C5 B

Cost and Efficiency

C5B Technical Annex 22
Non-Infrastructure Base Maintenance Investment Case:
Technical Approach and Business Case

NTPBP-INV-INF-0742

BRISTOL WATER

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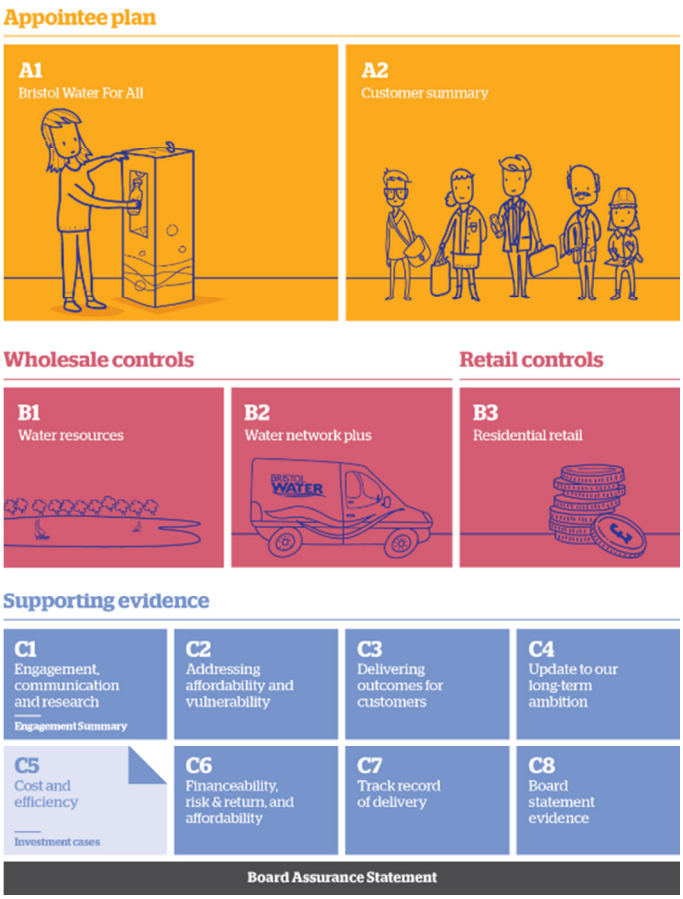
1 Foreword

This investment case concerns the levels of capital expenditure (capex) for base maintenance of non-infrastructure assets required generally and for the AMP7 and AMP8 periods in particular.

The purpose of this document is to set out Bristol Water's customer led, outcome focused plan which will mitigate risks posed by and associated with non-infrastructure base maintenance.

The investment case, one of 21, will summarise the facts, risks and investment requirements for non-infrastructure base maintenance for the next review period for 2020 to 2025. This investment case will also summarise performance related to non-infrastructure base maintenance for the current review period from 2015 to 2020 and our methodology for determining and delivering the future non-infrastructure base maintenance strategy.

This investment case document is a technical annex to section C5B of our overall business plan submission, as illustrated by the diagram below:



This investment case is aligned to the Water Network Plus Wholesale Control aspect of our business plan. It is recommended that this investment case is read in conjunction with the PR19 Investment Case Summary Document[1] which outlines in detail our methodology for defining investment.

[1] Bristol Water PR19 Investment Cases Summary Document NTPBP-INV-PR1-0635

2 Executive Summary

In order to ensure that our asset base has sufficient funding to manage risks associated with deterioration, we have assessed minimum levels of capital maintenance required for major asset types that deliver baseline performance. This allocation provides a foundation for any improvements to performance included in our business plan. We plan to invest £9.192m in non-infrastructure base maintenance interventions. We have set ourselves a challenging target of reducing out costs by 8% during AMP7. When considering our efficient and innovative approach we plan to deliver our non-infrastructure base maintenance capital programme for £8.457m.

There is a need to ensure that a baseline level of capital expenditure is included in our Investment Plan to facilitate dealing with the underlying rate of deterioration of non-infrastructure assets and provide an allowance for forecast customer driven requirements.

'Base Maintenance' is the term used to describe this requirement. It provides sufficient funding to prevent the base level of performance from declining. Insufficient base maintenance allowance would lead to a risk of worsening performance and prejudice the ability of strategic and enhancement interventions to deliver our proposed performance commitment levels.

The methodology used to calculate base maintenance links to the overall investment plan to establish whether sufficient funding has been provided to ensure that minimum values of planned expenditure have been included. Where there are clear shortfalls, additional cost provision is made to cover the discrepancies.

We plan to invest £9.192m between 2020 and 2025 in order to deal with the underlying rate of deterioration of non-infrastructure assets and provide an allowance for forecast customer driven requirements.

We have set ourselves a challenging target of improving our efficiency by 8% during AMP7. This will be achieved by delivery of our business transformation programme resulting in a post-efficiency investment of £8.457m.

62% of our investment for non-infrastructure base maintenance is associated with water treatment and 38% associated with treated water distribution business units. All investment is categorised as maintaining the long term capability of our non-infrastructure assets.

3 Background to Our Investment Case

3.1 Context

This investment case concerns the levels of capital expenditure (capex) for base maintenance of non-infrastructure assets required generally and for the AMP7 and AMP8 periods in particular. It provides a plan for individual asset categories and a mechanism for preventing double counting of interventions between this investment case and other non-infrastructure investments.

In the context of this business case the term 'base maintenance' is taken to mean:

> *Minor capital works (with no engineering design and with lower levels of supervision) managed directly by Bristol Water's Operations directorates through simple procurement processes. These works are treated as programmes within the PR19 process each representing relatively large numbers of small, like for like replacements of, for example, mechanical and electrical equipment, customer-driven requirements and works to resolve local health and safety issues. These works are on-going throughout the AMP periods.*

In essence, base maintenance relates to the expenditure required in any period to retain a base level of performance. The overall aim of this business case is to establish reasonable levels of such expenditure from the evidence of historical costs and deterioration modelling.

