to Purton so as a mitigation to reduce risk of bromate failures at Littleton we use chlorine gas for the raw feed to Littleton.

- public health (particularly proximity to densely populated areas); and
- efficiency.

17. An initial programme was developed in 2012 which identified OSEC installation to be completed in AMP5, AMP6 and AMP7, taking into account other planned work which could interact negatively or positively (i.e. intervention might be programmed earlier to develop synergies or later to avoid conflicts).

18. As the OSEC expenditure had not been part of our funding for AMP5, the delivery of the scheme has been slower than initially planned as a result of needing to balance different investment priorities. During AMP5 OSEC was only installed at Lockleaze PS and Purton TW (completed 2014).

19. Therefore, as an estimation of the expenditure expected on OSEC for AMP6, the remaining tranche of OSEC installation originally programmed for AMP5 was included as a must invest named scheme within the CAO process. The expectation was that sufficient funding would be obtained to enable us to progress the programme such that we could deliver OSEC to the levels we had initially planned for the end of AMP5 by the end of AMP6.

20. The original programme had schemes at Alderley, Cheddar, Chelvey, Clevedon, Frome, Oldford, Stowey and Tetbury treatment works.

21. OSEC at Tetbury is being installed this year as the site is considered to be high priority due to the location of the site in a residential area. Future installations will be determined by available funding.

22. Due to affordability constraints on costs, rather than being delivered in four phases (AMP5 - AMP8) as initially planned, delays in AMP5 have caused the programme to be extended across another AMP so OSEC will be installed at further sites until AMP9.

3.3 Interactions between named schemes and modelled schemes

23. Within the WTWs model, there is expenditure included for the maintenance of the existing chlorination process at:

    - Banwell TW
    - Barrow TW
    - Cheddar TW
    - Chelvey TW
    - Purton TW[63]
    - Rowberrow PS

    and for the maintenance of dechlorination process at:

    - Banwell TW
    - Barrow TW
    - Cheddar TW.

[63] Purton TW has recently had OSEC installed but retains drum based chlorination as well (this cannot be replaced)

24. Expenditure is also included for OSEC refurbishment at the existing OSEC sites of:

- Avonmouth PS
- Maesbury
- Victoria PS.

Expenditure at these sites has been selected on the basis of the assets being low cost and high risk; in balancing the risk and cost the model has selected the early replacement of low cost high risk dosing assets.

25. There are two named schemes relating to chlorination.

26. **N41 Various sites: chlorination – electrochlorination (Phase 1)** – this is the new OSEC installation discussed in **Section 3.2**.

27. **N102 Various sites: chlorine safety (chlorguard/drum weighing / super and D gas flow measurement)** – this scheme relates to the improvement of existing gas based chlorination sites for the following locations, which are planned to continue using chlorine gas until after AMP7:

- Almondsbury
- Littleton
- Banwell
- Shipton Moyne

28. The intervention covers site/room improvements/chlorguard/weighing/direct use (mass) interlocks/Computational Modelling (environmental/safety dispersal models)/Whole Room Scrubber).

29. The Company has decided that it is acceptable not to spend money on existing gas drum and cylinder installations where there is a definite target date for OSEC installation.

30. However, disinfection is absolutely key to the maintenance of potable water quality within the network and therefore it is not acceptable to allow such equipment to fail. Consequently in the absence of planned OSEC intervention, maintenance of the existing equipment will be continued. Such sites then move down the priority list for OSEC installation.

31. There will therefore remain a need to maintain existing chlorination equipment until OSEC is installed over the next three AMPs.

4 Named environmental schemes

32. The two named environmental schemes challenged by the CMA are:

- Various Sites: Environmental compliance upgrades (SERA); and
- Various Sites: Environmental compliance upgrades (Oil Containment).

33. Aqua has suggested that there may be duplication across the two named environmental compliance schemes, and that they are not appropriate. [64]

34. In the following paragraphs we:

- explain that the schemes relate to two components of our environmental compliance upgrades and do not cover the same areas;
- demonstrate that they are not linked to deterioration but to change in standard, so they would not be expected to be identified by a deterioration model, such as the ALM; and
- provide the basis for the identification of the environmental compliance programme from our company wide risk assessment programme.

35. In essence, whilst the schemes are broadly similar, they are mutually exclusive and have been scoped specifically to prevent duplication. As such, we can demonstrate that Aqua's concerns in relation to these schemes are unfounded.

36. The projects have been treated as separate interventions because fuel storage and management is a narrow scope that can be let to a contractor as a single project; other risks identified under the Site Environmental Risk Assessment (SERA) project are far more site-specific and variable so it is not appropriate to use this approach.

37. These schemes were not part of deterioration modelling because they are related to a change in standards. New environmental standards apply and the sites and equipment installed at the time of original construction do not meet current environmental good practice. This is therefore an enhancement programme to enable Bristol Water to meet current good practice and reduce the risk of environmentally-damaging events and the associated risk of significant financial penalties.

4.1 Environmental compliance upgrades (SERA)

38. In 2014 a risk assessment programme was carried out across Bristol Water's property portfolio to determine the sites and activities that represent a risk to the environment, particularly with regard to pollution risk. For the risks identified, mitigation actions were costed in outline. This approach was then refined by taking generic "example" risks where costs were determined in more detail by engineering investigation at specific sites.

39. A total of 245 significant risks were identified at company sites. 86% of the cost of the mitigation programme identified to address these risks is at water treatment works sites as these represent the greatest environmental risk (handling of bulk chemicals etc). Programme costs were therefore assigned to water treatment works.

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[64] PFs, para. 5.130(b).

40. The mitigation option chosen and risks selected for final action will be determined as part of the investment programme - the total cost of investment required to mitigate risks identified under the SERA programme was £4.4m and as the investigation is in its first stage this cost was reduced to the final PR14 post-efficiency investment of £1.8m. This reduction was made on the assumption that only a proportion of the risks would be mitigated in AMP6 and that efficiency savings could be made during the implementation of the mitigation programme.

4.2 Environmental compliance upgrades (Oil Containment)

41. In 2014 as part of a broader environmental risks assessment programme (the SERA programme), fuel storage was investigated across Bristol Water's property portfolio to determine installations that do not meet current standards for safe storage of fuels. This work built on a 2012 investigation programme specific to fuel storage.[65] These two investigation programmes identified sites which represent a risk to safety or the environment, due to current or historic fuel storage at the site.

42. A total of 21 significant risks were identified at company sites through the SERA project and 11 sites through the 2012 fuel storage investigation project. 83% of the cost of mitigation work required to address risks identified through SERA is at water treatment works and 50% of the cost of mitigation work required to address risks identified the fuel storage investigation programme is at water treatment works so the overall costs were assigned to water treatment works. The mitigation option chosen and risks selected for final action will be determined as part of the investment programme - the total cost of investment required to mitigate risks identified was £2.9m and this cost was reduced to the final PR14 post-efficiency investment of £1.8m, or 60% of the identified cost. This reduction was made on the assumption that only a proportion of the risks would be mitigated in AMP6 and that efficiency savings could be made during the implementation of the mitigation programme.

5 Treatment works media costs

43. The CMA challenges the inclusion of £3.6 million for media replacement, following expenditure of £2.1 million in AMP5.[66]

44. In this section we:

- explain the basis of the media costs, and
- explain the UV costs and compare forecasts with experienced and expected annualised costs .

45. Within the WTW model, media is defined as capital consumables. Examples of media types are:

- Granular activated carbon (GAC) (replacement and regeneration)
- Powdered activated carbon (PAC) (replacement and regeneration)
- Pressurised membranes

[65] Bulk Fuel Oil storage feasibility report (RPF074).

[66] PFs, para. 5.131(b).

- UV lamps.

46. The breakdown of the sites with additional media consuming processes was provided in our response to CMA Main party hearing question 3 of 3 June 2015 Table 9.

47. The costs for AMP6 are discussed below.

48. **GAC** - Purton Treatment works £540k asset costs (£600k pre efficiency) (asset expenditure, not media)

49. **PAC** - Purton Treatment works £450k asset costs (£500k pre efficiency) (asset expenditure, not media)

50. **Submerged membranes** – Banwell TW £837k (£930k pre-efficiency). This involves the 'wholesale replacement of these membranes. The membranes have a manufacturer's life of 7 years. Performance of the membranes fell off dramatically by year 7, requiring us to reduce the output of Banwell by half (30 to 15 Ml/d during 2014-15) pending their replacement.

51. **Pressurised membranes**:

Table 4 Modelled pressurised membrane costs

Site	Modelled	
	Cost of Media (£k)	Replacement Costs (£k)
Alderley	90	54
CharterhouseT	36	56
Chelvey TW	353	90
Forum	72	54
Frome Town TW	108	54
Oldford TW	259	63
Total	**918**	**371**

Source: Bristol Water

52. Pressure membrane have an manufacturer's life of 7 years life, which has been 'stretched' through optimisation and management with approx. 55% of the existing membranes reaching between 12-14 years of age[67]. The replacement strategy is based around a 'rolling' replacement each year and we have been making heavy use of the old modules recovered from both Banwell and Sherborne TW. Hence, pressure membrane replacement expenditure in AMP5 was only approx. £265k against an expected value of approx. £850k based on a normal (extended) replacement cycle.

[67] This is the assumption within the model.

53. **UV lamps**:

Table 5 Modelled UV costs

Site	Modelled cost of Media (£k)
BanwellTW	203
LittletonTW	198
PurtonTW	284
ShiptonMoyne	203
Total (AMP6)	**887**

Source: Bristol Water

54. For AMP6, media costs include UV lamps.[68] The CMA suggests that the "*replacement of UV lamps is a relatively inexpensive maintenance intervention.*" [69] We explain why we think the CMA has drawn this conclusion and why we do not consider UV lamp replacement is a low cost intervention in the paragraphs below.

55. In its assessment, Aqua[70] has taken the Atkins estimate of opex for UV lamps at Cheddar (£14k p.a.).

56. Our assessment compares the costs identified by the modelling approach (risk based replacement) validated against actual costs seen at existing sites.

57. As shown in Table 5, the modelled component for UV lamp replacement forecasts costs of £177k p.a. (post efficiency).

58. UV lamps have to be replaced once they have been used for a specified period of time to maintain the certifiable validity of the process. AMP6 costs for UV lamp replacement alone are estimated to be £179k p.a. [71] This represents an increase of £59k[72] pa over our AMP5 base position, not including the impact of the Barrow UV scheme which is due to be commissioned in July 2016.

59. In relation to 'new media consuming processes', the CMA considers whether "*these new approaches would have replaced other processes, which would also involve expenditure to maintain.*" [73]

60. The 'new media consuming processes' are related to additional processes installed rather than replacing existing processes. Thus all the UV disinfection schemes were put in as enhancement schemes, rather than as replacements for existing processes.

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68 Bristol Water's response to CMA Main Party Hearing Question 3 on MINI,3 June 2015, Table 9.

69 PFs, para. 5.131(b).

70 Aqua has cited the data comes from the SoC itself; the reference for the data is SOC233 page 38.

71 £200k p.a. once Barrow UV completed; UV consumable costs (all) (RPF097)

72 UV consumable costs – not included in base year(RPF065)

73 PFs, para. 5.131(b).

6 Management and General (M&G)

6.1 Buildings

61. Proposed expenditure on buildings increased from £0.3 million in AMP4 to £2.5 million in AMP6 and results from an identified need to undertake remedial work on many of our operational buildings. This increased need was seen during AMP5, and, as a result, a programme of inspection of these building was initiated in 2013 to provide input to the PR14 process. This was undertaken by Edward Symmons Group, a specialist property consultants company, who undertook detailed surveys of the buildings on the following sites:[74]

Barrow Logistics	Oldford TW
Blagdon TW	Oldford BH
Charterhouse TW	Pucklechurch Reservoir
Cheddar TW	Stowey TW
Chew Valley Lake	Tolldown Reservoir
Kingswood Depot	Victoria PS
Littleton TW	

62. These sites were specifically chosen to be a representative sample of the overall buildings asset base reflecting the different mix of size and type. During the surveys, they assessed the condition of the buildings on the site and identified the remedial work required and provided an estimated cost to complete this. An example of the output from the surveys is provided.[75]

63. The expenditure identified for AMP6 as a result of this work was £2.876m. This included an allowance for professional fees for supervision of the work and for contingency, both of which we considered to be unnecessary. These elements were removed and the revised estimate for work in AMP6 was £2.435m. Summary information is provided for the original estimate[76] and for the revised estimate.[77]

64. As noted above, this estimate was for a representative sample of buildings assets and covered the main buildings on 13 sites. Had this been projected for the company as a whole, the resulting overall level of expenditure would be unrealistic. Consequently, we reviewed and challenged the results of the surveys and used this to inform the development of our approach to assessing AMP6 investment requirements using one of the asset level models and the SEAMS WiLCO optimisation tool. This is described in Buildings – Work Package 2 Report (SOC458). It involved an assessment by the managers responsible for the different sites of the priority grade and risk grade for more than 500 buildings against a standard set of criteria. The results of this work provided the input data to the model.

65. Our use of these models and other inputs to determine the required level of future investment is described in detail in Section 7.4.1 of the SoC.

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[74] Edward Symmons group building surveys original (RPF022).

[75] Example building survey results (RPF024).

[76] Edward Symmons group building surveys original (RPF022).

[77] Edward Symmons group building surveys revised (RPF023).

66. The output from the optimisation process for all interventions indicated that the level of investment required in AMP6 to avoid deterioration of the asset base and meet the performance commitments was £2.2m (post efficiency). This is the level that has been included in our Business Plan.

6.2 Health & Safety

67. Proposed expenditure on Health & Safety increased from £0.1m in AMP4 to £4.3m in AMP6. As noted in para 5.137 of the PFs, part of this, amounting to £3m, is due to switchgear replacement. The remaining difference results from three areas outlined in the following sub-sections.

6.2.1 Working at Height Regulations

68. The Working at Height Regulations 2005 introduced new obligations on employers to provide protection for staff working at height. For Bristol Water, the key areas were the need to have someone who is rope rescue trained accompanying anyone working on a ladder greater than 4 metres high and the need to provide protection at sharp drops. Initial work in response to these new regulations involved developing new operating procedures, providing safety harnesses, providing training and ensuring the regulations were taken into account in new projects by designing to provide steps rather than ladders.

69. In AMP5, work started on a programme to review all locations affected by the regulations with a view to replace ladders with steps where possible and install guardrails. This will avoid the inefficient use of resources as it will no longer be necessary to have two people involved on tasks at these locations. Expenditure in AMP5 was £0.3 million with work starting on the highest risk sites. Proposed expenditure in AMP6 is £0.4 million for the continuation of this programme to allow us to comply with this legislation.

6.2.2 Asbestos Removal

70. All of the company's sites have been surveyed for the presence of asbestos and a report prepared for each site. An example is provided as RPF025 Barrow Treatment Works Asbestos report. Details are recorded and maintained on the Asbestos Register. Re-inspection is carried out on a regular basis to confirm that the asbestos is still there and to monitor its condition. If it is found to be damaged, it is re-encapsulated or removed by specialist contractors in accordance with HSE Guidance. In addition, if the asbestos is in a high risk location, for example, if it vulnerable to damage or there are a lot of people passing, it will also be removed. The allocation of £0.4m in AMP6 is to cover this work.

6.2.3 Active Fire Prevention

71. The allocation of £0.4m in AMP6 is for the installation of active fire prevention equipment such as gas suppression systems to protect plant on operational sites in the event of fire. This intended to protect the peripheral equipment and the fabric of the building and will reduce the cost and time taken to get the site operational again by minimising the extent of damage and giving the potential to repair rather than replace.

