

C8 Justification for proposed investment – Outcome of cost benefit analysis and carbon accounting

Reporter Summary

I confirm that I have reviewed the Company's commentary and raised queries where necessary. I have confirmed the calculations made as follows: for CBA I have carried out independent calculations based on the Company's stated assumptions, and for carbon accounting I have reviewed their calculation sheets and carried out spot-checks.

The Company has conducted an appropriate Willingness to Pay (WTP) survey to quantify benefits. Although the second phase of this survey has not been peer reviewed, it has been carried out by the same external consultants as the first stage which was peer reviewed. The Company has made use of external environmental and social valuation data where required.

Cost Benefit Analysis (CBA) has been applied to the following elements of the programme:

- Base Service – Infrastructure: via application of the Common Framework;
- Enhanced Service Levels: leakage via customer WTP; flood resilience via estimated benefits;
- Quality Enhancements (excluding catchment management for nitrates; WFD/NEP): taste & odour via customer WTP (also DWI support); SEMD via estimated benefits (also with reference to Government guidelines).

In the area of supply-demand balance, there are no new resource schemes planned. New mains and meter optants are excluded from CBA as they are required expenditure.

In the area of base service for non-infrastructure, the Company has found implementation of the Common Framework to be unwieldy, given the small size of its asset base. It regards its detailed knowledge of its assets as the best way to identify maintenance requirements. This area has not therefore been subject to formal CBA. Similarly, management and general (M&G) expenditure has been estimated based on historical trends.

In relation to carbon accounting, the Company has evaluated both direct and indirect GHG emissions, relating to both embodied and operational carbon.

The commentary below follows the numbering sequence of the Company commentary.

C8.1 Company Approach to Cost Benefit Analysis

C8.1.1 General approach

The Company has conducted customer Willingness to Pay (WTP) surveys, covering the following measures:

- First phase:
 - Hardness
 - Pressure
 - Planned supply interruptions
 - Unplanned supply interruptions
 - **Water leakage**
 - Reliable & Continuous Supply into the future
 - Customer Service
 - Environment
- Second phase:
 - Reliable & Continuous Supply into the future (further service levels)
 - **Taste & odour**
 - Extent of mains renewal
 - Metering.

The measures indicated in bold above, leakage and taste & odour, have been used in CBAs relating to schemes included in the Final Business Plan (FBP). In addition, I have used the unplanned supply interruptions measure as a comparator to the Company’s estimation of benefits by other means.

Whilst the quanta used in the survey to represent alternative service levels might prove difficult to relate to scheme outputs in some cases, this does not apply to those measures used to justify schemes in the FBP.

In relation to Environmental & Social (E&S) measures, the Company has utilised the measure for carbon in the FBP, according to the Defra guidelines.

C8.1.2 Capital Expenditure - Items Excluded from Cost Benefit Analysis

The Company has carried out CBA on its programme with the following exceptions:

Area	Reason CBA not applied
Base Service: Non-infrastructure	The Company has found implementation of the Common Framework to be unwieldy, given the small size of its asset base. It regards its detailed knowledge of its assets as the best way to identify maintenance requirements.
Base Service: M&G	I note that it is difficult to quantify the benefits of many of these schemes.
Quality Enhancements: Catchment management for nitrates	I note that it is difficult to quantify the benefits, and that any alternative scheme to remove nitrates in the future would be significantly more expensive. DWI support.
Quality Enhancements: WFD/NEP	Required expenditure.
Supply-demand Balance: New mains; optional metering	Required expenditure.

C8.1.3 The Cost Benefit Model

The prototype CBA model used at Draft Business Plan was developed by WRc and peer reviewed by Frontier Economics. The peer review found that the appropriate guidance had been followed, with the following observations:

- Carbon calculations could be more visible
- Negative non-financial benefits are treated as positive financial costs
- Sensitivity analysis could consider non-financial factors such as the level of the benefits.

I requested and received further details on the carbon calculations and reviewed these on a spot-check basis. The monetised carbon impact of the schemes is not significant in relation to the costs and other benefits.

For the FBP, the CBA model has been revised to compare net financial ‘costs’ against net non-financial ‘benefits’. I have carried out independent CBA calculations based on the Company’s stated assumptions, with results in close agreement.

The analysis spans a 40 year horizon.

Whilst no formal sensitivity analysis has been carried out by the Company, the benefit to cost ratio is significantly greater than one for each scheme and it would not be expected that uncertainties in the input data have unduly influenced the results.