Excluded from this business case are interventions or asset-related schemes to provide performance enhancements or strategic capital maintenance interventions. In this context 'strategic interventions' are defined as:

> *Interventions that are individually reviewed through the Investment Planning process for PR19 and usually include larger projects that require more sophisticated or complex solutions or procurement processes and that will normally require engineering design and delivery.*

Enhancement schemes are defined as:

> *Interventions that are required to improve future performance above current levels, as dictated by statutory, regulatory or organisational requirements.*

Also excluded from this business case are the base levels of operational expenditure (opex) associated with non-infrastructure assets.

The planned capital expenditure is based on the following evidence and processes:

- Deterioration modelling of assets
- Historical expenditure analysis
- Cost- Benefit analysis of investment options

We have utilised a Water Industry standard system (Servelec 'Pioneer') to undertake deterioration modelling for our AMP7 investment plan. Pioneer provides the functionality to assess all interventions developed across our AMP7 investment cases, and produces an optimal investment plan to meet the targeted performance commitment improvements in AMP7.

The base maintenance requirements are categorised in line with the following non-infrastructure investment cases:

- Service Reservoirs & Towers
- Water Pumping Stations
- Customer Meters
- Raw Water Pumping Stations
- Treatment Works Strategic Maintenance

The fundamental risk that this business case deals with is the decline in underlying performance associated with non-infrastructure assets through an inability to deal with asset deterioration and customer demands.

Without the provision of sufficient funding for base maintenance, the proposed strategic and enhancement interventions may not be able to deliver their planned performance benefits.

3.2 Strategy

We have developed a set of outcomes and associated performance commitments. Asset related investment supports the delivery of many of these outcomes. The relevant programme of interventions and asset activities is contained in the investment cases.

Our Asset Management Strategy supports the development and delivery of our outcomes by translating organisational goals into asset management objectives. The risks to meeting these aims have been examined and a range of solution options prepared, utilising a consistent and focussed methodology. Each proposal includes its costs and benefits.

Through the use of cost-benefit analysis, we have determined the best package of interventions that deliver the required outcomes at the lowest wholelife cost. In addition, we have a clear 'line of sight' from each planned asset activity to its effect on performance and outcome.

All details of the overall process are documented as are the information and data used and produced in the assessments. Reviews have been undertaken of all main stages of the procedures including the quality of supporting information.

Base maintenance assessment forms a foundation for all strategic interventions and consequently the delivery of our outcomes and performance commitment levels. This investment case provides a level of minimum expenditure for a number of asset activities. These minimum amounts are subsequently adjusted to reflect the total maintenance provisions already included in the overall investment plan.

3.3 Customer Priorities

Customer priorities relating to our outcomes, performance commitments and outcome Delivery Incentives (outcome delivery incentive) have been determined through customer Engagement and Research. This ensures that we have engaged effectively with customers on longer-term issues such as resilience, and has taken into account the needs and requirements of future customers. Through this process the high level objectives, known as outcomes, that customers value most have been identified as:

- Excellent Customer Experiences
- Safe and Reliable Supply
- Local Community and Environmental Resilience
- Corporate and Financial Resilience

To secure these outcomes, and based on the customer priorities, we have developed innovative and sector-leading performance commitments together with corresponding outcome delivery incentives. The performance commitments are therefore, in effect, a measure of what the customer wants.

As this business case deals with base levels of maintenance, it is not specifically driven by customer priorities. However, base maintenance delivers a base level of performance that supports several performance commitments.

Customer consultation has demonstrated strong support for reducing supply interruptions. These are primarily caused by the effects of burst mains and overlong planned mains rehabilitation. However, non-infrastructure base maintenance supports the reduction of supply interruptions through the maintenance of mechanical and electrical assets within our treatment works and pumping stations.

The maintenance of non-infrastructure assets generally also supports compliance with the following performance commitments:

- Water quality compliance, as measured by the Compliance Risk Index (CRI) (in terms of compliance failures at treatment works and service reservoirs)
- Supply interruptions
- Unplanned outages
- Meter penetration
- Turbidity
- Unplanned maintenance events (non-infrastructure)

Base maintenance by definition does not provide additional performance improvements. However, it is the foundation upon which strategic and enhancement schemes are built.

The health of our assets is a key element in delivering resilient water services to our customers. Our non-infrastructure base maintenance investment will help ensure our assets are being maintained appropriately for the benefit of current and future generations.

3.4 AMP7 performance commitments & outcome delivery incentives

Non-infrastructure base maintenance provides a baseline platform for a number of performance commitments. However, it does not contribute directly to performance improvements.

Similarly, base maintenance has no effect on outcome delivery incentives, other than it provides the foundation for interventions that are designed to deliver improved performance.

3.5 Compliance Obligations

The Water Industry Act 1991 requires every water undertaker to develop and maintain an efficient and economical system of water supply within its area. It is therefore necessary to ensure that existing assets are well managed and repaired or replaced as necessary to maintain a robust water supply system.

We have a statutory obligation under the Water Supply (Water Quality) Regulations 2016 to ensure that all water supplied to our customers meets prescribed Water Quality Concentrations or Values. Our obligations are defined as undertakings for the Drinking Water Inspectorate.

Health and Safety legislation requires water undertakers to provide safe working environments for staff and the public. Assets need to be maintained to minimise hazards related to asset condition and location.