6.3 Information Technology

72. Proposed expenditure on Information Technology increases from £7.1 million in AMP4 to £9.6 million in AMP6. Although it shows a reduction over AMP5, it is in line with

expenditure in AMP3 (£9.2m in 12/13 prices) during which period several of the corporate systems were upgraded or replaced, reflecting the cyclical nature of such expenditure.

73. SOC140 section 2.2.2 provides information on the increase in expenditure allowed by the CC for AMP5 highlighting four work areas where expenditure was required. The proposed expenditure in AMP6 continues the work in these work areas but extends it to cover new areas which are focussed into themes as outlined in our IT and Business Improvement Strategy. The increase over AMP4 reflects the greater reliance on IT systems and the need to maintain these, particularly in the areas of mobile working, customer experience, business intelligence and efficiency.

74. The process we have undertaken to determine our AMP6 IT budget is based on analysis of systems, consultation with the business and our experience to create our Strategy and projected spend. This has then been challenged a number of times, refined and then a Roadmap for certain components was developed with our IT partner, Wipro.

75. The IT budget is driven by the need to keep systems operational or by business driven change. The investment to keep systems operational relates primarily to replacement of aged/failing hardware (server/desktop/network) and upgrades to systems out of vendor support. The Roadmap illustrates the vendor support position for the main business systems. Whilst we are not averse to risk relating to IT we believe critical systems such as SAP should be within vendor support for their main components (application, database version, etc) otherwise, in the event of failure, we cannot guarantee with any certainty the ability to restore them. Also as critical systems fall further out of support, with increased levels of integration we cannot provide new business driven requirements. Examples of this would be the flow of data from customer driven requests into our asset management system, then scheduling and dispatch system where operational improvement opportunities exist. The Roadmap shows how many systems are falling further out of support during AMP6 hence a prioritised plan of investment has been developed using a risk based approach with our IT partner Wipro. The high priority requirements in the early part of the AMP6 period are detailed in the Roadmap including the evaluation of the options considered.

76. The second type of IT investment relates to business driven IT requirements and these fall into a number of sub categories such as regulatory driven change, customer service improvements, efficiency opportunities, risk mitigation etc. IT as a change enabler allows us to improve and serve our customers better however this has led to an increase in expectations and the number of systems used which has driven increased cost to support and maintain systems as seen above. One example of this planned improvement would be our proposed SCADA integration project which will integrate the operational Telemetry system into our SAP Asset Management system to dynamically drive works management. This integration will create a more dynamic efficient business and builds on success in this area during AMP5, for example dynamic reordering of stock.

77. Other examples of planned IT investment in this area are:

- Changes to systems to support our new operating model – SAP Finance, SAP Business Objects, Oracle Data Warehouse, SAP Works Management systems, SAP CRM
- Improved information management/decision support - SAP ECC, SAP Business Objects, Oracle Data Warehouse, MS Sharepoint

- Enhanced Asset Management - SAP Plant Maintenance, Field Force Automation (scheduling and dispatch), MS Sharepoint
- Adapting to market changes – Oracle Data Warehouse, SAP integration, SAP CRM/SAP ECC and MS Sharepoint process changes

6.4 Other

78. Proposed expenditure on the Other area of M&G decreases from £7.9 million in AMP4 to £5.3 million in AMP6. The largest element within this is for vehicles which is showing a small increase. Telemetry and ICA also show an increase in AMP5 and 6 because of the withdrawal of some of their communication products by BT and Vodafone . The programme of work to address this commenced in AMP5 and continues into AMP6. Expenditure on modification of standby plant to comply with fuel storage regulations has been completed and accounts for some of the reduced expenditure level.

79. For M&G items, we successfully developed a model for buildings. Other models for Information Technology, Telemetry and Communications, Vehicles and Standby Generators were attempted but lack of performance data meant the models were insufficiently robust. Where we were unable to develop models, we devised named scheme solutions, where possible using low, medium and high levels of investment. The CAO then chose the appropriate solution.

80. Ultimately the schemes put forward and whether selected or not by the CAO were as follows (Table 6):

Table 6 M&G schemes presented to the CAO

Scheme Name	Capex Total (£k)	Must Invest	Selected	Category
Conservation at Company sites	225	Yes	Yes	Other
Health and Safety	180	Yes	Yes	H & S
Office Equipment	45	Yes	Yes	Information and Technology
Standby Generation	540	No	No	Not selected
Abandoned sites/ Company Properties Decommissioning	90	Yes	Yes	Buildings
Active Fire prevention	360	Yes	Yes	H & S
Asbestos Removal	360	Yes	Yes	H & S
Building Management System	0	No	No	Not selected
Electrical Asset Review - Safety and Compliance with Regulations (including transition investment from AMP5)	2,935	Yes	Yes	H & S
Electronic safety management system	72	Yes	Yes	H & S
Emergency Radio network	32	Yes	Yes	Other
Microwave Phase 3	874	Yes	Yes	Other
Purton Paging Lone worker scheme	59	Yes	Yes	H & S
Power- Distribution Boards - Segregation of Building services and Control & Instrumentation	180	Yes	Yes	Buildings
Remove mod bus replace with 4-20 Ma loops	27	No	No	Not Selected
Replace swipe readers with proximity readers	72	No	No	Not selected
Standby Generator fuel levels on scopex	45	No	No	Not selected
Telemetry Communications Network	23	Yes	Yes	Other
Telemetry Outstation Upgrade	108	Yes	Yes	Other

Appendix 3.2: Maintenance Non Infrastructure

Scheme Name	Capex Total (£k)	Must Invest	Selected	Category
TW Provision of contractors' toilets	90	No	No	Not Selected
Working at Height Improvements (including Guard Rails)	360	Yes	Yes	H & S
Telemetry General	360	Yes	Yes	Other
IT Budget	9,450	Yes	Yes	Information and Technology
Vehicle	3,420	Yes	Yes	Other
Buildings_Model_M&G	2,223	ALM Model	Yes	Buildings
Market Setup - Central Market Costs	127	Yes	Yes	Information and Technology
Instrumentation general	270	Yes	Yes	Other

Source: Bristol Water

7 Cost efficiency – bulk chemical storage tanks

81. The CMA draws its conclusion that the costs associated with the replacement of bulk chemical storage tanks do not appear efficient from Aqua's suggestions.

> *"Aqua has calculated that the allowance for bund capacity is overstated and said that the chemical tanks also have a bund included in the price"*[78]

82. Aqua also stated in para 227 of the revised technical response that "*having considered the survey information for the chemical tanks we would not have expected that all of the bunds would require replacement*".

83. Firstly we would note that not all of the bunds are being replaced. Only three are being replaced and five new ones are being provided as described in section 10 of Chemical Tank Report For Issue (ENQ073);

84. Atkins' estimate only refers to the polypropylene tanks as having integral bunds. The steel tanks selected do not include bunds. In the comparison between polypropylene and steel tanks Atkins only priced five polypropylene tanks rather than eight steel tanks to take account of this.

> *"Aqua identified that for replacement tanks the level of instrumentation controls may be relatively high, as existing telemetry should be sufficient"*[79]

85. Level systems include:

- low
- low low
- high, and
- high high

alarms, with local and remote warning (visual and audible).

86. In addition, all our bulk tanks are now remotely monitored with a direct interface with telemetry and SAP. Levels are converted into tonnage and both usage (dosing) and inventory

[78] PFs, para 5.144 (a).

[79] PFs, para 5.144 (b).

are measured and recorded every 15 mins. When tanks reach pre-determined levels SAP automatically re-orders a tanker delivery. Secondly, following a recent event (chemicals syphoned into the process/supply during shut down events, creating a point pollution event that nearly led to a significant breach of the water quality standards) we now have a standard design that includes suction/dosing flows and flow switches at the point of dosing. These measurements/inputs are used to close failsafe valves on the bulk tank outlets and dosing point, eliminating the risk of chemicals being 'overdosed' in the event of plant shut down.

87. Thus the inclusion of the stated ICA provision is consistent with good practice within the water sector.

> *"The estimate includes substantial quantities of pipework, which Aqua considered should not be required for a tank replacement"*[80]

88. This is a standard design arrangement considered to be best practice in the water sector. In the event of a chemical leak anywhere on the pipework/joints the outer containment runs to a catch pot/pit with probe which automatically shuts the bulk tank outlet valve (mentioned above) minimising loss of containment and losing high volumes of hazardous chemicals, stopping damage to the tank or bund (exothermic reactions etc.) and eliminating the need for a hazardous/expensive clean up operation within the bund, particularly as many of the existing tanks have integral bunds which are almost impossible to safely access and clean.

89. The CMA concludes that "*If any of these items could be excluded, this would suggest the potential for material cost efficiencies against Bristol Water's planned unit costs*"[81]

90. In light of our explanations above, we do not believe that any of these items could be excluded without having a detrimental effect on the service provision expected from the asset, therefore the suggestion that there is a potential for material cost efficiencies is misconstrued.

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[80] PFs, para 5.144 (c).

[81] PFs, para 5.145.

Appendix 3.3 – Estimate of incremental operating costs due to AMP5 capex

1 Introduction

1. We have performed detailed estimates of actual costs for three of the AMP5 schemes that were not fully operational in the base year 2013/14 and would therefore result in additional costs being incurred in future years.

2. The following process was followed when producing these estimates:

- identify the types of costs likely to be incurred;
- estimate the expected cost for each type. This should be achieved by:
  - utilising actual data for that particular scheme (e.g. from operational data available after completion or from test runs as part of commissioning) ; or
  - utilising actual cost information from a similar process elsewhere, with appropriate adjustments made to reflect any differences between the schemes that would have a financial impact;
- consider the existing costs for each type and subtract where appropriate to leave just the incremental costs of the new process; and
- convert all costs to 2012/13 prices for consistency.

2 Calculations

3. The tables below show the results for each scheme, and provide further details behind the figures presented in the main response document.

2.1.1 Sherborne Lead removal

4. This scheme represents a significant upgrade to an existing process involving more than doubling membrane capacity; the addition of pH correction (dosing both sulphuric acid and sodium hydroxide); the addition of a coagulation agent (dosing poly-aluminium chloride) and a sludge/effluent treatment plant. Therefore the majority of the costs involved are new costs. However some costs (such as power and maintenance) are incremental.

Table 7 – Sherborne lead removal

Cost type	Annual estimate (£m)	Commentary
Chemicals	0.044	12 month cost at 9 Ml/d output, calculated from costs observed to date. Previously only small amounts of cleaning chemicals were used at Sherborne.
Effluent	0.090	12 month cost at 9 Ml/d output, calculated from costs observed to date. Previously only a small amount of effluent was removed Sherborne.
Power	0.039	12 month pumping cost at 9 ml/d output, calculated from costs observed to date and after deducting power costs for previous (3 Ml/d) output.
Pro-active maintenance & operator routines	0.073	Based on observed costs from a similar treatment works (Chelvey) and after deducting previous existing costs at Sherborne.
Re-active Maintenance	0.017	Based on observed costs from a similar treatment works (Chelvey).
Additional Membrane Costs (breakage only)	0.005	Calculated as 3% annual losses based on other existing pressure membrane plant. Due to later commissioning of plant membranes, full membrane replacement will now not be required until AMP7 (estimated cost of £160k).
EA consent to discharge	0.008	Actual costs as indicated by the Environment Agency.
Total	**0.276**	

Source: Bristol Water

2.1.2 Cheddar & Stowey UV

The implementations of UV treatment at Cheddar & Stowey represent completely new treatment processes (as opposed to upgrades of previous processes). Therefore all the costs incurred are new costs rather than incremental.

Table 8 – Costs incurred for UV treatment at Cheddar & Stowey

Cost type	Cheddar annual estimate (£m)	Stowey annual estimate (£m)	Commentary
Lamp replacement	0.028	0.028	Based on manufacturer specified replacement cycles and current replacement costs.
Pro-active maintenance & operator routines	0.005	0.005	Based on average costs observed at existing UV sites
Re-active maintenance	0.001	0.001	Estimated on the assumption of 80% pro-active and 20% re-active cost ratio
Power	0.059	0.048	Stowey costs calculated from actual telemetry data post go-live. Cheddar costs estimated from average costs observed at existing UV sites due to lack of telemetry data at Cheddar.
Total	**0.093**	**0.082**	

Source: Bristol Water

Appendix 4.1 – Cheddar Reservoir Two

1 Introduction

1.1.1 Overview of proposed enhancement

1. The proposed enhancement project is for a new raw water reservoir close to an existing reservoir at Cheddar. The reservoir will have a capacity of approximately 9,000 megalitres and will take water from springs in Cheddar Gorge, through an existing abstraction licence. The existing reservoir at Cheddar provides the best-quality surface water available to Bristol Water and is located approximately in the centre of the area supplied by Bristol Water. The new reservoir will create an additional 16.3 Ml/day yield by storing winter flows of the same source water used for the existing Cheddar reservoir.

1.1.2 Need

2. Our proposal for a new reservoir at Cheddar has been developed through the statutory Water Resource Management Planning (**WRMP**) process carried out in collaboration with the Environment Agency and other stakeholders. Based on the accepted understanding of the role that the WRMP plays in the overall business planning process, we consider that it is the primary statement regarding our supply demand balance, and how it will be addressed.[82]

3. Development of our WRMP included assessment of over 150 schemes, encompassing demand-side reduction plans such as increased metering and leakage management. Inclusion within the WRMP of a project to develop a new reservoir at Cheddar involved assessment of a range of scenarios on climate change, population growth and changes in non household demand, followed by investigation of multiple potential reservoir sites across the local region, with geotechnical assessment of land condition at shortlisted sites. In nine out of the 12 scenarios we examined, commencement of works on Cheddar 2 during AMP6 was the most cost-beneficial approach.[83] The scenarios where Cheddar reservoir was not selected as part of an optimal solution would require the following assumptions:

   - a substantial reduction in supply security;
   - that the company will make no further provision for large industrial supplies; or
   - climate change projection for wet conditions in future.[84]

1.1.3 Non-domestic demand

4. In relation to non-domestic demand, the CMA concludes that:

   "(i) there was significant uncertainty that one or both proposed power stations would be granted planning permission and constructed in the initially proposed timescale; and

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[82] Role of the WRMP in a price control determination, Greenberg Traurig Maher – provided as **Appendix 4.4**.

[83] WRMP (SOC039), p.191.

[84] WRMP (SOC039), alternative scenarios, s.11.2.

(ii) there was no certainty that Bristol Water would be required to supply either power station in the event of their construction."[85]

5. In our planning we have followed the relevant guidelines in respect of ensuring there will be sufficient water available in future to facilitate economic growth.[86] We have therefore taken into consideration the following:

- the possible requirements for currently planned large water consumption developments (extant at the time we completed our WRMP); and
- the likely variations in demand of other areas of non household consumption.

6. It is probable that the power station developments referred to in the WRMP may be unable to proceed within the AMP6 period. However, this does not mean development will not occur in future. Avonmouth is a significant industrial area for the South-West and the availability of industrial quantities of water will attract development in future.

7. In 2014/15 the non household demand for potable water was 5 Ml/d (10%) above the projection made in 2012 (continuing the trend observed in 2013/14).[87]

8. In discussions with the LEF, Bristol Water made the point that there was considerable uncertainty regarding the timing and magnitude of non-household demand. The LEF was aware that it was our view that Cheddar Reservoir Two provided the lowest-risk solution for maintaining future supply security at affordable cost.