The cost of capital discount rate used is 5%, whereas 6.05% has been used by the Company in its financial modelling. My independent calculations estimate

the impact of this to be a 5-10% overstatement of the benefit to cost ratios: again this has not unduly influenced the results.

The social time preference discount rate used is in accordance with the Green Book.

The Company has applied an annual inflation rate of 1.15% to the customer WTP values, on the basis of wage inflation of 2.3% in real terms and a 50% elasticity in relation to WTP. This would appear to be a reasonable assumption for the long-term (i.e. neglecting the immediate economic situation).

C8.1.4 Cost and Benefit Analysis of the Final Business Programme

C8.1.4.1 Quality Enhancements

Taste and Odour Trihalomethanes (THMs)

The River Itchen source is subject to algal growth producing Trihalomethane (THM) disinfection by-products. A scheme is proposed to provide roof coverage to the Highwood raw water storage reservoir and to the clarifiers. A number of alternative solutions have been considered, as described in Section B4.

No maintenance costs have been included in the analysis.

With regard to the scheme impacts, it appears reasonable to expect that this solution will remove all taste & odour problems associated with this site.

With regard to monetisation of the impacts, following the DBP a second phase of the customer survey has provided a WTP valuation for removing this specific taste and odour issue. CBA has been applied using this WTP value, and the benefit to cost ratio obtained is 1.79. Whilst no formal sensitivity analysis has been presented by the Company, this ratio is significantly greater than one and it would not be expected that uncertainties in the input data have unduly influenced the result.

I agree that the scheme is cost-beneficial. It is also noted that the scheme has DWI support.

Security and Emergency Measures Directive (SEMD)

The Company is of the view that a terrorist attack on an unsecured site would result in loss of output for several months. It has based its benefit valuation on the surrogate of a GSS payment of £30 to a total of 210,000 properties (approximately 70% of its customer base), in one of the 40 years (2015). Whilst a GSS payment would not be triggered under such circumstances, the Company regards this as a surrogate benchmark. The value is counted as a benefit and not double-counted as a cost.

Maintenance costs of £73k per annum have also been included in the analysis.

It is noted that monetisation of the benefits for a scheme such as this is difficult. I would have preferred an annual benefit value applied for the remainder of the 40 year horizon following completion of the scheme. As an example, my independent calculations indicate that scheme benefits based on this GSS calculation would equal costs if an attack affected the supply to one property in ten, and had as high a likelihood as one year in six (or affected all properties with a likelihood of one year in sixty).

The scale of a GSS payment is likely to be a vast underestimate of the true benefit of the scheme. As an alternative view, I have carried out independent calculations utilising the customer WTP to avoid unplanned interruptions. As an illustrative example, it might be taken that loss of supply for a day would have four times the valuation of a single 6-hour-plus interruption. In this case, also assuming that a terrorist event would result in loss of supply for only one day (taking into account storage), benefits would equal costs if the likelihood of attack was one year in approximately 950.

On this basis, it is my view that the scheme is cost-beneficial. It is also noted that the scheme is based upon the Government SEMD guidelines.

C8.1.4.2 Enhanced Service Levels

Removing Those at Risk from Receiving Low Pressure

Whilst the Company has reported its CBA for this scheme and it appears to be highly cost-beneficial, it has not included the scheme in its FBP.

The scheme would have been to install pressure boosters within individual properties and to maintain them for 12 months. For practical reasons, all electricity (and maintenance) costs thereafter would have been the customer's responsibility. Following feedback on the DBP, it was decided that this would not be equitable. The Company intends to assist any customer on the register who approaches it with concerns about pressure from its own resources.

A 3 MI/d Reduction in Leakage

This scheme covers setting up a DMA structure in order to reduce leakage, and increased leakage detection activity. In addition to the capital expenditure, net operating costs of £163k per annum have been included in the analysis.

The Company has modelled the scheme impacts using the MELT leakage modelling tool: it is assumed that the modelled 3MI/d leakage reduction will be delivered.

With regard to monetisation of the impacts, the customer survey has provided a WTP valuation for reducing leakage by this amount. CBA has been applied using this WTP value, and the benefit to cost ratio obtained is 2.2. Whilst no formal sensitivity analysis has been presented by the Company, this ratio is significantly greater than one and it would not be expected that uncertainties in the input data have unduly influenced the result.

I agree that the scheme is cost-beneficial.

Resilience of Water Treatment Works

This scheme is to provide flood protection of three treatment works, as summarised below.