4 Developing Our Investment Case

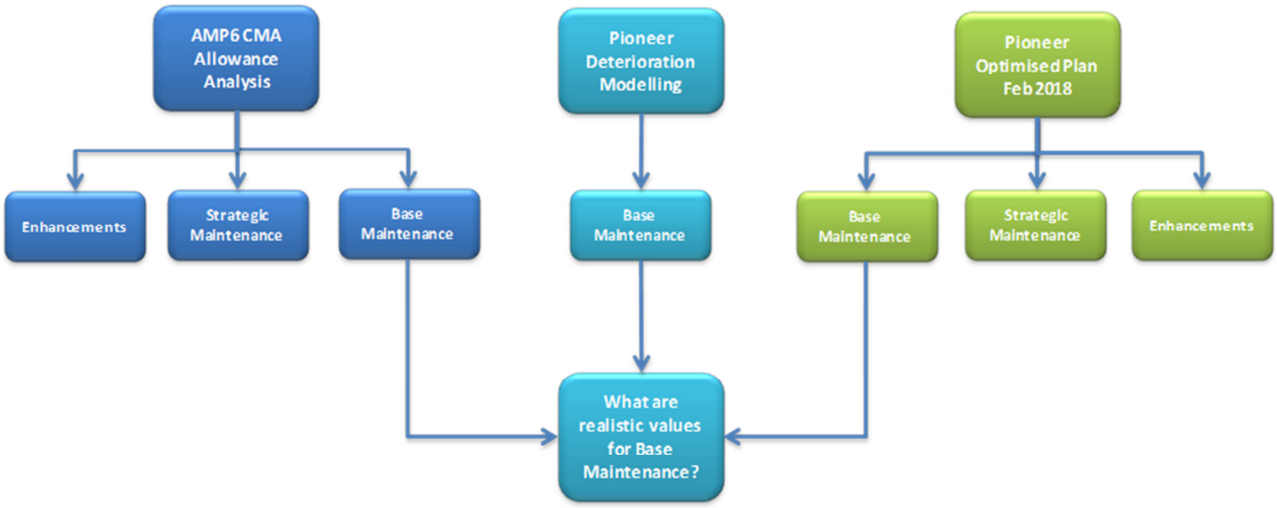
4.1 Investment Case Development Process

In this section, the evidence for base maintenance expenditure levels is examined in terms of cost and preserving assets to sustain prevailing performance. Support for establishing such levels is obtained from a three main sources as illustrated in Figure 1. These three main sources are:

- Historical activity and costs;
- Deterioration modelling to establish underlying asset deterioration; and
- Investment planning analysis.

These three main sources are considered singly and in the ways their individual results provide collaborative evidence.

Figure 1: Evidence sources for base maintenance expenditure



4.1.1 AMP6 Costs Analysis – Competition and Markets Authority Determination

The costs allowed by the Competition and Markets Authority (CMA) in their final determination for the AMP6 period were chosen as they represent an externally approved budget for capital expenditure.

An analysis has been carried out on the overall capital programme as determined by the Competition and Markets Authority to allocate costs between the ‘base maintenance’, ‘strategic maintenance’ and ‘enhancement’ categories, based on the definitions described in Section 2.

The values in Table 1 show the breakdown of AMP6 expenditure against the principal asset maintenance groups for non-infrastructure mechanical and electrical assets, structural assets, and meter replacement.

Table 1: AMP6 non-infrastructure base maintenance – Competition and Markets Authority redetermination

Base Maintenance Expenditure Category	Expenditure (£m)	Asset Group
TW Equipment Failures	10.600	Mechanical and electrical activities
Civil Structures Inspections	5.400	Structural inspections and associated work
Treatment Works: Other	2.400	Mechanical and electrical activities
Treatment Works (Sub Total)	**18.400**	
PS General Pump Replacement	5.200	Mechanical and electrical activities
Pumping Stations (Sub Total)	**5.200**	
Potable Structures Inspections	4.100	Structural inspections and associated work
Reservoirs and Towers (Sub Total)	**4.100**	
Meter Replacement (Sub Total)	**4.500**	Meter replacement activities
Total AMP6 Non-Infrastructure Base Maintenance	**32.200**	

In terms of how the activities associated with these costs are managed and how they may be compared with the deterioration benchmark categories, the AMP6 expenditure can be expressed as shown Table 2.

Table 2: AMP6 Non-infrastructure base maintenance expenditure by category

Non-Infrastructure Base Maintenance Asset Group	Expenditure (£m)
Mechanical and electrical activities	18.200
Structural inspections and associated work	9.500
Meter replacement activities	4.500
Total AMP6 Non-Infra Base Maintenance by Category	**32.200**

4.1.2 Deterioration modelling – Mechanical and electrical assets

We currently do not have sufficient long-term historical failure data to produce comprehensive deterioration models. This issue has already been addressed and suitable data have been collected for over two years. However, it is considered that at least five years' data are required to produce most mechanical and electrical deterioration models.

A benchmark analysis has been carried out using our in-house asset and cost data and a 'standard' deterioration models provided by our consultant, Servelec. These 'standard' models are based on an amalgamation of fault and failure data from a number of other water utilities.

The asset data are taken from our company financial, operational and asset systems system, and the costs used are derived from our in-house experience. The deterioration models, however, are not

based on our data but on industry-wide information. As a consequence, the results of the deterioration modelling are considered to be a reasonable guide.

In order to provide the most suitable comparison with historical costs, a deterioration analysis of mechanical and electrical assets was undertaken assuming no proactive interventions were applied in the AMP7 and AMP8 periods. This is the equivalent of assessing the natural rate of rise of deterioration and the activities that would be needed to address the resulting failures. This provides an indication of an absolute minimum level of expenditure that is required. Table 3 shows the results of the analysis.