9. The fact that the power station development may not proceed has not changed our view that Cheddar Reservoir Two should remain a key component of our long term strategy. We have set out the case for maintaining the timescale for construction by retaining planning permission during AMP6. As Ofwat states, there is still an emerging deficit by mid 2024.[88] Due to the length of planning construction and testing we would need to begin construction approximately 10 years before the resource was required in order to have the structure operational by that date

1.1.4 Improving service levels

10. The CMA concluded that it had "*found no clear evidence that customers would support an increase in bills even if security of supply improved (in the event that no power station bought a supply)".*[89]

11. Our customer research showed that customers placed a high value on supply security, both in respect of frequency of water use restrictions and temporary supply cuts. [90] We have

[85] PFs, para. 6.116(a).

[86] HM Gov statement of obligations PB13829, October 2012 (RPF095).

[87] 2014/15 Bristol Water Annual Reporting (RPF096).

[88] PFs, para. 6.135.

[89] PFs, para. 6.116 (e).

[90] June Company Wide Plan (SOC005).

explained that our current level of service for these metrics is significantly lower than that customers of neighbouring companies experience. [91]

12. Expressed as a monetised value, our business plan research indicates that household customers have assigned a relatively high benefit for an improved service. [92] However, developing a scenario providing the level of service equivalent to neighbouring companies would have resulted in potential bill increases customers would be unwilling to support. [93]

13. Our preferred scenario provides some degree of certainty that current service levels can be maintained in future (as a hedge against large industrial supplies or other supply demand impacts). In the event that no further industrial supplies materialise, our plan would also provide an affordable means of ensuring service levels could be improved in future. [94] Customers would then be subject to the same level of risk of restrictions as neighbouring companies and closer to the service level they would prefer. At least 92% of customers have supported our preferred plan. [95]

1.1.5 Developing appropriate headroom

14. In relation to headroom, the CMA concluded that:

> *"we found that Bristol Water's headroom target included an amount of operational headroom sufficient to ensure an appropriate level of supply in the event of asset failure and to accommodate the uncertainty of climate change."*[96]

15. This is a critical issue for us. Our headroom target appears high because our total headroom is significantly less in future than most other water companies. Where companies have a high percentage of total headroom, they have no need for a significant headroom target. For much of our plan our headroom target is close to our total headroom, effectively meaning we are more vulnerable than companies with apparently lower headroom targets.

16. We would suggest that use of headroom target is unreliable as a comparative metric to assess risk appetite across the industry and that available headroom would be a more suitable indicator to interpret the risk position of companies.

1.1.6 Most suitable option

17. The CMA concluded that:

> *"we further found that the uncertainty modelled in Bristol Water's target headroom would reduce as time progressed and that smaller schemes would be more proportionate in addressing any shortfall in supply in the short term".*[97]

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[91] SoC, p.358.

[92] June Company Wide Plan (SOC005).

[93] WRMP (SOC039).

[94] WRMP (SOC039).

[95] June Business Plan (SOC001), p.16.

[96] PFs, para. 6.116(d).

[97] PFs, para. 6.116(f).

18. It is important to recognise that the uncertainty in climate change will not reduce as time progresses. This is because a long time period is required to establish the changing likelihood of infrequent (e.g. 1 in 50 years) droughts. This view is confirmed by HR Wallingford (climate change experts) who state "changes to river flows that are of importance to water resources management may be realised prior to the signal being statistically detectable in the observational record."[98] This means that target headroom for climate change will not reduce over time.

19. In addition, the June 2015 report for the Parliament form the Climate Change Committee stated "significant decisions in terms of new water Storage, treatment and supply will need to be taken. These must fully account for climate change."[99]

20. This shows that the CMA's proposed approach is not consistent with good climate science, nor with Government Policy.

21. We have previously set out our position on our preferred scenario, the result of an optimiser that takes account of costs and benefits.[100] The optimiser generates one solution that is 'optimum' (i.e. lower cost than other competing solutions for the scenario considered).

22. As we have shown in our response to the Aqua modelling of alternate solutions, reliance on depictions of alternate ordering of schemes without considering the cost implications may provide a misleading result.[101] The WRMP process that we are obliged by statute to observe is specifically designed to ensure a no regrets, long term approach to providing water for the future.

23. We have some concerns that this long term planning process could become less effective if superseded by shorter term planning assumptions such as a five-year year horizons. Under such short term assumptions it may be reasonable to delay larger options by bringing forward poorer-value smaller options, but that approach would result in higher costs for future customers and be incompatible with our statutory duties.

1.1.7 Cost estimation

24. In para. 6.54, the CMA notes that Aqua identified opportunities to reduce the cost of this project by £11.3 million. We raised the points made by Aqua with Arup, our consulting engineers on the project. Arup have considerable experience of delivering similar projects around the world. The following comments are based on Arup's response.

1.1.7.1 Basis and Appropriateness

25. Aqua has questioned the estimate and suggested a potential saving of £11.3 million, reduced from its earlier assessment of £12.6 million.[102]

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98 HR Wallingford BW Climate Change Adaptation Review (RPF010), p.2.

99 Reducing emissions and preparing for climate change: 2015 Progress Report to Parliament, Committee of Climate Change 2015 Progress Report to Parliament (RPF099), para. 2, p.18.

100 WRMP (SOC039).

101 Bristol Water response to Aqua's Report: "Initial Finding – 15 June 2015".

102 Aqua report, section 3.6.

26. The cost estimate that Arup produced (Cost Plan 09) gave the earlier figure of £126m. [103] An independent review was then carried out by specialist cost consultants ChandlerKBS, and a revised estimate (Cost Plan 10) was produced at £116m. [104]

27. The project has been designed to a stage suitable for obtaining planning permission, and to ensure that there are no overwhelming risks that could render the scheme undeliverable. The assumptions made and allowances included are set out in the Cost Plans provided. We note that a number of the specific cost comments raised by Aqua are not considered to be significant, and have concentrated on responding to those that suggest a greater cost impact. Overall, we consider that the figure of £116m provides a robust cost estimate, and includes an appropriate optimism bias allowance for a scheme at this stage of development.

1.1.7.2 Borrow Pit

28. Aqua states:

> *"There appears to be some double handling of excavated material to the value of £808,320. From the information provided we can not be certain of the definite need for this, however there is potential to reduce this cost through programming effectively."*[105]

29. There will need to be some double handling of excavated material; the site itself is fairly constrained on all sides, and the planning conditions require a phased construction approach with certain 'enabling works' particularly the proposed Flood Compensation Nature Area, to be established prior to excavation for the main reservoir. [106] We consider that the allowances contained in the cost estimate are reasonable for the stage of design that the scheme is currently at.

1.1.7.3 Mechanical & Electrical works

30. Aqua states:

> *"Given the experiences of algal blooms on the existing reservoir and also Arup's concerns expressed about reservoir management we would have expected this to have been considered in more detail."*[107]

31. An allowance of £200k is included within the cost build up for de-stratification of the reservoir. [108] We consider this to be appropriate for the current stage of the design, and the recognition of further design and modelling required.

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[103] Cost Plan 09 Report, Ove Arup and Partners (SOC555).

[104] Cost Plan 10 Report, Ove Arup and Partners (SOC310).

[105] Aqua Report, para. 68.

[106] Arup, Bristol Water Cheddar Reservoir Two Programme Implications Report (RPF067).

[107] Aqua Report, para. 75.

[108] Arup, Bristol Water Cheddar Reservoir Two Programme Implications Report (RPF067).

1.1.7.4 Utility Diversions

32. Aqua states:

> *"Wessex Water Rising Main and other services, not sufficient details, however this is not considered to be significant."*[109]

33. Many meetings have been held with the principal utility owners affected (Wessex Water and Western Power), and the proposals and costs for the necessary diversions have been developed from these discussions, and budget quotations provided. [110]

1.1.7.5 Landscaping

34. Aqua states that it does "*not have a comprehensive scope to validate the prices included however a number of priced furniture items included appear excessive*"[111] and notes that whilst it has not had sight of a design to verify all inclusions, some of the significant inclusions do not appear to have full substantiation.[112]

35. The costs and allowances included in this section are considered reasonable. The children's playground, duck decoy restoration and modifications to the River Cheddar Yeo are requirements of the scheme, and have been discussed at length with parties including the Planning Authority, English Heritage, Natural England and the Environment Agency. [113] The included allowances are based on these discussions and Arup's experience of similar developments elsewhere. It should be noted that the details of these particular elements of the scheme still need to be developed and agreed, and will no doubt require further extensive consultations with appropriate third parties.

1.1.7.6 Other Items

36. Aqua criticises the amount of justification or substantiation available to support some of the other cost items.[114]

37. The allowance of £2m for dealing with groundwater is considered appropriate. We will be creating a significant and extensive excavation in an area with a high groundwater table, known to suffer regular fluvial flooding. The project will require groundwater to be pumped from excavations and treated in settlement lagoons to ensure it satisfies Environment Agency discharge limits before being discharged into local water courses. Dealing with groundwater will be one of the key challenges faced by the contractor carrying out these works in the very sensitive water environment of the Somerset Levels.

38. The items included for Compensatory Storage refer to excavations required to form the Flood Compensation Nature Area, and are not included within the reservoir excavation figures.

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[109] Aqua Report, para. 76.

[110] Arup, Bristol Water Cheddar Reservoir Two Programme Implications Report (RPF067).

[111] Aqua Report, para. 77.

[112] Aqua Report, para. 78.

[113] Arup, Bristol Water Cheddar Reservoir Two Programme Implications Report (RPF067).

[114] Aqua Report, paras. 80-81.

1.1.7.7 Construction Preliminaries

39. Aqua states:

> *"The 20% Construction Preliminaries included appears excessive in our opinion and would we expect to be in the region of less than 10%."*[115]

40. We consider that an allowance of 20% is appropriate for a scheme of this nature at this stage of design development. This is based upon Arup's experience of delivering many large infrastructure projects and it should be noted that the independent review carried out by Chandler KBS considered a figure of 24% to be more appropriate.

1.1.7.8 Archaeology

41. Aqua states:

> *"There is a £10M inclusion which we are unable to validate with the information provided. On face value this looks extremely excessive, we understood this is for investigation and reporting rather than excavation and removal, and would need further justification to be able to substantiate this sum."*[116]

42. The area of the site is potentially rich archaeologically, and following extensive ground scanning and slit trenching, a detailed archaeological investigation is proposed across the majority of the site. This will require substantial excavation and removal. The costs are based upon the anticipated manpower that will be required to carry out this task. Further details regarding archaeology are contained within the Environmental Statement submitted with the Planning Application for the scheme. [117]

1.1.7.9 Efficiency of Solution

43. Aqua states that "*it may be possible to construct a new reservoir at a lower cost if the existing one is taken out of service for a period of time*".[118]

44. Essentially, Aqua is suggesting we enlarge the current reservoir. Consideration was given this option to provide the additional storage volume required, but this was not appropriate for the following reasons:

- loss of the storage volume of the existing strategically vital reservoir for a number of years during construction;
- which would lead to frequent supply restrictions for customers.
- provision of a wildlife corridor between the two reservoirs to provide habitat and connectivity for European protected species and existing protected habitats;
- the existing reservoir is a Site of Special Scientific Interest. Works to extend the reservoir would be constrained by the requirement that such works should not have any damaging impact on the designated features of the site; and

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[115] Aqua Report, para. 88.

[116] Aqua Report, para. 89.

[117] Arup, Bristol Water Cheddar Reservoir Two Programme Implications Report (RPF067).

[118] Aqua Report, para. 91.

- technical difficulties of merging an almost 100 year old structure with a 'new build' extension that will be subject to differential settlement rates and the opening up of leakage paths. The favoured solution of a new separate reservoir has been accepted by the Independent Technical Panel of Reservoir Experts established by Bristol Water to monitor the design process.

45. In view of Arup's extensive experience of similar projects around the world, we maintain our view that the cost estimate is appropriate for a project of this magnitude at this stage of development. As noted by the CMA in para. 6.52, this is a view shared by ChandlerKBS.

Appendix 4.2 – Cheddar WTW Regulatory Framework

1 Introduction

1. As set out in Section 4 of our response to the CMA's PFs, the background to the inclusion of the Cheddar WTW scheme in our Business Plan is heavily linked to broader regulatory framework for management of water quality, and the recommendations and interventions of the EA and the DWI.

2. In this Appendix 4.2, we have set out detailed comments in relation to:

- the role of the EA and DWI in relation to water quality (see **Section 1.1**); and
- the evolution of the Cheddar WTW scheme (see **Section 1.2**).

1.1 The role of the EA and DWI in relation to water quality

3. The EA's remit includes responsibility for overseeing delivery of the benefits of the Water Framework Directive (**WFD**) which impacts, amongst other things, on the environmental objectives for water sources.[119] Under the WFD any water body from which >10 m3/day is abstracted for human consumption is defined as a Drinking Water Protected Area (DrWPA). Cheddar Reservoir is designated as a DrWPA.

4. Drinking water safeguard zones are one of the EA's main tools for delivering the drinking water protection objectives of the WFD. Under Article 7.3 WFD a safeguard zone may be set in the catchment which drains to a DrWPA. The safeguard zones are designated areas for any raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment.[120] Action is targeted in those zones to address pollution so that extra treatment of raw water can be avoided.[121] As such, in accordance with Article 7 of the WFD the EA is the competent authority responsible for ensuring that there is no deterioration of raw water quality.

5. As set out in the SoC, the principal task of the DWI is to ensure that water companies fulfil their statutory obligations for the supply of wholesome drinking water.[122] The DWI has power to take enforcement action if the requisite water quality standards are not met. [123]

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[119] SoC, Section 2.3.3.

[120] This is based on Article 7.3 of the Water Framework Directive which sets out the obligation to avoid deterioration in the water quality of Drinking Water Protected Areas and so reduce the level of treatment required in the production of drinking water. We note that Aqua has sought to interpret this as justification for a strategy based on only the minimum amount of additional facilities being added to Cheddar WTW (Aqua Report, para. 260). This is a complete misinterpretation of the objective of this provision. Whilst it is true that the aim is to reduce the need for additional treatment through the prevention of the raw water deterioration at source, it does not mean that if additional treatment is needed, it should not be provided.

[121] EA Webpage on Safeguard Zones (RPF026).

[122] SoC, Section 2.3.2.

6. For every water treatment works and associated supply system (i.e. from source to tap) companies must carry out risk assessments under the requirements of Regulation 27 of the Water Supply (Water Quality) Regulations (as amended) (**Water Quality Regulations**) and submit the associated reports, know as 'Drinking Water Safety Plans' (**DWSPs**), identifying those risks to the DWI under Regulation 28.

7. The DWSPs identify all the hazards in the catchment, treatment and distribution systems that could potentially impact on our ability to adequately treat, disinfect and supply wholesome drinking water. Wholesomeness is defined in Regulation 4(2) of the Water Quality Regulations by reference to drinking water quality standards and any other substance or organism alone or in combination with another substance that would constitute a potential danger to human health.[124]

8. The DWSPs consider the short, medium and long term control mechanism(s) required to address each hazard and assess whether there is a need for additional control measures to ensure that drinking water is wholesome at consumers' taps. If such measures are needed, the DWSP will include suggestions regarding potential remedial actions. [125]

1.2 The evolution of the Cheddar WTW scheme

1.2.1 Designation of Cheddar Reservoir as a safeguard zone

9. In 2012 the EA designated Cheddar Reservoir as a safeguard zone in response to the water quality issues caused by algal blooms within the area. The details behind the designation are set out in the EA's 'WFD Safeguard Zone Action Plan 2012 for the Drinking Water Protected Area Cheddar Reservoir for total algae' (**SgZ Action Plan**).[126]

10. The SgZ Action Plan noted that:

> *"the primary source of water to the Reservoir is the Cheddar Springs at the foot of Cheddar Gorge. Water is collected in a series of ponds at the spring rising, and gravitates to the reservoir by a series of pipes. Water is also pumped to the Reservoir from the River Axe. Water from the River Axe is of very poor quality (due to high nutrient and ammonia load from agricultural pollution) and is subject to substantial pre-treatment before being stored in the Reservoir. Pumping from the River Axe is only carried out if the resource situation requires it, during the period 1st November to 30th April inclusive."*[127]

11. The SgZ Action Plan summarised the EA's trend assessment of algal concentrations in the raw water:

> *"In 2011, the monitoring data for the raw water of Cheddar Reservoir were assessed by the Environment Agency to see if there was any deteriorating trend in quality.*

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[123] SoC, Section 2.4.3.1.