Site	EA river flood maps	Company experience	Works proposed
Aldingbourne WTW	Yes	No	Minor works to seal the building
Lavant WTW	Yes	Extensive (groundwater)	Re-route cable entries into the main building, to above flood level
Westergate WTW	No	Extensive (groundwater)	

Capital costs for re-routing cables, raising the motor control panels and reconnecting has been based on a budget costing from a contractor (£95k per site). This includes an allowance of £30k for brick building work to protect the cabling on the external face of the existing building. I queried this element, and was informed that it was expected to have a floor plan of 1 square metre and a security cover, and that difficulties were anticipated in mating with the existing building facia. The Company has in the past attempted to seal the cables in situ rather than raise them and this has proved unsuccessful.

No significant maintenance costs are envisaged.

With regard to the scheme impacts, it appears reasonable to expect that this solution will protect these sites fully from the flood events considered. I challenged the Company as to whether other sites would be able to supply the demand within these zones at times of flooding. Aldingbourne and Westergate lie in the same zone as each other, interconnected to the Lavant zone. It seems reasonable to expect that all three sites would be flooded simultaneously, given the nature of the flooding events considered. It was demonstrated that the peak deployable outputs of the remaining sites are not sufficient to meet demand fully.

With regard to monetisation of the impacts, the Company has based its benefit valuation on the surrogate of a GSS payment of £30 to a total of 34,103 properties served, in one of the 40 years (2015). The same comments apply as for the SEMD scheme above.

I would have preferred an annual benefit value applied for the remainder of the 40 year horizon following completion of the scheme. My independent calculations indicate that scheme benefits based on this GSS calculation would equal costs if the flooding had a return period of approximately one year in ninety. The nominal return period for the EA river flood maps is one year in a hundred; the groundwater flood events are based on experience of historical events and have no formal return period, although there is a frequent history of more minor flooding.

The scale of a GSS payment is likely to be a vast underestimate of the true benefit of the scheme. As an alternative view, I have carried out independent calculations utilising the customer WTP to avoid unplanned interruptions. As an illustrative example, it might be taken that loss of supply for a day would have four times the valuation of a single 6-hour-plus interruption. In this case, taking the flooding return period as one year in a hundred, and assuming that a flooding event would result in loss of supply for one day (taking into account storage), benefits would equal costs if approximately 1% of the flooded sites' output could not be met from other sources.

On this basis, it is my view that the scheme is cost-beneficial.

C8.1.5 Potential Improvements Not Seen as Beneficial

The three schemes reported in this section were not found to be cost-beneficial and have not been included in the FBP.

C8.1.5.3 Water Hardness

Data on capex and opex costs were obtained from another WoC with experience of operating such plant, for comparison to customer WTP. Whilst it is unclear whether the extent of softening required (and hence the capacity of the plant) would be the same in both companies, the benefit to cost ratio of 0.21 suggests that this would not alter the decision.

C8.1.5.4 Planned Interruptions to Supply Over 3 Hours to be Reduced to Zero

The increased opex to deliver the benefit has been assessed and compared to customer WTP. The benefit to cost ratio is reported as 0.62.

C8.1.5.5 Unplanned Interruptions to Supply Over 6 Hours to be Halved

The increased opex to deliver the benefit has been assessed and compared to customer WTP. The benefit to cost ratio is reported as 0.59.

C8.1.6 Summary of Cost Benefit Analysis for Service Levels

A summary table of scheme benefit to cost ratios is provided. Notes are as per the commentary above.

C8.1.7 Scheme Comparison Chart

A chart of costs versus benefits is provided. Notes are as per the commentary above.

C8.1.8 Cost Benefit Analysis of the Overall Plan

C8.1.8.1 Benefit to be Used

The CBA of the overall plan is given: this is the sum of the individual CBAs for the schemes that were demonstrated to be cost-beneficial. The NPV of benefits figure presented here has not been updated from an earlier draft, and should be £28.7m, making the overall benefit to cost ratio 1.96. This has been completed correctly in Table C8.1, and does not affect the conclusions of the CBA.

I have verified that the total benefits do not exceed the WTP bill cap.

C8.3 Carbon Accounting

C8.3.1 Introduction

The analysis follows the Strategic Direction Statement’s aim that “In the construction of new assets and in the maintenance of existing assets, we will consider the level of carbon emissions in deciding between alternative solutions.”

C8.3.2 Overview of the Carbon Management Plan

A table is presented outlining the Company’s strategic plan for carbon management. Further details are given in a later section.