Table 3: Deterioration results for mechanical and electrical assets

	Projected Expenditure (£m)	
Process Type	**AMP7 Total**	**AMP8 Total**
Air	-	-
Chlorination	0.135	0.171
Clarification	1.181	1.340
Destratification	0.104	0.147
Effluent	1.383	1.553
Electrical Distribution	0.271	0.285
Electrochlorination	0.422	0.541
Filtration	1.207	1.304
Final Water	0.110	0.113
Generation	0.630	0.675
Other	-	-
Oxidation	0.020	0.257
Ozone	1.324	1.785
pH Correction	0.227	0.244
Plumbo-Solvency	0.115	0.147
Pumping	4.415	4.760
Raw Water	0.510	0.558
Site Serv	0.001	0.001
Softening	0.037	0.074
Telemetry	0.247	0.258
Ultra Violet	0.474	0.669
Total	**12.812**	**14.652**

The on-going trend, as would be expected, shows a gradually increasing degree of asset failure, as shown in Figure 2 and Figure 3.

Figure 2: Trend of all mechanical and electrical asset failures with no proactive interventions

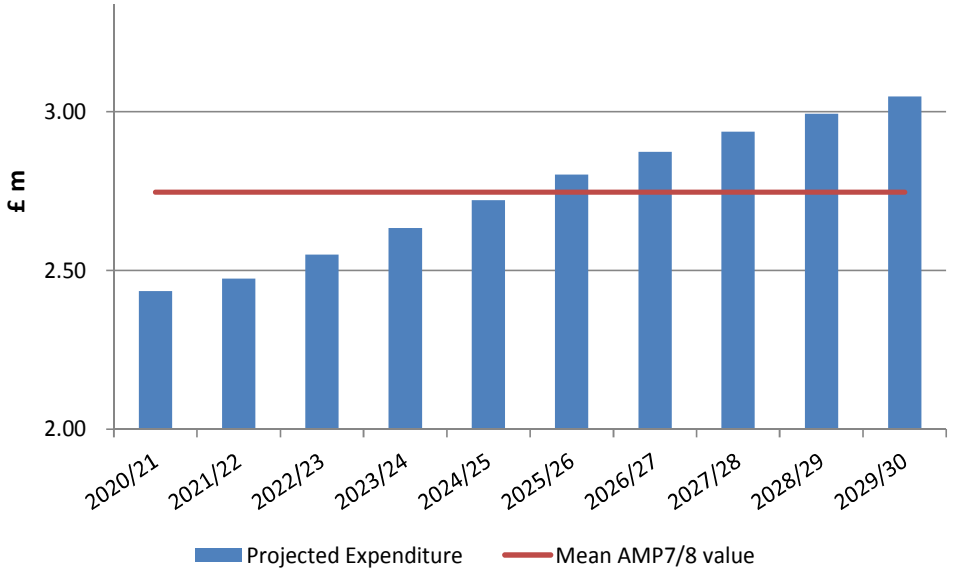
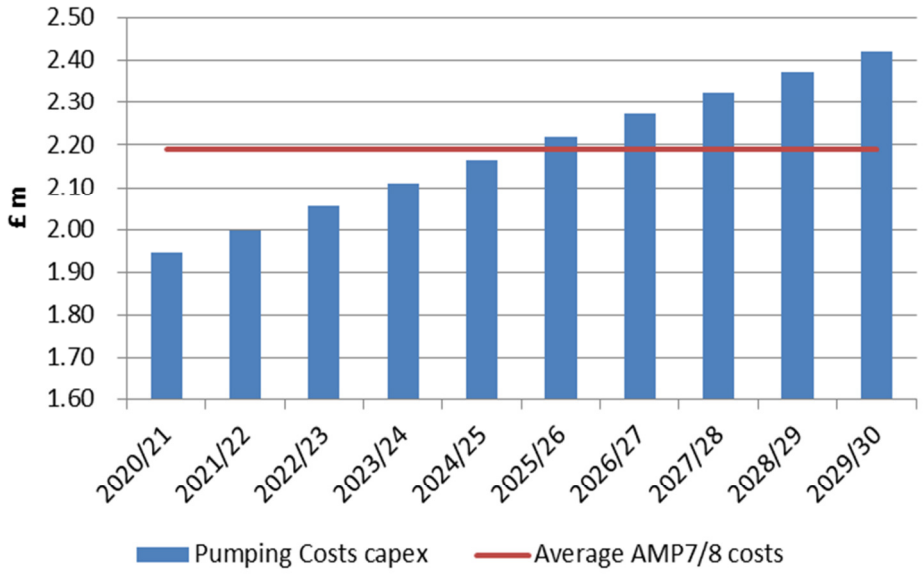


Figure 3: Trend of pump failures with no proactive interventions

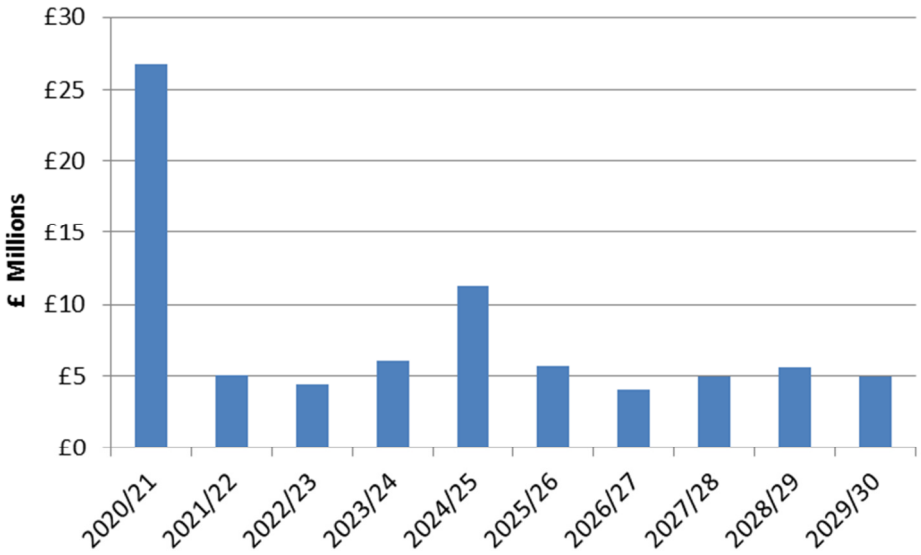


Costs shown are those associated with major replacement or rehabilitation works on failed assets. These are treated as capex. Minor fault repairs are treated as opex. Historically, minor repairs to these asset types have low values of opex associated with them.