[124] Information Letter 01/2003, para. 4.3.

[125] Information Letter 01/2003, para. 4.4.

[126] WFD Safeguard Zone Action Plan 2012 for the Drinking Water Protected Area Cheddar Reservoir for total algae' (**SgZ Action Plan**) (RPF001).

[127] Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.3.

Total algal concentrations started to get worse in 2006 (compared to period 2000-2005) with peaks in 2008 and 2010 and increased total algal levels in spring 2011." [128]

12. The EA noted that this had led to consequences for Cheddar WTW:

"The increased algal populations have provided Cheddar WTW with a challenge that it has struggled to deal with. Slow sand filters have required frequent cleaning to maintain the works output which has worsened in recent years. Options for increased treatment are being considered for the next AMP period."[129]

13. The EA therefore considered that it was necessary to designate Cheddar Reservoir as a safeguard zone because:

"i Total algal populations have increased in recent years causing issues at Cheddar WTW.

ii Impact on WTW has occurred such as increased maintenance of sand filters.

iii Increasing algal populations are confidently attributed to historic and on-going anthropogenic activity in the inputs to Cheddar Reservoir".[130]

14. The SgZ Action Plan also looks at the potential causes of the high total algal populations in the raw water.[131] It concluded that:

"The groundwater source protection zone identified for Cheddar Springs is largely rural and although no source apportionment has been possible it is reasonable to assume that the dominant source of phosphorous and nitrogen is agriculture."[132]

15. The EA recommended that monitoring of the input streams should continue in order to track the magnitude of the problem.[133]

1.2.2 Drinking Water Safety Plan risk assessment for Cheddar WTW

16. The issue of raw water deterioration at Cheddar Reservoir, and the resultant impact on Cheddar WTW, arose in the context of the Drinking Water Safety Plan for Cheddar (**Cheddar DWS Plan**).[134] The Cheddar DWS Plan analyses risk. In looking at the range of hazards identified as part of the risk assessment, the July 2013 report identified increased algae loading due to deterioration of raw water leading to blinding of Slow Sand Filters (SSF) and development of anaerobic conditions in SSF which has the potential to:

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128 Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.6.

129 SgZ Action Plan (RPF001), p.7.

130 Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.7.

131 Cheddar Reservoir Safeguard Zone Action Plan (RPF001), Section 4

132 Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.9.

133 Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.9.

134 Cheddar TW water safety plan (SOC561).

- cause the release of soluble metals from the filter media and impact upon the final water quality;[135]
- produce taste and odour and impact upon the final water quality; [136] and
- restrict throughput.[137]

17. It was noted in respect of each of these hazard, which were scored as 14, 14 and 12 respectively, that:

> *"Although this risk score does not currently classify as an Unacceptable Residual Risk, the risk will increase over the next five years due to deteriorating water quality. This has been recognised by the Environment Agency by them identifying Cheddar Reservoir as failing for algae under Water Framework Directive and the determination of the catchment area supplying this reservoir as a Safeguard Zone."*[138]

18. As a result, the Cheddar DWS Plan identifies as a possible remedial measure the "*construction, installation and commissioning of suitable treatment processes to adequately treat deteriorating raw water quality from Cheddar Reservoir*" during AMP6.[139]

19. In the context of the PR14 business planning process, the DWI issued guidance to companies on the process to be followed for schemes associated with drinking water quality.[140]

20. In particular, the DWI noted that for PR14 it would "*look to ensure that companies have paid due regard to the need for public water supplies to be safe, clean and compliant with all the regulatory standards, and that provision is made for a sustainable level of asset maintenance to maintain public confidence in drinking water quality*".[141]

21. In order to obtain the DWI's technical support for drinking water quality proposals contained in our business plan, the DWI is clear in specifying that we will have to have demonstrated the need for each proposal.[142] Any case for justification will need to be accompanied by evidence of the process employed to assess and determine the most appropriate technical

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135 Cheddar TW water safety plan (SOC561), p.25 – heavy metals hazard.

136 Cheddar TW water safety plan (SOC561), p.26 – poor taste and odour due to anaerobic conditions in SSF – geosmin and methyl isoborneol hazard.

137 Cheddar TW water safety plan (SOC561), p.26 – treatment works output unable to meet demand hazard.

138 A risk score of 12 or 14 is categorised as a medium risk, by reference to impact and probability, but is at the high end of the medium risk range – see tab le on p.25 of the Cheddar TW water safety plan (SOC561). A medium risk will generally prompt a watching brief unless there is a perception that the situation is deteriorating, in which case it will prompt remedial measures so that we can avoid it becoming an 'unacceptable remedial risk' (**URR**). A URR is a risk we consider needs to be addressed either by a change or improvement in operational practices or by a capital investment.

139 Cheddar TW water safety plan (SOC561), p.25-26.

140 Information Letter 01/2013. In addition to giving guidance for PR14, this letter also gives a helpful overview of the statutory obligations relating to drinking water quality. (Available from the Scottish Executive on request).

141 Information Letter 01/2003, para. 2.1. (Available from the Scottish Executive on request).

142 Information Letter 01/2003. Para. 5.2. (Available from the Scottish Executive on request).

and cost effective solutions, and specific supporting evidence of the appropriateness of the preferred option. [143]

22. In particular, we have to provide detailed supporting evidence to the DWI that any identified remedial scheme would mitigate the risk of the hazard occurring or, where the hazard already exists, reduce the risk to an acceptable level (i.e. compliance with any relevant standard or guideline value for an unlisted parameters) within a prescribed timescale. [144] We also need to show cost benefit analysis and confirm that the proposals are consistent with our long-term strategies for delivering water supply outcomes and are supported by our customer and stakeholder research. [145]

23. Specific advice was provided by the DWI for schemes associated with raw water deterioration:

> *"Failure or a likelihood of failure to supply wholesome water because of a deterioration in raw water quality (such as nitrate, pesticides, turbidity, THMs (link to colour), Cryptosporidium and other pathogens) should be identified through raw water monitoring and the risk assessments carried out for each treatment works and its associated supply system. Deterioration in this context means a measured change in raw water quality over time. It does not mean evidence of poor performance of a treatment works….*
>
> *Companies should consider long term catchment management/control solutions in the context of the WFD as a primary solution to address hazards arising from raw water deterioration. However, the capacity of a company to adopt this approach will depend on the level of risk and whether a catchment solution could deliver in time to prevent the supply of unwholesome water. In some situations, an end-of-pipe solution may need to be installed as a medium term control measure. If there is an identified risk to wholesomeness that is likely to materialise before 31st March 2020, it is anticipated that in these situations companies will be required to adopt a twin track approach that includes treatment or other operational control measures in addition to catchment management actions to mitigate raw water deterioration.*
>
> *The Environment Agency must be consulted on all schemes required as a result of deterioration of water quality."*[146]

24. The scheme for Cheddar WTW was one of the schemes put forward to the DWI for consideration. In previous AMP periods we have proposed schemes to the DWI for inclusion within our Business Plan but the DWI has failed to support them on the basis that the level of risk was insufficient to warrant their inclusion. Consequently, we did not include such water quality related schemes in past submissions.[147]

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[143] Information Letter 01/2003, para. 5.3. More detailed information requirements are specified in Annexes A and B to that letter. (Available from the Scottish Executive on request).

[144] Information Letter 01/2003, para. 5.4. (Available from the Scottish Executive on request).

[145] Information Letter 01/2003, para. 5.5. (Available from the Scottish Executive on request).

[146] Information Letter 01/2003, Annex B Section 1. (Available from the Scottish Executive on request).

[147] For example, we proposed the UV scheme at Barrow WTW as an AMP5 scheme but the DWI did not feel it was warranted at that time. The risk has continued to increase through the AMP5 period due to raw water deterioration

25. The scheme for improvements at Cheddar WTW was included within Business Plan submissions on the basis of the recommendation of the DWI that it should be included to ensure on-going compliance with statutory water quality requirements:

> *"Companies have statutory duties under Section 68 of the Water Industry Act 1991 to ensure no deterioration of drinking water quality, and we consider that the proposals for Cheddar are necessary to ensure that the Company continues to comply with this duty. Furthermore, under the requirements of Regulation 27 of the Water Supply (Water Quality) Regulations 2000, and amendments, companies have a duty to manage risks to public health. We agree with the Company that, in order to manage risks to public health that are likely to materialise if this work is not carried out, these proposals are necessary and are required to ensure compliance with Regulation 27…*
>
> *We agree that the preferred technical solutions proposed by the Company to mitigate these risks are appropriate. Whilst we suggested in our final decision letter that the Company should give consideration to catchment management steps to mitigate the impact of nutrients in the raw water, we recognise that the outcomes of catchment measures are uncertain and may extend into future AMPs before any benefits are realised. We agree, therefore, that the proposed improvements for Cheddar should be commenced in AMP6 in order to mitigate proactively the risks to quality and sufficiency posed by the deteriorating raw water quality".* [148]

26. Given this regulatory background, failure to provide funding during AMP6 for the proposed Cheddar WTW scheme could leave Bristol Water in an awkward regulatory position, vis-à-vis the EA and the DWI, and their expectations with regard to management of water quality risks. The proposal to allow funding for on-going investigation and some remedial works is, therefore, the very minimum that the CMA should allow in its final determination.

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and consequently the DWI now feels the level of risk associated with Cryptosporidium has increased sufficiently to support this scheme for implementation during AMP6.

[148] DWI further support letter Cheddar TW RW deterioration (SOC234).

Appendix 4.3 – Cheddar WTW raw water deterioration

1 Introduction

1. As set out in **Section 4** of our response to the CMA's PFs, we considered it would be helpful to address some of the concerns and questions raised in the PFs in relation to the need for the Cheddar WTW scheme, and the nature of the proposed solution.

2. In this Appendix 4.3, we have set out detailed comments in relation to:

- the need for intervention (see **Section 2**);
- identification of the most suitable option (see **Section 1.2**); and
- cost estimation (see **Section 1.3**).

1.1 Need

3. The CMA has provisionally concluded that there is evidence of raw water deterioration at Cheddar reservoir which has affected the treatment works, but that at present, there is uncertainty as to the cause of the deterioration and the degree to which it will impact in the future.[149] Each of these areas of concern is addressed below in the following sections.

1.1.1 Cause of the increase in algae from 2006

4. In considering the cause of the step change in the level of algae from 2006 onwards, the CMA notes that "*Mott MacDonald advised Bristol Water to fully justify what the primary causative factor responsible by demonstrating the link between climate change and algal blooms.*"[150]

5. As explained in Appendix 4.2, Cheddar Reservoir is the subject of a safeguard zone action plan (**SgZ Action Plan**) imposed by the EA in response to the impact of the algal blooms and raw water deterioration.[151] The EA's assessment of the "*primary causative factor*" for the algal blooms in the DrWPA Cheddar Reservoir is outlined in the SgZ Action Plan in which increasing algal populations are confidently attributed to historic and on-going anthropogenic activity in the inputs to Cheddar Reservoir. The SgZ Action Plan also ascribes the source of the nutrients as predominantly entering the reservoir via Cheddar Springs. As such, we considered that this particular challenge had been satisfied by the EA's analysis.[152]

6. In terms of the its assessment of the evidence we submitted in relation to need, the CMA states:

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149 PFs, paras. 6.146-6.148.

150 PFs, para. 6.128.

151 WFD Safeguard Zone Action Plan 2012 for the Drinking Water Protected Area Cheddar Reservoir for total algae' (**SgZ Action Plan**) (RPF001).

152 Letter from Mott MacDonald regarding the Aqua report. (RPF012).

> *"We were cautious in our interpretation of the data presented by Bristol Water on when the increase in algae levels had occurred, what the cause was, and the likely trend in the future."*[153]

7. The case for Cheddar WTW was also looked at by Aqua on behalf of the CMA. In relation to need, the CMA notes that Aqua considered that we had not demonstrated that we had "*investigated and understood the cause of the algal bloom with particular reference to the replacement and operation of the destratification equipment and introduction of water from the River Axe*".[154]

8. This demonstrates a fundamental lack of understanding of the EA's SgZ Action Plan, which clearly states that the pre-treatment works we have installed for the River Axe means that our storage of River Axe water in Cheddar Reservoir makes a minimal contribution to the algal growth in the Reservoir. The EA SgZ Action Plan states:

> *"The primary source of water to the Reservoir is the Cheddar Springs at the foot of Cheddar Gorge. Water is collected in a series of ponds at the spring rising, and gravitates to the reservoir by a series of pipes. Water is also pumped to the Reservoir from the River Axe. Water from the River Axe is of very poor quality (due to high nutrient and ammonia load from agricultural pollution) and is subject to substantial pre-treatment before being stored in the Reservoir. Pumping from the River Axe is only carried out if the resource situation requires it, during the period 1st November to 30th April inclusive."* [155]
>
> *For phosphorus, inputs from the Cheddar Springs are dominant with an average daily load of 3.1 kg/day compared to 0.1 kg/day from the River Axe."*[156]

9. The River Axe now makes a minimal contribution of phosphorous flowing into the reservoir due to the substantial pre-treatment it now undergoes which substantially removes the phosphorous from it.

10. Additionally, the presumption of a causal link between the refurbishment of destratification equipment and increased algal blooms is not supported by technical literature.[157,158]

11. In relation to the impact of potential disturbance of sediment, there appears to have been some confusion regarding whether phosphorous can be released from phosphates held in the sediment.[159] This is an issue that has been raised by Aqua and which has a fundamental misunderstanding at its heart; that the majority of nutrients impacting on water quality are held within sediments in the lake. This assumption is factually incorrect as detailed in the EA's SgZ Action Plan:

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153 PFs, para. 6.143.

154 PFs, para. 6.137(a).

155 SgZ Action Plan (RPF001), p.3.

156 SgZ Action Plan (RPF001), p.8.

157 UKWIR "Oxygenation and Circulation to Aid Water Supply Reservoir Management" (Available on request).

158 WRc Climate change, algal growth and management of water supply (RPF038).

159 The CMA slightly misunderstands the chemical environment required for phosphorous to be soluble or insoluble. This is explained in the UKWIR and WRc reports referenced in the previous footnote. Destratification by improving the oxygen levels at the bottom of the reservoir reduces the release of phosphorous from the sediments.

> *"There is no indication of an increase in the phosphorous mass in the Reservoir in excess of input loads. Therefore there is no direct evidence of internal loading of the Reservoir".*[160]

12. As stated in the Cheddar WTW Water Quality Improvement Final Report and referenced in the PFs (at para. 6.144):

> *"Nutrients are released as organic matter decomposes and settles to the bottom of the reservoir, disruption of the sediment by wind action or temperature inversion can result in these nutrients re-suspending and once again becoming available to sustain algal growth."*[161]

13. Nutrients can be made available if the lower cooler layers (hypolimnion) of the reservoir are allowed to become very low in oxygen (anoxic).[162] Undisturbed by any form of destratification the hypolimnion can then provide anaerobic and ideal conditions for release of phosphorous from the bed sediments. Maintenance of an effective reservoir management (destratification) system can prevent this from occurring.