C8.3.2 Carbon Assessment

The Company has evaluated both direct and indirect emissions, relating to both embodied and operational carbon. In accordance with the guidance, it should be noted that indirect emissions have been included in the Table.

The Company commentary identifies the key assumptions made. I have reviewed the calculation sheets provided by the Company and carried out spot-checks. I can confirm that these found appropriate values to have been used, according to the guidance.

1 Calculation Methodology and Assumptions

1.1 Embodied carbon and emission associated with construction

1.1.1 Pipelines

I have verified that the embedded carbon values associated with laying pipelines are based on the appropriate UKWIR guidance. The Company’s commentary notes where assumptions or interpolations have been made, for diameters and laying methods not given in the guidance: I agree that these are reasonable.

The Company has also analysed historical data to determine typical main laying depths for each diameter.

The FBP programme represents 23.2km mains per annum. The carbon calculations originally represented a slightly shorter programme, 21.1km, and have been scaled pro-rata i.e. assuming the same mix of diameters and surfaces. In view of the relatively small difference in total lengths it is not expected that this will have impacted on the results greatly.

The emissions for new communication pipes (listed as growth mains) have been calculated from the average emissions per metre of the mains renewal scheme. The Company considers that this gives the most representative basis according to use of ductile iron rather than PE in contaminated ground, and mains depth and surface type. However, in view of the difference in diameters it should be noted that this is likely to have overestimated the embedded carbon associated with this element of the programme.

1.1.2 Membrane filters

The Company has estimated the weight of the filter and used the appropriate carbon figure from the UKWIR guidance.

1.1.3 Highwood Reservoir Roof

The Company has provided detailed calculations, based on the sum of the materials indicated in its commentary. These appear to be an appropriate measure of the work proposed.

1.1.4 All other construction activities

For other elements of the programme there are no emission values given in the guidance. The Company has used the proprietary Bottomline tool (from the Centre for Sustainability Accounting). This estimates embodied carbon based on the capital expenditure under a range of classifications.

It has not been possible to review the calculations made within this tool.

1.1.5 Uncertainty associated with emissions factors

Confidence grades have been taken from the UKWIR guidance where this has been the source of the emission values. The Company notes that for those elements evaluated using the Bottomline tool, the tool provides a range of uncertainty. These ranges have not been reported.

1.2 Operational Emissions

Operational emissions have been reported for electricity usage (as carbon emissions) and for transport fuel usage (as other GHG emissions).

Electricity usage has been estimated directly for some schemes, however for the vast majority of additional usage it has been estimated from the average cost per MI treated (taken from the June Return).

Transport fuel usage has been assessed based on expenditure held in the management accounts.

C8.3.3 Service Delivery

The Company’s commentary is self-explanatory, and provides evidence of its commitment to understanding and reducing its carbon footprint.

C8.3.4 Customer Behaviour

The Company’s commentary is self-explanatory, and outlines the measures planned to reduce carbon emissions via reduced customer demand.

C8.4 Table Commentary C8.1

The Company commentary indicates which line and column each scheme is assigned to. I make the following notes:

- Line 23 columns 3-9 should all be null entries: I have confirmed this with the Company. The issue has arisen from the import of null entries into Reservoir not overwriting previously entered numbers.
- Schemes for which CBA has not been applied, and those justified under the Common Framework, have not been given entries in columns 3 (NPV costs) or 5 (customers’ bills). It is the Company’s understanding that this is how the table is intended to be completed.
- (Line 1 Column 15: For clarity - there is a typographical error in the total in the commentary. The correct figure of £35.021m has been entered in the Table.)

The contribution to customers’ bills has been evaluated using the Target model (a tool which replicates the Ofwat financial model for use in “what if “ calculations), which I have not reviewed. However, I have carried out a simple cross-check and confirmed that the values are in line with expectation.

The figures are net of grants and contributions.

C8.5 Table Commentary C8.3

The Company commentary indicates which line and column each scheme is assigned to.

I have reviewed the calculations and carried out spot-checks. I can confirm that the appropriate discounting calculation has been used. As discounting has been carried out over the five year period of the AMP, the NPC figures in column 6 are not directly comparable to those presented in Table C8.1, where discounting has been carried out over a forty year horizon.

C8.6 Appendices

Appendices show:

- The WRc CBA model and data
- Outputs from the WRc CBA model
- The WRc CBA report
- The Frontier Economics peer review of the CBA methodology.