A separate deterioration analysis has been carried out to look at the degree of proactive work required for non-infrastructure mechanical and electrical assets. The results of this assessment are shown in Figure 4.

The costs are indicative and illustrate the general pattern of expenditure. The high peak in the first year is partly caused by gaps in age data and also by the actual ages of many assets being beyond the normal renewal period.

Figure 4: Proactive intervention trend - mechanical and electrical assets



However, the main reason for the spike is that the most cost beneficial interventions are selected based on whole life costs. The implication is that whilst, on whole life cost grounds a significantly high number of interventions may be justified in the first part of AMP7, there is no pressing need from a deterioration viewpoint. The report[2] by our consultant accompanying the analysis recommends that "the underlying average spend in the stable service optimisation is therefore the best estimate of base maintenance level". It suggests "a value in the region of £4 to 6 million a year" is appropriate. It also suggests that the "true figure is likely to lie towards the top of this range".

In view of the inherent uncertainty in the cost models used in the deterioration analysis, it is considered inappropriate to take the highest value in the range. Bearing in mind the AMP6 Competition and Markets Authority allowance of £18.2m and the likelihood that some deterioration may require early attention, it is considered that the base maintenance levels should set as shown in Table 4.

Table 4: AMP7 and AMP8 base maintenance levels - mechanical and electrical assets

Period	Base Maintenance Level (£M)
AMP7	25.000
AMP8	20.000

These values are the maximum amounts and should be adjusted by subtracting the total mechanical and electrical 'capex before' or 'do nothing' capex estimates from chosen interventions in any plan produced by the optimiser (see Section 4.1.6).

[2] 'Non-Infrastructure Methodology' report, Servelec Technologies, 29 March 2018

4.1.3 Structures and Buildings

No deterioration analysis has been carried out on structures and buildings. Therefore, the principal sources for cost estimation are historical costs.

As shown in Table 1, the current level of expenditure in this category is £5.4m for treatment works structures and buildings inspections and remedial works, and £4.1m for inspections and remedial work associated with service reservoir structures and buildings.

Current data on actual work on operational buildings is not readily available. Almost all work carried out at present is reactive and therefore historical expenditure levels provide the best current source of data for estimating future costs.

It is considered that the current level of expenditure for treatment works structures and buildings is sufficient and should be retained at a slightly inflated value of £5.5m.

Similarly, there is no additional evidence that the work associated with service reservoirs structures and buildings should be different in AMP7 from that in AMP6. It is considered therefore that a level of £4.2m is appropriate for AMP7.

4.1.4 Meters

Customer meter replacement is currently governed by Company policy to replace meters after 18 years. The relevant intervention for meter replacement follows this policy and also allows for a degree of failures within the 18-year period.

Interventions also exist within the Customer Meters Investment Case for the meter option scheme and for installing new meters when a change of occupancy occurs. These interventions will not overlap with age-based meter replacement.

The AMP6 base maintenance Competition and Markets Authority determined spend on meter related work is £4.5m. This value excludes additional work associated with the ‘Meter 66’ initiative.

Deterioration modelling for customer meters used our consultant’s ‘standard’ deterioration model which includes an economic appraisal of meter under registration. This ‘standard’ model’s meter under registration assessment is based on under registration data from a number of customers from other water companies. There is also an allowance for reactive replacements.

An in house deterioration model was developed during AMP6 which determined the economic replacement age at 18 years. This model used company specific meter under registration data.

4.1.5 Summary of Output and Expenditure Allowances

From the explanations provided in the preceding sections, the minimum intervention expenditure provisions listed in Table 5 are proposed for AMP7 non-infrastructure base maintenance investment

Table 5: Minimum Intervention Values – AMP7 Non-infrastructure base maintenance

Intervention ID	Category	Notes	Minimum AMP7 Base Maintenance Capex Provision (£m) (2016/17 prices)
100.003.01	Mechanical and electrical	Includes all non-infrastructure mechanical and electrical assets in treatment works and pumping stations	25.000
Basis: value set following deterioration analysis and recommendation from our consultant. Whilst the AMP6 cost is slightly lower than £25m, there is evidence that there has been historical underfunding and that the most cost beneficial strategy would be to carry out more maintenance early in AMP7.			
100.003.02	Treatment Works Civils	Structures, buildings and site works in treatment works and operational buildings	5.500
Basis: historical expenditure and the evidence that backlogs exist in structural repairs.			
100.003.03	Service Reservoirs	Service reservoirs and towers inspections and remedial work	4.200
Basis: historical expenditure			
100.003.04	Customer Meters	Age based replacement of customer meters	4.500
Basis: historical expenditure			
Total AMP7 Non-Infra Base Maintenance minimum expenditure requirement			**39.200**

4.1.6 Adjustments

The allowance for mechanical and electrical assets (intervention 100.003.01) is adjusted by deducting the total AMP7 values of 'capex before' (reactive cost) amounts related to mechanical and electrical assets from all interventions included in the AMP7 plan that relate to the following three investment cases:

- Water Pumping Stations Investment Case;
- Raw Water Pumping Stations Investment Case; and
- Treatment Works Strategic Maintenance Investment Case.