14. The seasonal water quality issues experienced at Cheddar are presented graphically in the Cheddar WTW Water Quality Improvement Final Report by hardness and alkalinity charts, which clearly demonstrate the seasonal bicarbonate fluctuation caused by summer algal blooms. This is further supported by geosmin, MIB and algal cell count data.[163]

15. The ratio of nutrients for algal growth is generally C(42):H(8.5):O(57):N(7):P(1), with very little phosphorous needed. However, because phosphorous is easier to control than nitrogenous compounds and is normally the limiting nutrient for algal growth, it is often the focus of most reservoir control strategies.

16. Figure 1 below illustrates phosphorus concentration in the raw water.[164] The chart shows that since 2005 the mean concentration of phosphorous has reduced significantly. This reduction coincides with the replacement of stratification equipment in 2006/7. This is likely to be a result of the improved mixing, minimising hypoxia in the lower cooler layers (hypolimnion) of the reservoir. Undisturbed, the hypolimnion provides anaerobic conditions; ideal conditions for release of phosphates from the reservoir sediment and consequentially increased availability to algae which migrate vertically within the body of water.[165]

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160 SgZ Action Plan (RPF001), p.8.

161 Cheddar WTW Final Report Jul 2013 (SOC233).

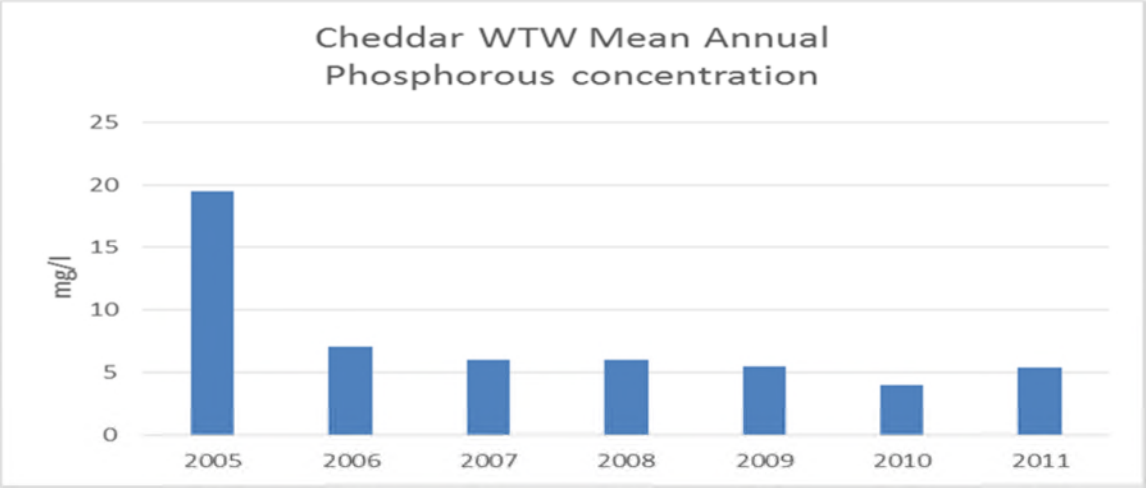
162 UKWIR "Oxygenation and Circulation to Aid Water Supply Reservoir Management" (Available on request); WRc Climate change, algal growth and management of water supply (RPF038).

163 Cheddar WTW Final Report Jul 2013 (SOC233).

164 Atkins Response to CMA Technical note, July 2015 (RPF037), p.2.

165 WRc Climate change, algal growth and management of water supply (RPF038), p.30.

Figure 2 Cheddar WTW Mean annual phosphorous concentration



Source: Atkins

17. It is likely that de-stratification of the reservoir is causing a demonstrable downward trend in phosphorous concentrations and effectively limiting phosphorous availability to algae.

18. We are pleased that the CMA saw the assertion from Aqua that either the interaction of water from River Axe or the replacement of destratification equipment might be the cause of the increase in algae as being unreliable, concluding:

> *"We did not consider that there was sufficient evidence to conclude that either of the issues identified by Aqua had led to increases in algae."*[166]

1.1.2 Future trends for raw water deterioration

19. The CMA considers that the "*evidence on the levels of algae in the reservoir was mixed with respect of whether or not the levels of algae were increasing either by frequency of blooms or overall number of algae cells in the water*"[167] and that we had not "*presented evidence that future blindings would increase in frequency or duration*."[168]

20. In its assessment, based on its own analysis, the EA has stated clearly:

> *"Cheddar Reservoir is deemed to be at risk of failing Article 7.3 (of the WFD) and therefore requiring a Safeguard Zone because:*
>
> *1 Total algal populations have increased in recent years causing issues at Cheddar WTW.*
>
> *2 Impact on WTW have occurred such as increased maintenance of sand filters.*

[166] PFs, para. 6.145, p.191.

[167] PFs, para. 6.141, p.191.

[168] PFs, para. 6.148, p.192.

3 *Increasing algal populations are confidently attributed to historic and on-going anthropogenic activity in the inputs to Cheddar Reservoir."*[169]

21. The WRc report states that "*It is widely reported that climate change is likely to lead to increased algal growth in the future, but quantification of this is not possible*." [170]

1.1.3 Relationship between algal blooms and operational activities

22. The CMA notes that:

> *"Mott MacDonald also recommended that in order to justify the scheme when the current risk level is acceptable, Bristol Water needed to demonstrate a detailed analysis of water quality and works throughput that is both historic and forward-looking, and analyses risk, both with and without intervention".*[171]

23. Subsequent to these challenges we provided algal count data and further details of our reasoning in our revised Business Plan. This was commented on by Mott MacDonald in its letter of 7 November 2014. [172]

24. The CMA also raises concerns from Aqua's review regarding the type of algae and the impact on operations at Cheddar WTW:

> *"Aqua observed that the species of algae that Bristol Water has identified as causing issues in two incidents (dinobryon) is too small for the current microstrainer to filter, but that on the two occasions when the dinobryon count exceeded 5,000 cells per ml there was no evidence presented that demonstrated that increased levels of algae had caused operational difficulties".*[173]
>
> *"It was also not fully clear from Bristol Water's analysis whether the species that were dominant in the reservoir at a given point had an overall impact on the effectiveness of the existing water treatment works."*[174]
>
> *"Bristol Water told us that one instance of dinobryon algae led to blinding of the filters but presented evidence that related to the overall level of algal blooms. Bristol Water told us that species other than dinobryon could lead to blinding of the filters. We did not consider this evidence to be compelling, given the relatively low counts of dinobryon and the lack of evidence that the largest peaks in dinobryon coincided with operational issues in the treatment works. Similarly, there had been no blindings during large peaks in other types of algae."*[175]

25. In response to the query from Aqua we endeavoured to explain the historic problems caused by different algae species. High concentrations of algae in water undergoing treatment can

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169 SgZ Action Plan, p. 7.

170 WRc Climate change, algal growth and management of water supply (RPF038), p.1.

171 PFs, para. 6.128.

172 MM Cheddar TW query 172 (SOC547).

173 PFs, para. 6.138.

174 PFs, para. 6.141.

175 PFs, para. 6.142.

result in the rapid deterioration of water quality. Problems affecting the water supply include reduced filter run time.[176] Different species of algae have varying abilities to cause blinding of filters. Dinobryon (a flagellate), diatoms and blue/green species have the largest impact on the performance of our slow sand filters.

1.2 Identification of the right solution

26. The CMA outlines the approach to optioneering that was followed, but states that:

> *"Bristol Water had failed to demonstrate that it understood the cause of the significant increases in algae counts and frequency of blooms in the period 2006-2008. Without understanding the sudden increase in algae it was not clear how Bristol Water could provide evidence that a replacement WTW would be the most appropriate option."*[177]

27. We concur that it would be helpful to have a better understanding of when and why algal blooms are occurring, aligned to their frequency and intensity to ensure the optimum treatment solution is selected. That said, the proposals for Cheddar WTW have been reviewed in detail by the DWI and the DWI has recommended that the proposals are necessary to meet our water quality obligations (see **Appendix 4.2**).

28. The CMA also references Aqua's conclusions that we had not demonstrated that the scale of the algal issue requires a new treatment works, or that the proposed solution is the most proportionate and appropriate.[178] In particular, the CMA notes:

> *"Aqua found that Bristol Water had dismissed a reservoir management option in dealing with algal loading and that it appeared that the two options that Bristol Water had considered in any detail were the proposed solution or an alternative treatment using membranes. Aqua considered that a number of alternative solutions through combination of different treatment processes were feasible."*[179]

29. We disagree with the conclusions reached by Aqua in relation to the range of potential solutions, and our analysis of the options. We consider that the suggestions made by Aqua show a lack of understanding of water treatment process. Our specific comments in relation to each of the options put forward in the Aqua Report are set out in the sub-sections below.

1.2.1 Catchment Management

30. In the Aqua Report it is suggested that we have ruled out catchment management solutions, whereas we should have considered a number of phased options.[180]

31. That catchment management can play a part in reducing potential for algal blooms is not disputed. However, the report 'Cheddar WTW – Water Quality Improvement Final Report'

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[176] WRc Climate change, algal growth and management of water supply (RPF038), p.67.

[177] PFs, para. 6.145.

[178] PFs, para. 6.137 (d) and (e).

[179] PFs, para. 6.139.

[180] Aqua Report, paras. 262-271.

highlights the current lack of control on the application of nutrient rich fertilisers.[181] The Cheddar catchment falls outside of the current Nitrate Vulnerable Zone making it difficult to enforce nutrient discharge to the environment. The report also stressed that changes to the catchment must be considered as a long term project and that it is at best difficult to quantify both the timing and the required impact on reservoir water quality that these changes may ultimately have. [182]

32. Catchment management requires liaison with farmers in controlling application of fertiliser and slurry to land both from the EA and Bristol Water. We have no powers to enforce any changes in agricultural practice and we rely on the EA to undertake this. European agricultural policy is constantly changing and grants that dictate land use and crops planted may well change; financial incentives are inevitable to make up short falls in crop production. It is also the case that, with the changing economic climate, farmers may face significant commercial challenges in changing practices which may significantly influence their willingness or ability to deliver improved catchment management strategies that they may have previously signed up to.

33. Other sources of pollution must also be addressed including neighbouring water companies and industrial developments that currently discharge into the catchment, requiring close liaison with EA initiatives. While all these advances are possible it is inevitable that such organisations require time, incentivisation or potentially legislation, to drive through the catchment management plans.

34. As a long term methodology for reducing the impact of algae, the use of catchment management will continue as this will drive down opex costs. However the degree of success over control of pollution sources is by no means either guaranteed or quantifiable. It is also unlikely that significant benefits will be attained within the next 10 to 15 years.

1.2.2 Reservoir Management

35. Aqua opines that we have not considered a reservoir management option, whereas Aqua believes it to be the primary option to be investigated.[183]

36. As a starting point, it should be noted that addressing the issue through reservoir management, above and beyond what we do already, was only dismissed from consideration because it was not an appropriate solution given the EA's characterisation of the problem as being one of increasing algal levels and progressively deteriorating water quality.[184] In such a situation, reservoir management will not be effective.

37. While it is acknowledged that further study into additional reservoir management may yield benefits in water quality and a better understanding of algal populations, the presence of high levels of seasonal nutrients observed within the body of the reservoir and the sediment are likely to be an on-going issue for some years.

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[181] Cheddar WTW Final Report Jul 2013 (SOC233).

[182] Cheddar WTW Final Report Jul 2013 (SOC233).

[183] Aqua Report, para. 274.

[184] Cheddar Reservoir Safeguard Zone Action Plan (RPF001), p.6.

38. We operate a consistent approach to the management of our reservoirs, combining water resource, environment, water quality and maintenance concerns to deliver a sustainable reservoir system.

39. Destratification is already installed in Cheddar Reservoir, and operates to increase dissolved oxygen levels throughout the water column and reduce growth by:

- mixing algae throughout the water depth;
- reducing time spent in the epilimnion where both light and oxygen levels are at a premium; and
- reducing the release of nutrients from sediments.

40. Destratification is an aid in improving water quality and has been employed by the majority of water companies with raw water reservoirs to improve water quality. To date it has not proven fully effective in controlling algal blooms and while fine tuning may well improve performance, with the high incidence of nutrients entering Cheddar, further reservoir management cannot be guaranteed to fully address the existing water quality issues.

1.2.3 Additional Slow Sand Filter

41. Aqua suggests that there appears to be space for a further slow sand filter (**SSF**) and that addition of another SSF would counter the reduced throughput.[185]

42. Adding an additional SSF was not seriously considered because of the already congested nature of the Cheddar WTW site; while there is technically space available, much of this is taken up by both clean and dirty sand storage.

43. Additionally, under algal bloom conditions when filter capacity is significantly compromised a seventh filter could not be guaranteed to assist in meeting demand since this would also experience blinding.

1.2.4 Improvements to Microstrainers

44. Aqua suggests that we have not considered improvements to the existing microstrainer, which it believes would help to alleviate certain issues.[186]

45. The refurbishment of the microstrainers was reviewed and costed as part of the membrane solution where they could provide some benefit in removal of large particulates prior to membrane filtration.[187] However, in the membrane option, it is the action of the membranes which would provide removal of the algae assisted by dosing of PAC for removal of algal breakdown compounds liable to generate taste and odours.

46. The mesh size at Cheddar WTW is 35 micron, this sits towards the lower end of the normal microstrainer range of mesh sizes (25- 65 micron). Microstrainers operate by filtering particulates on the inside of the drum to the outside, the strainers are cleaned by high water jets positioned on the top of the screens to continuously backwash the screen.

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[185] Aqua Report, para. 275.

[186] Aqua Report, para. 275.

[187] Cheddar WTW Final Report Jul 2013 (SOC233).

47. Microstrainers are subject to two issues:

- the difficulty in treating sudden fluctuations in solids, and
- incomplete removal of solids.

48. Their efficacy is variable with removal efficiencies of 40-70% reported for cyanobacteria cells but as low as 10% for smaller single celled species. This change in speciation and the issues that present themselves is not to be overlooked, as dominant species have been and are shown to change on annual basis with potentially serious consequences to supply.

49. The use of microstrainers as a solution to algal blooms cannot be considered a robust standalone or sustainable long term solution. At best the current screens provide some shedding of the load although reports of their success are conflicting. The nature of slow sand filters with their large surface area, slow flow rates and shallow water depths lend themselves to colonisation by algae, indeed development of the biological schmutzdecke is an important attribute of their treatment.

50. That microstrainers alone could negate the impact of algal blooms on the filters is unfounded, especially when the impact of climate change is taken into account and the inevitable change in the dominant species of bloom forming algae liable to be present.

1.2.5 Use of DAF prior to Slow Sand Filters

51. Aqua suggests that Dissolved Air Flotation (**DAF**) as a pre-treatment to SSFs, which would reduce the load onto SSF, has not been considered.[188]

52. The use of DAF is a proven process option for algal control and used successfully all over the UK and worldwide. However it invariably requires application of chemical coagulant to ensure effective removal of particulate material including algal cells. Normally DAF is followed by rapid gravity filtration to remove the unavoidable element of floc present in the DAF treated water; the filters are then regularly backwashed to remove this.

53. Were slow sand filters to perform this function then the build-up of floc over the extended run duration of the filter would compromise the performance of the biological schmutzdecke and cause blinding of the filters resulting in an inferior water quality and early termination of filter runs with the associated downtime, implications on reduced works output and increased opex.

54. As a result of these issues the option for DAF (without Rapid Gravity Filters) is not considered a viable solution.

1.2.6 Use of pre-ozone up stream of the slow sand filters.

55. Aqua suggests that pre-ozonation could be used, but has not been considered.[189]

56. The impact of ozonation will cause a significant inactivation and kill of zooplankton and algae, however their removal from the process will not be achieved until the filters are

[188] Aqua Report, para. 275.

[189] Aqua Report, para. 275.

skimmed or re-sanded. Indeed the death of these organisms is likely to cause their increased settlement on the slow sand filter surface and potentially enhance the rate of filter blinding and hence their removal off line for maintenance. Inevitably, due to algae growth environments, this will occur during the spring and summer when demand for water may be at its highest. Indeed, other water companies' operational experience of using ozone and RGFs operating as "roughing filters" is that the RGFs take the brunt of the algal bloom. However those companies operating such systems report a dependence on algal species with the presence of "*filter blockers reported to routinely cause blinding of the roughing filter reducing run times to as little as 6 hours with disastrous consequences both to opex and to works output – typically just when demand is at its highest*".[190]

1.2.7 Mitigation offered by Southern Resilience Scheme

57. Aqua also makes the suggestion that "*Southern Resilience should provide relief in the event of future blindings*".[191] The CMA has relied on this in concluding that the Southern Resilience Scheme "*would provide resilience to the Cheddar supply area in the short to medium term should Cheddar WTW experience further blinding of the slow sand filters*".[192]

58. The potential interaction between these two schemes was the subject of significant internal challenge and also raised by the LEF.[193] Essentially, the Southern Resilience Scheme might potentially allow treated water to be provided to the Cheddar Zone in the event that the filters at the treatment works blinded due to algae. There are two key reasons why it was considered that the treatment works upgrade was still required, even allowing for this interaction:

- **water quality**: There is a significant risk that the algal blinding could lead to a water quality failure at the existing works, as set out in the Water Quality Safety Plan risk assessment, and based on the position advocated by the EA and DWI it was considered that the upgrade to the treatment works was necessary to mitigate that water quality risk; and
- **availability of Southern Resilience Scheme at time of need**: The resilience scheme is designed to allow demand in the Cheddar zone to be met at average demand levels. However, the high risk times for of algae are in very sunny weather, and/or when reservoir levels are low. In sunny weather, demand levels tend to be high and there will be insufficient treatment works capacity to provide all of the water needed for the Cheddar zone through the scheme (both because demand in the Cheddar zone would be high meaning higher volumes are required to be transferred, and because demand in the Barrow zone would be high, meaning less water would be available to be transferred south). If reservoir levels were low, it is likely that there would also be algae treatment issues at Barrow and Banwell restricting their capacity such that a sufficient transfer might not be available.

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190 Atkins Response to CMA Technical note (RPF037).

191 PFs, para. 6.148.

192 PFs, para. 6.150(d).

193 LEF challenges on Cheddar Treatment Works and Southern Resilience Scheme (ENQ022); Master LEF Challenge Log (SOC216) and Feb-June LEF Challenge Log (SOC2017).

1.2.8 Design of the replacement water treatment works

59. The CMA notes that Aqua and Arup questioned the capability of the proposed treatment solution to remove nitrate and ammonia.[194]

60. There is no requirement to remove nitrate through the treatment process. As stated in our earlier response to Aqua:

> *"Over a period of time nitrifying bacteria will colonise on the media in the rapid gravity filters (we have experienced this at other sites where we have RGFs) and this will lead to the oxidation of ammonia through to nitrite and nitrate. Until the bacterial populations have developed we would maintain the facility to utilise super and de-chlorination which would enable us to use chemical oxidation to the same effect".*[195]

1.3 Cost estimation

61. Whilst the CMA references the assessment of our cost estimates made by Ofwat and Aqua,[196] it does not reach any conclusions on the costs proposed for the Cheddar WTW scheme given the decision not to fund it at this stage, but to provide for further investigation and minor remedial works instead.

62. Given this, we have not addressed Aqua's criticisms in relation to our costs in detail, but note the following:

- level of detail - the detail we have provided is consistent with the feasibility stage of design; this has not been problematic in either our benchmarking exercises;
- inconsistencies – although the membrane option considered in the feasibility report is a lower cost than the chosen DAF solution in the outline design report this is due to design developments that resulted in additional requirements at the outline design stage. These are described in P8 of the Atkins response to the CMA Technical Report.[197] To ensure consistency an estimate of the membrane option was also undertaken at the time of the outline design report and this was very similar to the cost of the DAF option. It should be recognised that this is not a detailed design estimate and is a '30%' design complete estimate. Further details will be considered at the next stage of design. The Business Plan submission then shows a different figure of £20.8 million because a 12.5% efficiency was applied to the outline design estimate; and
- ability to benchmark costs: Aqua says that it has insufficient detail to benchmark the cost of the algae removal scheme at Cheddar WTW. We note that both Mott MacDonald and CKBS benchmarked the costs on the basis of the information provided.[198]

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194 PFs, para. 6.147.

195 Response to Initial Aqua Report, 15 June 2015.

196 PFs, paras. 6.134-6.136.

197 Atkins Response to CMA Technical note (RPF037).

198 CKBS Review of Benchmark Adjustment Sept 2014 (SOC203) & MM BW Commercial Benchmarking Feb 2013 (SOC390).

63. Elsewhere, where Aqua has not provided a cost estimate, the CMA has used the independent assessments by Mott MacDonald and CKBS to supplement its conclusions. [199] We consider that it would be consistent for the CMA to do the same for this scheme, should it decide to reinstate it.

[199] PFs, Southern Resilience Scheme Para 6.170; Barrow UV Appendix 6.1 para 14; Stowey pH Appendix 6.1 para 24-26.

Appendix 4.3: Cheddar WTW – raw water deterioration

Appendix 4.4

Role of the Water Resources Management Plan in a price determination

July 2015

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1. EXECUTIVE SUMMARY

1.1 Introduction

1. Greenberg Traurig Maher LLP has been instructed by Bristol Water to advise on the legal framework governing the Water Resources Management Plan (**WRMP**), and how this should impact on the CMA's assessment of the schemes contained within it in the context of its determination, particularly in the case of Cheddar Reservoir Two.

1.2 Key themes

2. In its provisional findings on Bristol Water's price determination (**PFs**), the CMA identifies the WRMP as one of the principal sources of evidence used by the CMA in its assessment of Bristol Water's proposed enhancement expenditure.[200] Other principal sources of evidence are Ofwat's models and assessments, the submissions of the parties during the determination process, the findings of Aqua and submissions by third parties.[201]

3. Ultimately, the CMA concludes that Bristol Water has not sufficiently demonstrated the need for construction of Cheddar Reservoir Two to commence in AMP6.[202] This is in direct contrast with the WRMP which concludes that commencing construction of Cheddar Reservoir Two in AMP 6 is a key part of the best solution based on whole life cost to address Bristol Water's supply demand balance requirements and to achieve an appropriate degree of resilience to the range of uncertainties considered in the WRMP.[203]

4. In reviewing the range of evidence, the CMA has not given any indication as to the relative weight it attaches to each source. Neither has it expressly commented on the status of the WRMP, nor how the decision to reject this scheme can be reconciled with the fact that it is contained in the WRMP.

5. As we set out below, the WRMP is the product of a process established by statute and is intended to be the definitive statement of how the supply demand balance should be managed. It is developed in accordance with detailed rules and guidance, overseen by the Environment Agency (**EA**), the specialist regulator with responsibility for managing water resources, and it is approved by the Secretary of State. It is also subjected to statutory consultation with key stakeholders and regulators, as well as going through a public consultation process.

6. Ofwat is a statutory consultee and participated in the development of the WRMP. Ofwat did not raise any concerns about the measures proposed in the WRMP during that consultation process, including in relation to Cheddar Reservoir Two.

7. The regulatory framework clearly anticipates that the WRMP will form an intrinsic part of each company's business plan, with any concerns about its contents and conclusions having been dealt with as part of the WRMP's statutory consultation process. In that context, the WRMP is seen as the definitive source document for demonstrating the need, selection of

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[200] PFs, para. 6.6.

[201] PFs, para. 6.6.

[202] PFs, para. 6.116.

[203] SoC, Section 10.6.8.

the best option, and even the costing of all proposals aimed at addressing supply demand balance issues.

8. If there is to be regulatory certainty in accordance with the principles of best regulatory practice,[204] Ofwat should have raised its concerns with the Cheddar Reservoir Two proposals during the consultation on the draft WRMP. By failing to do so then, Ofwat is arguably in breach of its duties and should be seen as having waived its opportunity to comment on the need for the scheme, as well as the nature of the proposed solution, particularly given that there has not been a material change in circumstances between the preparation of the WRMP and delivery of Ofwat's final determination in December 2014 (**FD14**).

9. Accordingly, Bristol Water submitted its business plan after detailed consultation with the LEF on behalf of its customers on the basis of the WRMP, unaware that Ofwat had any concerns in relation to the WRMP proposals.

10. Having a WRMP in place is one of Bristol Water's duties as specified by the WIA '91, so constitutes a function within the meaning of the Functions Duty.[205] The plans contained within the WRMP, which have been endorsed by the Secretary of State, constitute part of the statutory functions Bristol Water must fulfil. The Functions Duty requires the CMA to secure that Bristol Water's functions can be carried out. The Finance Duty requires that the CMA secure that the proper carrying out of Bristol Water's functions is financed.[206]

11. In such a context, if the WRMP can be disregarded in the context of a price control determination, this suggests that the entire process has been effectively rendered a nullity.

12. At the very least, the WRMP should be treated as the most important assessment of need and identification of the best solution for addressing supply demand balance issues, and given due weight in accordance with its endorsement by the EA, Ofwat, Defra and the Secretary of State. The evidential bar for departing from the recommendations of the WRMP should be set at the highest level and only be departed from in exceptional circumstances.

13. This is particularly so given that Ofwat's assessment of the Business Plan, and this redetermination by the CMA, ultimately result in a judgment made by a single regulator. By contrast, the WRMP is designed through engagement with multiple regulators and reflects the input from a much broader consultation process.

14. To the extent, therefore, that the CMA wishes to substitute its judgment for that of the range of parties that were involved in the preparation and acceptance of the WRMP, the CMA should directly address the question of the status of the WRMP in the context of the overall business planning process, and explain how the two contrary positions can be sensibly reconciled.

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[204] S2(4) Water Industry Act 1991 (**WIA '91**) provides that in exercising any of its powers, or performing any of its duties, Ofwat "*shall have regard to the principles of best regulatory practice (including the principles under which regulatory activities should be transparent, accountable, proportionate, consistent and targeted only at cases in which action is needed*".

[205] The Functions Duty is the duty to secure that Bristol Water's functions as a water undertaker are properly carried out (s2(2A)(b) WIA '91.

[206] S2(2A)(c) WIA '91.

15. The CMA must acknowledge that if the content of the WRMP can be disregarded in this way, it calls into question the purpose of that statutory process, and undermines the framework that governs how it should be developed.

16. We also note that in the PFs the CMA observes that whilst it "*recognised Bristol Water's duties as a water company, [it was] not certain that there was sufficient evidence that construction of the reservoir would be justified on commercial grounds in this AMP*". This is based on a consideration of "*whether other commercial entities would commit to such a large project if there was no certainty of return on the investment (as arises from the return on the RCV)*".[207] As the content of this note demonstrates, Bristol Water's investment decisions in this area are not simply a matter of commercial judgment, but are informed by a complex framework of regulatory considerations, and are overseen by a range of regulators and stakeholders. It is inappropriate, therefore, to assess an investment decision, such as that to build Cheddar Reservoir Two, by reference to standard commercial considerations.

1.3 Structure of Appendix

17. In order to support this position, the following issues have been addressed in more detail:

- the legal framework governing the role of the WRMP (see **Section 2**);
- the interaction between the WRMP and the broader business planning process in the context of setting price controls (see **Section 3**);
- the approach taken by Bristol Water in developing its WRMP, including details of the consultation input received in relation to Cheddar Reservoir Two from Ofwat (see **Section 4**); and
- conclusions on how this impacts on the weight that should be given to the WRMP when assessing the question of Cheddar Reservoir Two (see **Section 5**).

2. LEGAL FRAMEWORK APPLICABLE TO THE WRMP

18. The statutory framework governing the WRMP is set out in the WIA '91 as amended by Water Act 2003 (**WA '03**), as well as the Water Resources Management Plan Regulations 2007. The legislation is supported by periodic guidance issued by the relevant regulators, with Defra having primary responsibility alongside the Secretary of State, supported by the EA:

- 'Water resources planning guideline: The guiding principles for developing a water resources management plan', June 2012 - EA, Ofwat, Defra and the Welsh Government (**WRP Guiding Principles**);[208] and
- 'Water resources planning guideline: The technical methods and instructions', October 2012 - EA, Ofwat, Defra and the Welsh Government (**WRP Technical Guidelines**).[209]

19. Details of the allocation of responsibilities are reiterated in the WRP Guiding Principles:

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[207] PFs, para. 6.115.

[208] WRP Guiding Principles (RPF082).

[209] WRP Technical Guidelines (RPF083).

"Defra and the Welsh Government are responsible for water policy and provide the statutory framework and policy guidance for water resources management plans, within which water companies must operate. Both Governments are responsible for setting out policy.

Defra and the Welsh Government issue joint guidance, with the Environment Agency and Ofwat, setting out what is required in a water resources management plan. Following the publication of the draft water resources management plan, interested groups send representations to the Secretary of State or Welsh Ministers and these are forwarded to the appropriate water company.

The Secretary of State or Welsh Ministers will consider the water company plan and statement of response to determine whether there should be a public hearing or an inquiry. Defra will seek advice from the Environment Agency before making a decision.

The Secretary of State or Welsh Ministers may direct companies to make changes or to publish a new plan."[210]

2.1.1 General duty to maintain a water supply system

20. In accordance with s37 WIA '91 Bristol Water is under a duty to develop and maintain an efficient and economical system of water supply within its area. Bristol Water must also ensure that it has made all necessary arrangements to ensure that it continues to meet its obligations under Part III WIA '91, which are:

- to provide supplies of water to premises in its area, and to make such supplies available to people on demand; and
- to maintain, improve and extend its water mains and other pipes.

21. Compliance with this duty is a fundamental part of the functions that Bristol Water must perform as a water undertaker.[211]

2.1.2 Duty to produce a WRMP

22. In accordance with s37A WIA '91, Bristol Water is under a duty to prepare, publish and maintain a WRMP. The WRMP must show how Bristol Water will manage and develop water resources so as to continue to meet its statutory obligations both in the medium and long term.[212] To do this, the WRMP must set out how Bristol Water intends to manage its supply demand balance over a period of 25 years.[213]

23. The purpose of the WRMP is set out in more detail in the WRP Guiding Principles:

"Water Resources Management Plans should ensure an efficient, sustainable use of water resources. They should focus on delivering efficiently the outcomes that customers want, while reflecting the value that society places on the environment."[214]

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[210] WRP Guiding Principles (RPF082).

[211] SoC, Section 2.5.1.2.

[212] WA '03 Explanatory Notes, para. 349.

[213] WRP Guiding Principles, p. 43 (RPF082).

[214] WRP Guiding Principles, p. 2 (RPF082).

24. The WRMP must address in particular:

- Bristol Water's estimate of the quantities of water needed to meet its obligations under the WIA '91;
- the measures it will take to meet our obligations by managing and developing its water resources (taking account of licensed water suppliers contributions to its supply system);
- the sequence and timing of its measures; and
- anything covered in a direction from the Secretary of State.[215]

25. The WRMP must be reviewed annually, and a statement on the conclusions of the review sent to the Secretary of State. A revised plan must be prepared and published if:

- Bristol Water's annual review indicates a material change of circumstances;[216]
- it is directed to do so by the Secretary of State; and
- in any event a revised WRMP must be produced at least every five years.[217]

26. Bristol Water's current WRMP was published in June 2014. Bristol Water will commence preparation of its next version of the WRMP in 2017, with a view to the final version being published in 2019.