The calculation for mechanical and electrical base maintenance follows the following three steps:

1. Each selected intervention within the three investment cases listed above is examined to assess whether a value for 'capex before' is attributed to the intervention. Excluded from this assessment are any interventions that are not directly related to mechanical and electrical assets or are themselves proactive base maintenance activities (specifically, intervention 04.002.01 'Pumping Stations Base Maintenance (Minor Works)')

2. The value of 'capex before' is multiplied by 0.7 to recognise that the typical cost of a proactive intervention is 70% of a reactive intervention. 'Capex before' is an estimate of the reactive cost of dealing with failure. However, the deduction from the minimum base maintenance value assumes that the work would be carried out proactively. Typically, proactive mechanical and electrical jobs cost 70% of the equivalent reactive work.

3. The sum of the adjusted 'capex before' values is subtracted from the minimum value for mechanical and electrical investment (intervention 100.003.01) to provide the residual base maintenance requirement, with the proviso that the resultant value cannot be less than zero. This resultant value is the AMP7 mechanical and electrical base maintenance allowance.

For all other non-infrastructure base maintenance interventions (treatment works civils, service reservoirs and towers inspections and remedial work, and customer meters replacement), the interventions selected through the optimisation process are examined to assess whether the minimum provision is inherently met through the total 'capex before' element for the particular asset group non-infrastructure base maintenance requirement. The investment cases and interventions that are used to determine the non-infrastructure base maintenance intervention provisions are set out in Table 6.

Table 6 Determinants of AMP7 Infrastructure Base Maintenance Provision

Intervention ID	Intervention Title	Investment cases and interventions – determinants of AMP7 Base Maintenance Capex Provision
100.003.02	Treatment Works Civils	Water pumping stations investment case – all interventions; Raw water pumping stations investment case – all interventions ; and Treatment work strategic maintenance investment case – all interventions.
100.003.03	Service Reservoirs	Service reservoirs and towers investment case - intervention 03.003.01 (Service Reservoir Inspections)
100.003.04	Customer Meters	Customer meters investment case – intervention 07.006.01 (Replacement of Customer Meters)

Where the minimum base maintenance provision is not met, the sum of relevant intervention 'capex after' values is subtracted from the values shown in Table 5 to provide the residual base maintenance requirement, with the provision that no base maintenance value should be less than zero. The results of this are given in Section 5.1.1.

4.2 Data & Data Assurance

The development of our investment cases is dependent on having consistent, accurate and assured data. We therefore recognise that we must be able to demonstrate the quality of the data and information used in the development of our investment cases.

Wherever possible, we have utilised data from our core company systems in order to undertake our analysis and we have sense checked the quality of the data as we have used it.

However, in addition, we have applied a data assurance methodology. We have assessed data quality in terms of completeness, accuracy and reliability. In addition, the methodology also assesses whether data is used as part of the Annual Performance Report to Ofwat, and hence already subject to existing Annual Performance Report assurance mechanisms.

In total we have developed twenty one investment cases. The values of these investment cases range from less than £1m to over £37m. Our overall capital investment plan totals circa £212m.

We have selected a sample of nine investment cases, and have applied detailed data assurance based on their value and complexity. The total value of these nine investment cases represents 66% (circa £140m) of the total capital investment plan, and represents 286 individual data types. We have evaluated all 286 data types and we have evaluated them for quality and their use in the Annual Performance Report process. The overall data quality assessment identified 93% of the data as being good quality, and 55% as having been used and assured through the Annual Performance Report process.

This investment case was not included as part of the sample of nine investment cases. We will continue to focus on improving the quality of our data and the associated assurance processes.

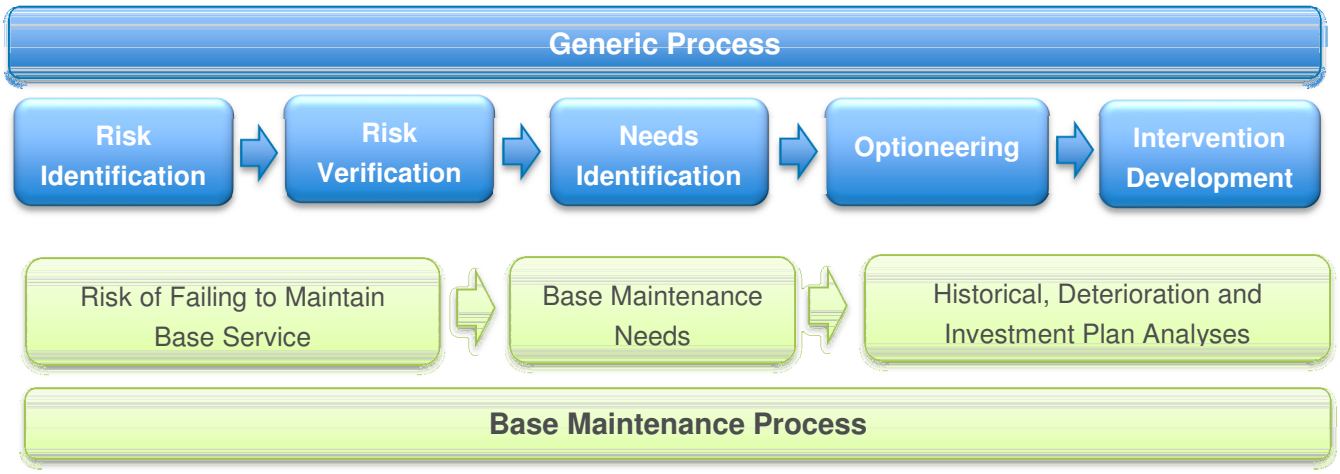
4.3 Investment Case Risk Identification, Verification and Needs Assessment

The assessment of base maintenance requirements examines risk in a different way from that used in other investment cases.