2.1.3 Preparation of the WRMP

27. The legislation and guidance set out detailed requirement in relation to how the WRMP should be prepared, and who should be involved in that process. For instance, in preparing its draft WRMP Bristol Water must engage with the following statutory consultees:

- the EA
- Ofwat
- the Secretary of State; and
- any licensed water supplier which supplies water to premises in Bristol Water's area via its supply system.[218]

28. This engagement takes place prior to the public consultation on the draft WRMP, and it is intended to ensure that all stakeholders have adequate opportunity to input into its development – as well as being able to raise any concerns about the content of the WRMP as early as possible:

> *"Those organisations being consulted should use the pre-consultation period to set out what they expect from the plan and highlight any issues that emerged during the*

[215] S37A(3) WIA '91. The Secretary of State may give directions which specify the form a WRMP must take and the planning period to which it must relate (s37A(7) WIA '91).

[216] As noted in Section 2.1.5 below, a material change of circumstance is one which impacts on customers either through loss of security of supply or higher bills.

[217] S37B WIA '91.

[218] S37A(8) WIA '91.

previous planning period where action is needed, as well as raising any potential concerns."[219]

29. The draft WRMP is then put through a public consultation process, allowing all interested parties to comment. Following that consultation, Bristol Water produces a statement of response which details how the WRMP will be adjusted to take account of the consultation representations. To the extent that the Secretary of State has specific concerns with the draft WRMP, a direction can be made to require a public hearing or inquiry:

> *"By involving interested groups effectively throughout the consultation process a water company may be able to resolve many issues relating to its plan. A hearing or an inquiry may be needed where there are substantial unresolved conflicts of opinions; where a water company has not provided enough evidence to justify a particular course of action or where a substantial change to the plan has been made that did not form part of the consultation."*[220]

30. The Secretary of State may also direct Bristol Water to vary its WRMP in specified ways if unhappy with its planned approach, and Bristol Water must comply. The Secretary of State's assessment of the WRMP will be informed by technical advice provided by the EA:

> *"The evidence requested from the Environment Agency is likely to cover:*
>
> - *whether the plan meets the statutory requirements;*
> - *whether the company has properly addressed the representations received;*
> - *whether or not the changes proposed to the plan in the statement of response are significantly different to the draft on which the company consulted on;*
> - *the improvements the Environment Agency advises should be made to the plan."*[221]

31. The final version of the WRMP must be published in accordance with the provisions of s37B(8) WIA '91.

1.3.1.1.1.1 1.2.3.1 Engagement with the regulators

32. Just as there is well accepted best practice that informs the development of a WRMP, so too are there best practice expectations about how the regulators should approach their review of its content and proposals, which are set out in the WRP Technical Guidelines:

> *"When a water company publishes its plan for consultation, the regulators will scrutinise the plan following the principles outlined in section 1.8. The regulators will be looking to make sure a water company has clearly demonstrated it has:*
>
> - *complied with the law, Directions, regulations and policy/aspirations from Government;*
> - *planned for a secure supply of water that protects the environment and demonstrates it is best value for customers. A water company should have*

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[219] WRP Guiding Principles, p. 27 (RPF082).

[220] WRP Guiding Principles, p. 33 (RPF082).

[221] WRP Guiding Principles, p.19 (RPF082).

explored all options to remove a deficit and clearly explained how it decided on the options it has selected;

- *provided evidence of a twin track approach to managing its supply and demand for water. Where a water company has proposed a new source of supply, it should demonstrate that it has thoroughly explored and tested all demand management options and fully considered and presented costs of water trading with other water companies (neighbouring or not) and other parties with supplies to ensure best value for its customers;*
- *involved statutory consultees;*
- *involved customers and taken into account their views in the development of its plan;*
- *investigated whether a Strategic Environment Assessment (SEA) is relevant if options are required to balance a supply-demand deficit; carried out a Habitats Regulations Assessment (HRA) and other appropriate assessments if an option could affect any designated European sites. These sites include Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSACs), Special Protection Areas (SPAs), potential Special Protection Area (pSPA), pRamsars (proposed Ramsars) and Ramsars sites;*
- *incorporated all the relevant environmental and social costs and benefits, even if it has not had to carry out a SEA or HRA;*
- *chosen the best solution, clearly justifying why it has made this choice, demonstrating that it has taken account of customers' views and the options' costs, benefits and value to the environment and society;*
- *explained clearly how it has made its decisions. Rather than just presenting a final answer, the regulators will be looking for the detail of the journey' the company has gone through to make that decision."*[222]

1.3.1.1.1.2 1.2.3.2 Engagement with customers

33. In addition to engaging with the statutory consultees, in keeping with the broader approach underpinning PR14, Bristol Water was expected to ensure that customers also played a central role in the development of the WRMP:

> *"Companies must take responsibility for involving their customers and seeking their views in preparing their water resources management plans. For example, customers may take a view on the levels of service (in terms of frequency of restrictions on use) or have particular priorities or concerns about levels of metering and leakage. These views should be ascertained through direct engagement and consultation with customers.*
>
> *Companies should make sure that their water resources management plans reflect a sound understanding and reasonable balance of customers' views. Each company has a Customer Challenge Group, the role of which is to test the quality of its engagement and how it plans to respond to customers' priorities. This group could also be used during the stakeholder consultation process for WRMPs to help ensure effective customer engagement and consistency with business plans.*

[222] WRP Technical Guidelines, p. 14 (RPF083).

Water resources management plans will inform the supply-demand balance part of the companies' strategic business plans that companies submit to Ofwat as part of the process of setting price limits. The price-setting process requires companies to develop plans in consultation with their customers and stakeholders. Customers need to know that the bills they pay are fair and legitimate. Good customer engagement is essential to achieving this.

The quality of customer engagement will be an important factor in determining the level of scrutiny Ofwat will apply to the companies' business plans, including the Water Resource Management Plan elements of the supply and demand balance, for the next price review."[223]

2.1.4 Technical approach to planning

34. In developing a WRMP, there is a good understanding of what constitutes best practice:

"A water company must develop a water resources management plan by law. The guiding principles provides details on what a company must do when preparing, consulting and publishing its plan. To achieve this, a water company should follow good practice offered in this guideline. The guideline has been developed between the Government and their regulators (Environment Agency, Ofwat, Natural England and the Countryside Council for Wales), together with the input of Water UK and water companies. The guideline, therefore, has significant weight and, consequently, there is good reason for companies to follow the methods contained within it.

The Government expect water companies to follow the methods/framework outlined here unless they have got a good reason not to. This approach is outlined in Table 1.1 below. A water company will find requirements to follow methods/approaches described as _should', rather than a compulsory _must'. A _must' indicates a legal status, either within the legislation or regulation or is a definite requirement of the Government. A company that ignores a 'must' is at high risk of producing a plan that is not valid, unless it can provide a very strong reason for not doing so.

Table 1.1 – Explanation of compliance approach

Category	Result
Complied with _should' and followed the guideline	This will provide confidence that a company has produced a well balanced plan that will be understood by consultees and regulators.
Has complied with a _should' but has used a different method or approach	The guideline does not prevent a company using a different method or approach. However, the water company should provide information to explain why it has chosen a different method/approach, how the results or decisions have been made, and how it differs from the guideline approach.
Has not complied and not provided any additional information	A water company would need to provide a very strong case to have not complied with the approach or method. Without strongly defending its position, further information would be required and this may delay a decision on publishing the plan.

If a company decides that it has a better method to develop its water resources management plan, it can use this alternative approach as long it fully explains and

[223] WRP Guiding Principles, p.18 (RPF082).

justifies its reasons. The company should discuss its approach at the pre-consultation phase (or earlier) with statutory consultees."[224]

35. It is also clear that companies should take a long term approach to planning:

> *"Given the long lifespan of water infrastructure, it is important that water resources management plans are resilient to a range of potential climate scenarios and are designed with climate risks built in. To achieve sustainable long-term results, water companies must be able to see beyond the immediate price review period."*[225]

1.3.1.1.1.3 1.2.4.1 Approach to developing the preferred solution

36. As the WRP Guiding Principles make clear, the WRP Technical Guidelines set out clear instructions as to how the right solutions should be developed, and the considerations that should be taken into account:

> *"The technical guideline sets out the minimum a company must demonstrate it has done to investigate such options. Any company proposing to develop a new source of supply will have to show that it has fully assessed the costs and benefits of water trading with neighbouring companies, increased connectivity, abstraction licence trading and options provided by third parties. Water companies can expect to be challenged on the evidence for their approach throughout the planning process. The Secretary of State may direct a company to change its plan if she believes that water trading options, or supply/demand options proposed by other parties, have not been sufficiently considered."*[226]

37. In terms of the particular considerations to be taken into account, the WRP Guiding Principles note:

> *"The UK Government expects each water company operating wholly or mainly in England, to demonstrate that its preferred solution is best value for water company customers and the environment. In developing a preferred option, a company must demonstrate it has considered:*
>
> *i.* ***interconnections between its own water resources zones*** *- Increasing interconnection between a company's own resource zones where it is cost effective will mean companies can use water resources more flexibly, efficiently and reduce the need for new resources and infrastructure;*
>
> *ii.* ***water trading*** *- through bulk supplies between water companies (neighbouring or not);*
>
> *iii.* ***Abstraction licence trading within catchments*** *- This provides a water company with an option to purchase or sell licences to help meet its supply needs or to sell surplus water to other abstractors;*
>
> *iv.* ***Supply/demand options provided by other water companies or by third parties*** *- allowing others to provide demand and/or supply options in the plan increases the scope for lower costs and innovative solutions. Options*

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[224] WRP Technical Guidelines, p. 5 (RPF083).

[225] WRP Guiding Principles, p.9 (RPF082).

[226] WRP Guiding Principles, p. 10 (RPF082).

proposed/provided by other water companies or third parties will need to be included in the options appraisal alongside other feasible options."[227]

2.1.5 How is the WRMP intended to operate in practice?

38. As the various guidance documents make clear, the WRMP is intended to identify the preferred solutions for addressing supply demand balance issues:

> *"A preferred solution will have to be decided on the basis of it being the best value for water company customers and the environment. The final preferred solution may not necessarily be the least cost option. Water companies should use the processes available to monetise costs and benefits that do not have a market value, and give weight to costs and benefits to which it is difficult to attribute a monetary value.*
>
> *Each company's plan should follow Government policies and aspirations to the extent that this does not impact unduly on water company customers' bills. An undue impact would be one that is not justified by the wider benefits that accrue from the plan, including the priorities that customers have identified through the consultation process. If a company is unable to follow Government policies and aspirations without having an undue impact on water bills or customers, it should demonstrate that it has explored the most cost-effective ways of following those policies and aspirations and considered a full range of potential solutions.*
>
> *A water company's plan should provide a realistic approach to managing water resources and reflect customers' preferences. If a company believes a particular position is not possible it should state why and what the barriers are. The company should provide evidence to support its chosen plan and demonstrate it clearly understands how its system performs, the main factors affecting its balance between supply and demand, what levels of service and risk are acceptable to customers, and how the plan is flexible and can adjust to the various risks and uncertainties, including the potential impacts of climate change."*[228]

39. It is not intended that the WRMP will be a static document. Instead it is envisaged that it should evolve as circumstances change and new opportunities become available in order to achieve the best results for customers. This is achieved through the process of annual reviews with any material changes being reflected in a revised plan:

> *"In the context of the annual review, 'material' changes are those with significant impacts on customers either through loss of security of supply or higher bills. Changes which do not impact detrimentally on security of supply or customers' bills would not normally require the company to prepare and consult on a revised water resources management plan."*[229]

3. INTERACTION BETWEEN THE WRMP AND THE PRICE REVIEW

40. Clearly, the WRMP is intended to be the definitive exposition of the supply demand balance challenges that Bristol Water faces, and the preferred solutions for addressing them, over the next 25 years. Just as the WRMP is revised every five years, so too does Bristol Water

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[227] WRP Guiding Principles, p.9-10 (RPF082).

[228] WRP Guiding Principles, p.22-23 (RPF082).

[229] WRP Guiding Principles, p.22-23 (RPF082).

have to produce a business plan every five years that sets out how it plans to spend the money raised from customers over the next five year period, and which forms the basis of the price controls set by Ofwat:

> *"Developing the water resources management plan and the periodic review of price limits (price review) are two separate but linked processes. Defra, the Welsh Government, Ofwat and the Environment Agency have worked together to streamline the processes to complement each other as much as possible, and thus incentivise efficient and effective responses by companies."*[230]

41. The WRP Guiding Principles acknowledge the work being carried out by Ofwat to create the PR14 framework and note that it should "*incentivise companies to maintain the supply demand balance, and allow innovation and a flexible response to customers' views and environmental conditions*". [231]

42. In this context, the WRP Guiding Principles are explicit about how the WRMP should sit alongside the business plan:

> *"Ofwat will expect the supply-demand balance element of a company's strategic business plan to reflect its water resources management plans. Ofwat's view of the robustness of a company's water resources management plan, and the effectiveness of customer engagement in its development, will determine the level of scrutiny it will give to the supply demand element of the strategic business plan.*
>
> *At the next price review, a company's forecast of demand will be a common element in both its water resources management plan and its business plan. This forecast will determine the costs of the company's feasible options when it carries out a cost effectiveness analysis to determine its preferred solution. In turn, these costs will directly underpin the business plan's supply demand investment proposals. Finally, Ofwat will use the same demand forecast to determine the company's projection of revenue when it sets price limits."*[232]

43. Given the relationship between the content of the WRMP and the business plan, it is important to consider the relative timing, and how it is intended that the WRMP should impact on the business plan and, therefore, Ofwat's review of the business plan and its determination of price controls:

> *"The draft water resources management plan will precede the submission of the strategic business plan to Ofwat. However, the final water resources management plan will not be published until after the company has submitted its strategic business plan to Ofwat. In order to manage this uncertainty:*
>
> - *In their response on the draft water resources management plan, Ofwat and the Environment Agency will provide clear feedback on their concerns, providing specific instructions where possible, so that the company can address these in its statement of response.*
> - *Where either Ofwat or the Environment Agency has significant concerns with a water company's draft plan, it will recommend that the company produces a*

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230 WRP Guiding Principles, p. 37 (RPF082).

231 WRP Guiding Principles, p. 37-38 (RPF082).

232 WRP Guiding Principles, p. 37-38 (RPF082).

revised draft plan to accompany its statement of response. In the absence of such a recommendation the company should be clear about any changes it has made to its draft plan in response to feedback it has received.

- *While the company is under no obligation to produce a revised draft plan this will help to achieve consistency between the final water resources management plan and the business plan. Ofwat and the Environment Agency will work together to review the statement of response and any revised draft water resources management plan in order to provide early feedback to the company on any outstanding concerns. The aim will be to guide the company on what will be acceptable for the business plan and final water resources management plan."*[233]

44. It is clear from the WRP Guiding Principles, therefore, that if either the EA or Ofwat has concerns about the analysis or proposals in the draft WRMP, it should raise them in the context of that consultation process in order to achieve early agreement on what will ultimately form part of the business plan. As a result, there is an expectation that

> *"the companies should use the supply-demand balance details from the water resources management plan to complete the supply demand section of the strategic business plan.* ***There should be no differences unless a company has been directed to amend its water resources management plan****".*[234] (emphasis added)

45. Equally, when it comes to Ofwat's review of the supply demand balance element of the business plan, it is expected that the level of scrutiny it applies will be informed by its view of the robustness of the WRMP. Given the onus on Ofwat to raise concerns with the WRMP at the pre-consultation stage, or in relation to the draft WRMP, if it has not done so, this would suggest that Ofwat is content with the approach of the WRMP:

> *"The water company's water resources management plan is used to determine the investment that the company needs in order to balance supply and demand. These investment requirements will directly inform the company's business plan proposals.*
>
> *Ofwat will use the water resources management plan as the basis of its assessment of the supply-demand balance element of the strategic business plan as part of the process for reviewing water company price limits. Ofwat's view of the robustness of the company's water resources management plan will inform the level of further analysis that it will carry out on the strategic business plan.*
>
> *Where Ofwat agrees with the proposals contained within a company's final water resources management plan, there will be minimal further challenge to its business plan if that accurately reflects those proposals. However, where Ofwat has concerns with a company's draft water resources management plan, and these concerns are not addressed in the company's final water resources management plan, then there will potentially be further challenge to its business plan. The extent of the challenge will be determined by the scale of the concerns."*[235]

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[233] WRP Guiding Principles, p. 37-38 (RPF082).

[234] WRP Guiding Principles, p. 40-41 (RPF082). This is an excerpt from the 'Timetable for the next Water Resources Management Plans and price review'.

[235] WRP Technical Guidelines, p.25-27 (RPF083).

46. As the final paragraph of the extract from the WRP Technical Guidelines clearly demonstrates, there is an expectation that if Ofwat has concerns with the proposals contained in the WRMP, then it should raise them as part of its challenge to the draft WRMP, in order for them to be addressed in the final WRMP. Only if they are not so addressed, should the issue be raised as a challenge to the business plan. As demonstrated in Section 3.2 below, Ofwat did not raise any concerns about the Cheddar Reservoir Two proposals at any stage during the WRMP consultation phases.

47. The WRP Technical Guidelines set out in detail how the content of the WRMP and the business plan will be explicitly linked. In particular, it demonstrates that the WRMP is not only relevant to the identification of the supply demand balance, but also to the costing of options and selection of the preferred solution that directly informs the business plan proposals:

> *"For the 2014 review of price limits, the water resources management plan and business plan are explicitly linked by the company's forecasts of demand and utilisation. Specifically:*
>
> - *the baseline forecast of dry year (annual average and / or critical period) demand in the water resources management plan will determine whether there is a potential supply demand deficit and when it occurs.*
> - *the baseline weighted annual average demand forecast, based on the dry year demand forecast, will be used as the basis of the company's revenue forecast in its business plan where there is no forecast supply demand deficit.*
> - *utilisation, the company's view of how much it will need to use any solution, where there is a supply demand deficit ,will determine the variable costs of feasible options during the options appraisal process to determine a least cost / preferred solution.*
> - ***the costs underpinning the options appraisal of the company's preferred solution, determined in the water resources management plan, will directly inform the costs of any supply demand investment proposed in the business plan**.*
> - *the final planning forecast of weighted annual average demand in the water resources management plan will take account of any demand management options that form part of the company's preferred solution. For companies with a forecast supply/demand deficit, it will also form the basis of the company's revenue forecast in its business plan."*[236] (emphasis added)

48. The thorough nature of the consultation process, and the acceptance of the WRMP by the Secretary of State means that, in practice, there is a legitimate expectation by Defra, the EA Bristol Water and customers, etc., that the proposals in the WRMP will be followed through.

3.1 Interaction between the various regulatory regimes

49. The water sector is characterised by having multiple regulatory regimes and regulators. These regimes have different areas of focus, but in practice are all inter-related. It is important, therefore, that they interact sensibly and in a way that does not allow the

[236] WRP Technical Guidelines, p.25-27 (RPF083).

decisions under one regulatory regime to jeopardise the fulfilment of obligations under another.

50. This is most keenly felt in the interaction between the role of Ofwat as the economic regulator with the roles of the EA and DWI as regulators responsible for water resources and water quality respectively. The CMA's role is to replicate the functions of Ofwat as economic regulator.

51. The WRP Technical Guidelines offer a view on the need for cooperation between the regulators, by reference to the evolution of the joint guidance:

> *"Defra commissioned the In House Policy Resource (IHPR) to undertake an independent review of the first round of the water resources management plans process and this was published in June 2011.*
>
> *There are 14 recommendations in the report, with a common theme of joint working between the regulators and between the regulators and the water companies. The report notes that, for real improvements to be achieved, all parties will need to commit to implementing them, with the three regulators having particular responsibilities. Those recommendations have been incorporated within this guideline."*[237]
>
> *"The guideline is widely accepted by all those involved in water resources planning, having been developed as a fair and consistent reference manual of good practice that all water companies should follow. It has enabled the water industry to see that common standards and approaches will be applied, both by neighbouring companies and regulators, in an industry that is subject to comparative regulation."*[238]

52. In terms of the role that Ofwat is expected to play in the WRMP process, the guidelines are quite clear:

> *"The Water Services Regulation Authority (Ofwat) sets price limits for water and sewerage companies in England and Wales. It is Ofwat's role to make sure that water companies carry out their functions and that they can finance those functions. At the same time, Ofwat protects consumers' interests, wherever appropriate by promoting competition. It also has duties to help achieve sustainable development and to promote economy and efficiency.*
>
> *Ofwat has a major role in the water resources management plan process, as water companies have a statutory obligation to consult Ofwat before preparing their plans (pre-consultation phase). Ofwat's views on water resources planning issues are reflected in the updated water resources planning guideline. Ofwat is also in the process of reviewing how it sets price limits in the future. It published its —Future price limits- statement of principles in May 2012. One of the aims of this review is to ensure more sustainable use of water resources. Ofwat plans to provide incentives consistent with the water resources planning process for companies to manage water resources more efficiently by increasing water trading, reducing unsustainable abstraction and increasing interconnection between a company's own resource zones, where this is the most cost effective way of managing supply and demand .*
>
> *Once the draft water resources management plan is published, Ofwat, as an interested organisation, may make representations to the Secretary of State or Welsh*

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[237] WRP Technical Guidelines, p. 9 (RPF083).

[238] WRP Technical Guidelines, p. 10 (RPF083).

Ministers on the content of the draft plan. The water resources management plans inform the supply-demand balance part of the companies' strategic business plans that they then submit to Ofwat as part of the process of setting price limits.

Ofwat will look to water resources management plans to demonstrate that water companies have:

- *taken account of the opportunities to share resources with neighbouring water companies;*
- *fully and consistently explored options to manage demand;*
- *enabled third parties to propose options to balance supply and demand and assessed these options consistently with other options;*
- *taken account of the views of customers in producing their plans;*
- *estimated fully the costs and benefits of the range of options considered;*
- *determined the best value solutions to balance supply and demand, taking account of climate change and the need for sustainability and resilience."*[239]

53. This clearly shows that the guidelines anticipate that the WRMP is, effectively, the source document for demonstrating the need, selection of the best option, and even the costing of all proposals aimed at addressing supply demand balance issues. As such, the very fact that Cheddar Reservoir Two has been through this process and been included in the WRMP should be seen as conclusive evidence that all of these tests have been met in accordance with the specific regime established by parliament for that purpose. It is not entirely clear, therefore, on what basis Ofwat has concluded that inclusion of a scheme in the final WRMP "*does not replace the need to successfully demonstrate the need and efficiency in line with the price review process*".[240]

4. BRISTOL WATER'S APPROACH TO ITS WRMP

54. In preparing its WRMP, Bristol Water followed all the stages envisaged by the statutory framework and accompanying guidance. Its WRMP and the associated processes were subject to multiple levels of external consultation, review and assurance at draft and final stages as set out below:

- Atkins – draft WRMP and cost benefit analysis;
- Atkins - final WRMP and modelling;
- Mott Macdonald - capital and operating costs; and
- ChandlerKBS - Cheddar Reservoir Two and other scheme costs.

55. The draft WRMP was published for public consultation on 13 May 2013 and a Statement of Response to the consultation was published on 22 November 2013.

56. Throughout the consultation process, Bristol Water worked with all stakeholders to resolve issues and concerns. This included extensive engagement with the Local Engagement Forum (**LEF**), as well as research carried out with individual customer groups.[241] The result of the

[239] WRP Guiding Principles, p.20 (RPF082).

[240] Ofwat's Response to Bristol Water's Price Determination Statement of Case, 11 March 2015, para. 193.

[241] WRMP, p.3 (SOC039).

process was a WRMP that the EA, Defra, Ofwat, the LEF and the local planning authorities agreed followed the principles of good practice and was acceptable.

57. After a detailed consultation process, the WRMP was formally cleared and approved by the Secretary of State for Environment, Food and Rural Affairs on 14 May 2014. The final version of Bristol Water's current WRMP was published on 20 June 2014.

58. The review of Bristol Water's WRMP process by Aqua in the context of the CMA's determination concluded "*that Bristol Water had appropriately prepared its WRMP and the inputs that flowed from the WRMP into its business plan*".[242]

4.1 Cheddar Reservoir Two and the WRMP

59. The inclusion of Cheddar Reservoir Two in Bristol Water's Business Plan is a direct result of it being part of the recommendations contained in the WRMP.[243]

4.2 Comments from Ofwat on the WRMP and Cheddar Reservoir Two

60. As noted above, Ofwat is one of the statutory consultees with whom Bristol Water must engage as part of the preparation of its draft WRMP.

61. Whilst there was engagement between Bristol Water and Ofwat during that consultation process, Ofwat did not make any comments in relation to the inclusion of the Cheddar Reservoir Two on grounds of either need, timing, best solution or cost. Despite this, Ofwat ultimately rejected Cheddar Reservoir Two as an enhancement scheme in its final determination for Bristol Water.

5. WHAT WEIGHT SHOULD BE GIVEN TO THE WRMP IN THE CONTEXT OF THE DETERMINATION?

5.1 General comments on regulatory 'good order'

62. No company can plan for the delivery of its statutory duties and functions on the basis that different regulatory authorities with different statutory responsibilities engage with substantive issues in sequence despite guidance to the contrary, and only raise fundamental objections as and when they see fit.

63. Water legislation has developed increasingly strong provisions demanding that water undertakers put in place detailed and comprehensive plans showing not just how they are able to meet their basic and fundamental water supply obligations now, but how they will continue to be able to do so in the future, given predicted pressure from a wide range of factors such as population growth, future house building and industrial uses, climate change, drought and weather patterns and so on.

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[242] PFs, para. 6.69.

[243] Cheddar Reservoir Two is considered in the WRMP at pages: 132-3; 157; 165; 167; 174; 178-190; 191-2 and 201 (SOC039). The position on Cheddar Reservoir Two is also set out in detail in the SoC at paragraphs: 331; 720; 1138-1140; 1144; 1289; and 1290-1367.

64. The provisions of the WIA '91 in this area were strengthened by more detailed provisions and requirements in the WA '03, and further by the resilience provisions introduced by the WA '14.

65. This framework of increasingly demanding requirements for the preparation and publication and consultation of each WRMP would be rendered ineffective and unworkable if each statutory consultee only engaged with the process in accordance with their own timetable. It would also be contrary to the principles of best regulatory practice as embodied in s2(4) WIA '91.

5.2 Conclusions on the weight to be given to the WRMP

66. The statutory and regulatory framework which supports the WRMP, and sets out the expectations for how it will be developed and how it should be used, including in the context of a price control determination, clearly demonstrates that it should be treated as the definitive statement on a company's management of its supply demand balance.

67. Schemes that are included in a final WRMP have been subjected to a thorough and robust statutory consultation process that is overseen by a multiplicity of regulators, as well as being informed by the views of customers. To be included, the company will have had to demonstrate the need for the scheme and that it is the best solution, taking into account the anticipated cost. It is for this reason that the WRMP and the business plan are seen as being so closely related.

68. In light of the statutory framework referred to above, and reasonable expectations of Ofwat's participation in the process of statutory consultation set out in the WIA '91, Ofwat had ample opportunity to raise detailed or other objections to the inclusion of Cheddar Reservoir Two in the WRMP, but opted not to do so. Ofwat declined to comment at that stage despite being fully aware that inclusion in the WRMP would inevitably mean the scheme would be included in the business plan.

69. The CMA should not endorse Ofwat's rejection of this reservoir as an essential component of the published and consulted plans advanced by the company for delivering its fundamental statutory duties. Similarly, given that the CMA, in setting the price control for Bristol Water, is effectively standing in the shoes of Ofwat, it should give significant weight to the fact that Cheddar Reservoir Two is included in the WRMP.

70. In this context, it is concerning that the CMA has simply treated the WRMP as just another piece of evidence – comparable to the opinion of a consultant such as Aqua. This fails to give due recognition to the real status of the WRMP, and risks undermining the statutory process on which it is based, as well as perpetuating the regulatory uncertainty resulting from Ofwat's approach. If the recommendations of the WRMP are rejected, this also means that the view of one regulator is replacing the view of the multiplicity of regulators, and other stakeholders, that were represented through the WRMP's consultation process.

71. The starting point, therefore, should be that any schemes recommended by the WRMP should be seen as an integral part of the business plan that should be funded, unless material new evidence has come to light since the WRMP was finalised that would suggest it is in need of material revision. To the extent that the CMA decides to take a contrary view to the WRMP, it must be prepared to justify the legal and factual grounds on which it has done so.

Appendix 7.1 – Response to CMA comments on Mean Zonal Compliance

1 Introduction

1. This is a short note on some of the points raised by the CMA in its PFs in relation to water quality.

2. In this Appendix 7.1, we have set out detailed comments in relation to:

   - water supply zones (see **Section 1.1)**; and
   - impact of AMP5 (see **Section 1.2**).

1.1 Water supply zones

3. We are not at liberty to adjust the make up of our zones to balance the population served, as the definition of zones is stipulated by Regulation 3 of the Water Supply (Water Quality) Regulations 2000 (as amended). The requirement to meet Regulation 3 (2) and (2A) means that there is invariably a wide variation in the size of Water Supply Zones and on occasion this leads to a zone with a small population. This carries the inherent risk that a failure in the zone can have a disproportionate impact on the company's Mean Zonal Compliance figure.

1.2 Impact of AMP5

4. The CMA states that we received around £4.8m at PR09 to fund two lead reduction schemes.[244] These schemes were at Sherborne Treatment Works, and for replacement of customers' lead communication pipes. We provide details below as to why these two schemes should not be expected to have significantly improved lead compliance across the whole of our customer supply area.

1.2.1 Sherborne Treatment Works

5. The work at Sherborne WTW was required because the raw water contains lead above 10 µg/l. If the capital enhancement work had not been undertaken the water leaving the site would have had a lead concentration greater than the regulatory standard.

6. However, Sherborne WTW only provides a supply to two of our 27 Water Supply Zones (WSZ). The water supply to these two zones (WSZ 422 and WSZ 424) is a blended flow of water from Sherborne and Stowey WTWs.

7. Although the work at Sherborne will impact to an extent on the concentration of lead in two of our WSZs it will, therefore, have no impact on lead concentrations in the other 25 WSZs.

[244] PFs, para. 9.41, p.226.

1.2.2 Lead Communication Pipe replacement

8. £0.165m was allowed for replacement of lead communication pipes at FD09. This has funded the replacement of 208 pipes, 8 more than assumed at FD09. We estimate that we still have over 150,000 lead communication pipes in our supply area,[245] so the replacement of 0.1% of these should not be expected to have a material impact on our lead compliance.

9. We acknowledge the 2014 industry data recently published by the DWI, and the CMA's analysis of MZC performance against the proportion of lead pipe replacements as set out in Appendix 9.1 to the PFs.

[245] This is taken from our GIS, which includes actual data on c60,000 CPs, and an assumption of a further c95,000 based on the age of the main and the properties it supplies. Overall lead communication pipes represent around 30% of the total communication pipes in our area.