This is primarily because we are concerned with establishing levels of asset rehabilitation required to sustain prevailing levels of relevant performance. The risk being addressed is that of failing to retain a baseline performance level rather than a group of individually identified hazards.

Figure 5 shows the basic relationship between the generic process for risk and needs identification and that used for base maintenance.

Figure 5: Generic and Base Maintenance Assessment Processes



4.4 Optioneering & Intervention Development

The standard procedures for optioneering and intervention development are not applicable in this business case. See Section 4.3 for the basic relationship between the generic process and that used for base maintenance.

Base maintenance requires the provision of sufficient funds to sustain prevailing levels of service. Interventions are many and varied but, in the case of non-infrastructure assets, are largely limited to small scale repairs, rehabilitation and replacements.

The methodologies used to derive suitable funding levels have been described in previous sections.

4.5 Intervention Costing

Costing of mechanical and electrical asset rehabilitation used cost models based on our recent costs for maintenance work. Standard uplifts were applied to invoiced costs to reflect the additional costs of installation, administration and other overheads. The costs do not, therefore, directly correspond to those used for specific strategic interventions.

Other estimates are based on historical costs, uplifted to the standard price level of 2017/18.

4.6 Benefits Quantification

Non-infrastructure base maintenance provides a baseline platform for a number of performance commitments. However, it does not contribute directly to any performance improvements.

Base maintenance has no effect on outcome delivery incentives, other than it provides the foundation for interventions that are designed to deliver improved performance.

5 Outcome

5.1 Investment Optimisation & Intervention Selection

The optimisation process determines which intervention options provide the optimal AMP7 investment plan, by delivering the required levels of performance improvement at the lowest cost. We have utilised a Water Industry standard system (Servelec 'Pioneer') to optimise its AMP7 investment plan. Pioneer provides the functionality to assess all the interventions developed in the Investment Cases, and produces an optimal investment plan to meet the required levels of performance improvement in AMP7. Pioneer assesses interventions primarily on the overall benefit in terms of performance and wholelife cost.

The AMP7 investment plan optimisation process is described in full in the Investment Optimisation Methodology – refer to the PR19 Investment Cases Summary Document.

The non-infrastructure base maintenance requirements are derived from the methodology described in Section 4, adjusted by interventions selected through the optimisation process.

5.1.1 Selected Interventions

The non-infrastructure base maintenance investment, including Water Service and Business Unit Allocation, is summarised in Table 8.

The non-infrastructure base maintenance requirements are derived from the interventions selected through the optimisation process, and are summarised in Table 7 along with details of the associated costs.

When it comes to delivering our programme of works we know that we must continue to be innovative and efficient. We have set ourselves a challenging target of improving our efficiency by 8% during AMP7. This will be achieved by delivery of our business transformation programme.

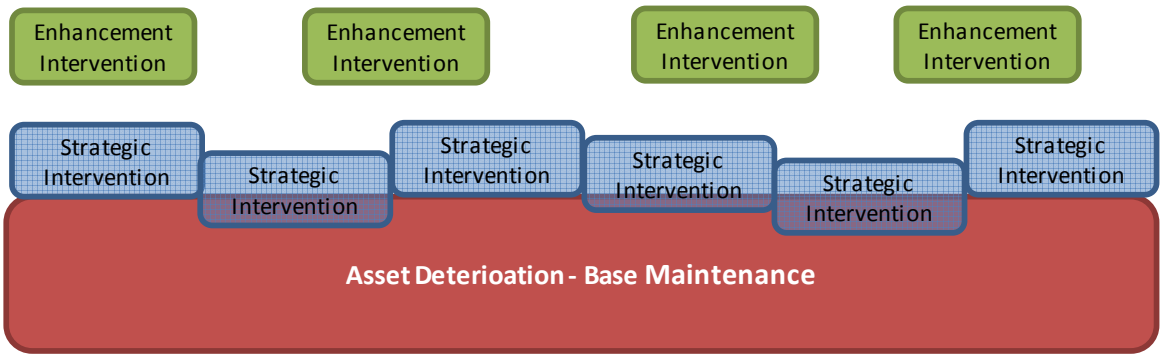
We see innovation as an integral to our everyday working at Bristol Water. We have deliberately embedded it within the business-as-usual processes of our asset management teams by embracing the full flexibility that Totex and outcomes enables. We will look to be innovative in the following ways:

- **Open Innovation:** We have defined our strategic innovation challenges and run events such as our "Innovation Exchange" that invite suppliers to present their innovative solutions to predefined challenges that we set
- **Market Scanning:** We conduct market scanning through for cutting edge technology against our strategic innovation challenges and feed this into our optioneering process. In particular we subscribe to the Technology Approval Group which regularly scans and meets with water companies to unearth the most promising innovations for the sector
- **Partnering:** we undertake leading research into areas that we provide effective solutions for the future.

We will specifically look for innovations that mean we can contribute to our 8% efficiency challenge and keep our customers' bills low into the future.

In relation to infrastructure assets, an example of such innovation is a move towards future optimisation, based on deterioration as a foundation, as illustrated in Figure 6.

Figure 6: Deterioration-based approach to non-infrastructure optimisation



The Infrastructure Base Maintenance selected interventions are set out in Table 7, along with details of the associated costs.

Table 7: Summary of selected interventions in the non-infrastructure base maintenance investment case

Intervention ID	Intervention Title	Total Capex (£)	Change in Opex (£)
100.003.01	**Mechanical & Electrical assets** (Treatment Works and Pumping Stations)	**2,767,000**	0
	Derived from the minimum value of £21m, with a deduction of £18.233m of adjusted 'capex before' values for relevant selected interventions in the overall investment plan, in accordance with the adjustment mechanism as described in Section 4.1.6. Remaining AMP7 provision set as base maintenance.		
100.003.02	**Treatment Works Civils**	**4,300,000**	0
	Minimum requirement of £5.5m partially covered by selected Treatment Works civils interventions with a value of £1.2m; remaining AMP7 provision set as base maintenance.		
100.003.03	**Service Reservoirs**	**2,125,000**	0
	Minimum requirement of £4.2m partially covered by selected Service Reservoirs inspection interventions with a value of £1.2m; remaining AMP7 provision set as base maintenance for remedial works.		
100.003.04	**Customer Meters**	**0**	0
	Minimum allowance of £4.5m covered by selected metering interventions.		
Total non-infrastructure base maintenance capital investment		**9,191,873**	**0**
Total non-infrastructure base maintenance capital investment with 8% efficiency applied		**8,456,523**	

The total Non-Infrastructure Base Maintenance investment, including Water Service and Business Unit Allocation, is summarised in Table 8. This investment case is aligned to the Water Network Plus Wholesale Control category of our Business Plan. Costs are allocated to the Water Treatment and Treated Water Distribution Business Units. Investment is all related to maintaining the long term capability of our non-infrastructure assets.

Table 8: Non-Infrastructure base maintenance investment – Water Service and Business Unit Allocation

Wholesale Control	Water Network Plus		Total
Business Unit Allocation	***03 Water Treatment***	***04 Treated Water Distribution***	
Non-Infrastructure Base Maintenance capital investment (%)	**61.8%**	**38.2%**	**100%**
Non-Infrastructure Base Maintenance capital investment	**£5.683m**	**£3.508m**	**£9.192m**
Maintaining the long term capability of the assets - non-infra	£5.683m (61.8%)	£3.508m (38.2%)	**£9.192m (100%)**
Non-Infrastructure Base Maintenance capital investment with 8% capex efficiency			**£8.457m**

5.1.2 Contribution to performance commitment Targets

Base maintenance provides a foundation level of asset activity. As such its contribution to performance commitment targets is to ensure that strategic interventions deliver additional performance benefits where required.

5.1.3 Non-Selected Interventions

Base maintenance does not define individual interventions. It describes minimum levels of capex required to retain underlying performance.

In line with the methodology described in Section 4, the base maintenance allocations are listed in Table 7.

5.2 Assumptions

There are a number of general assumptions that have been made in the development of our investment cases. These are discussed in detail in the PR19 Investment Cases Summary Document. Assumptions specific to this investment case are discussed below.

The need for a separate provision for non-infrastructure base maintenance is founded on the knowledge that interventions included in other non-infrastructure related investment cases are risk specific and do not necessarily take account of all capital maintenance requirements. This base maintenance business case states a minimum requirement together with a means of adjusting that value to allow for base maintenance elements of relevant selected strategic interventions.

Base maintenance in this investment case is restricted to capital items only; so does not include operating expenditure maintenance activities such as inspections, servicing, replacement of consumables and calibration.

Deterioration analyses are based on our asset and cost data but rely, for failure data, on industry wide models.

Note: 'Capital maintenance' is defined as: Planned work by appointed water companies to replace and renovate water assets to provide continuing services to consumers (Ofwat definition).

5.3 AMP8

Mechanical and electrical asset deterioration is shown by the models employed to be reasonably constant over time with a slight slowdown forecast if proactive replacement were to be carried out. It is therefore reasonable to assume that base maintenance provision for minimum allowances for non-infrastructure assets should remain the same for the AMP8 period as for AMP7.

Other aspects exhibit fairly steady expenditure profiles over time and therefore the AMP8 expenditure requirements will be broadly similar to those of AMP7.

Provided the funding for the base maintenance activities listed in Table 7 is provided and the other related interventions are carried out, there will be no residual risk additional to those listed in the following investment cases:

- Treatment Works Strategic Maintenance
- Raw Water Pumping Stations
- Treated Water Pumping Stations
- Service Reservoirs and Towers
- Customer Meters

5.4 Base Maintenance

All or part of estimates for some strategic non-infrastructure interventions (as detailed in other relevant investment cases) are categorised as 'base maintenance'. The methodology used to assess the underlying non-infrastructure base maintenance requirement takes account of contributing values from such strategic schemes. Therefore, there is a balance between the contributions made by strategic interventions and the overall base maintenance provision.

6 Conclusions

The non-infrastructure base maintenance interventions proposed as part of this investment case provide a baseline platform for a number of performance commitments, and provide the foundation for interventions that are designed to deliver improved performance.

We plan to invest £9.192m in non-infrastructure base maintenance interventions. We have set ourselves a challenging target of reducing out costs by 8% during AMP7. This will be achieved by delivery of our business transformation programme, resulting in a post-efficiency investment of £8.457m.

Our plan will provide assurance that it will deliver and monitor delivery of its outcomes, meet relevant statutory requirements and licence obligations and take account of the UK Government strategic policy statements.

The allowance for non-infrastructure base maintenance derived using the methodology and data described in this business case provides a prudent and reasonable expenditure plan for small scale planned and reactive activities to sustain the relevant asset base.

7 Appendices

- Appendix A: Datasets Used

7.1 Appendix A: Datasets Used

Data used in this investment case are as described in the previous sections.

Table 9 provides a summary of the main data sources.

Table 9: Data Sources

Data	Use	Source
Asset Data	Used for deterioration analysis	SAP
Cost Data	For deterioration analysis	Bristol Water
	For AMP6 cost analysis	Bristol Water – Capital Programme
Deterioration Data	For deterioration analysis	Servelec report
Intervention Costs		Investment Cases *See individual investment cases*