water industry commission FOR SCOTLAND

Entity A: the use and analysis of the RFI information and other benchmarks

July 2021

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This presentation provides an audit trail for the amalgamation analysis…

- Financial model for amalgamated entity
- Financial model assumptions and references
- Modelling the scope for efficiency
- Monte-Carlo analysis for amalgamated entity
- Additional Monte-Carlo sensitivity analysis
- Conclusions
- Appendices

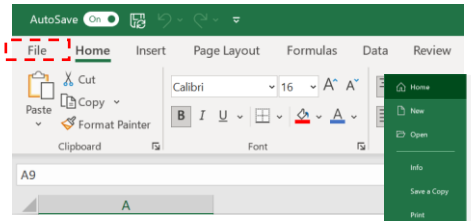
This presentation provides an audit trail for Entity A of the following amalgamation scenario*…

Group	Councils included
A	Auckland, Far North, Kaipara, Whangarei
B	Hamilton, Hauraki, Kawerau, Matamata-Piako, New Plymouth, Opotiki, Otorohanga, Rangitikei, Rotorua Lakes, Ruapehu, South Taranaki, South Waikato, Stratford, Taupo, Tauranga, Thames-Coromandel, Waikato, Waipa, Waitomo, Western Bay of Plenty, Whakatane, Whanganui
C	Carterton, Central Hawke's Bay, Chatham Islands, Gisborne, Hastings, Horowhenua, Kapiti Coast, Lower Hutt, Manawatu, Marlborough, Masterton, Napier, Nelson, Palmerston North, Porirua, South Wairarapa, Tararua, Tasman, Upper Hutt, Wairoa, Wellington City
D	Ashburton, Buller, Central Otago, Christchurch, Clutha, Dunedin, Gore, Grey, Hurunui, Invercargill, Kaikoura, Mackenzie, Queenstown-Lakes, Selwyn, Southland, Timaru, Waimakariri, Waimate, Waitaki, Westland

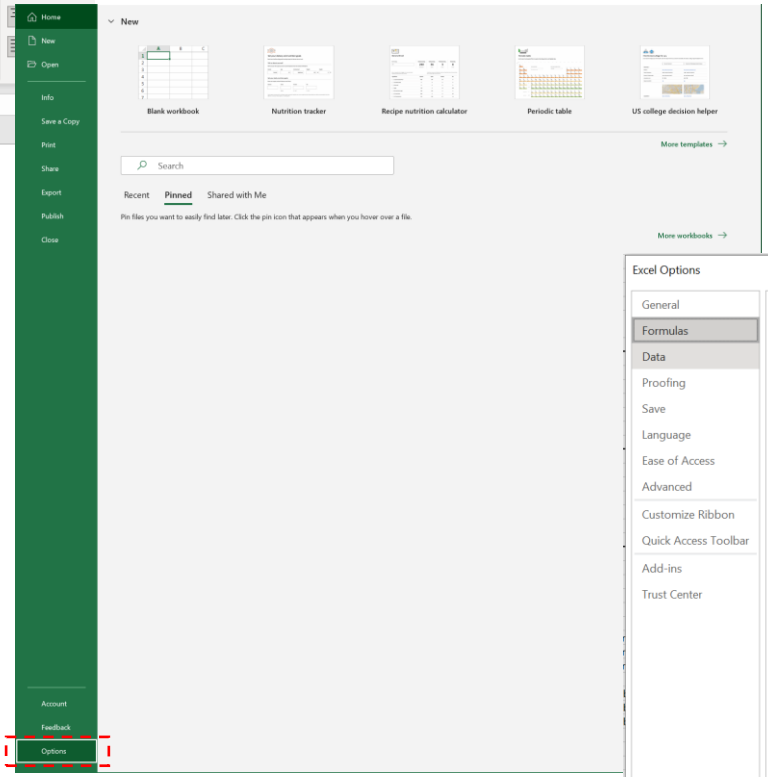
*This is the four entity scenario presented in the WICS final report. It relates to scenario 30: Latitude Split Extended Catchment B in the Supporting Material Part 3.

WICS has developed a financial model for Entity A. To use the model…

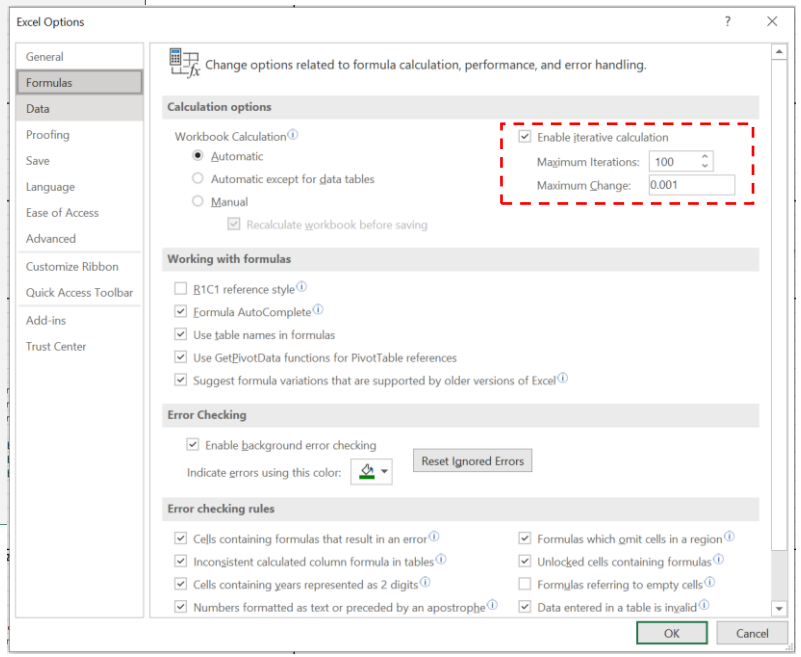
Step 1: Select File



Step 2: Select Options



Step 3: Select Enable iterative calculations



The model outputs are provided in the ‘average cost per household’ tab…

This sheet shows how revenues in the year are converted into an average cost per household. It involves three steps - these are:

1. Multiply the revenue requirement in the year (2020, 2031 or 2051) by the percentage of revenue that relates to household customers.

2. Calculate the average cost per household by dividing the output from step 1 by the assumed number of connected household properties.

3. Convert the average cost per household from step 2 into current dollars based on projected inflation of 2.2% per annum over the period.

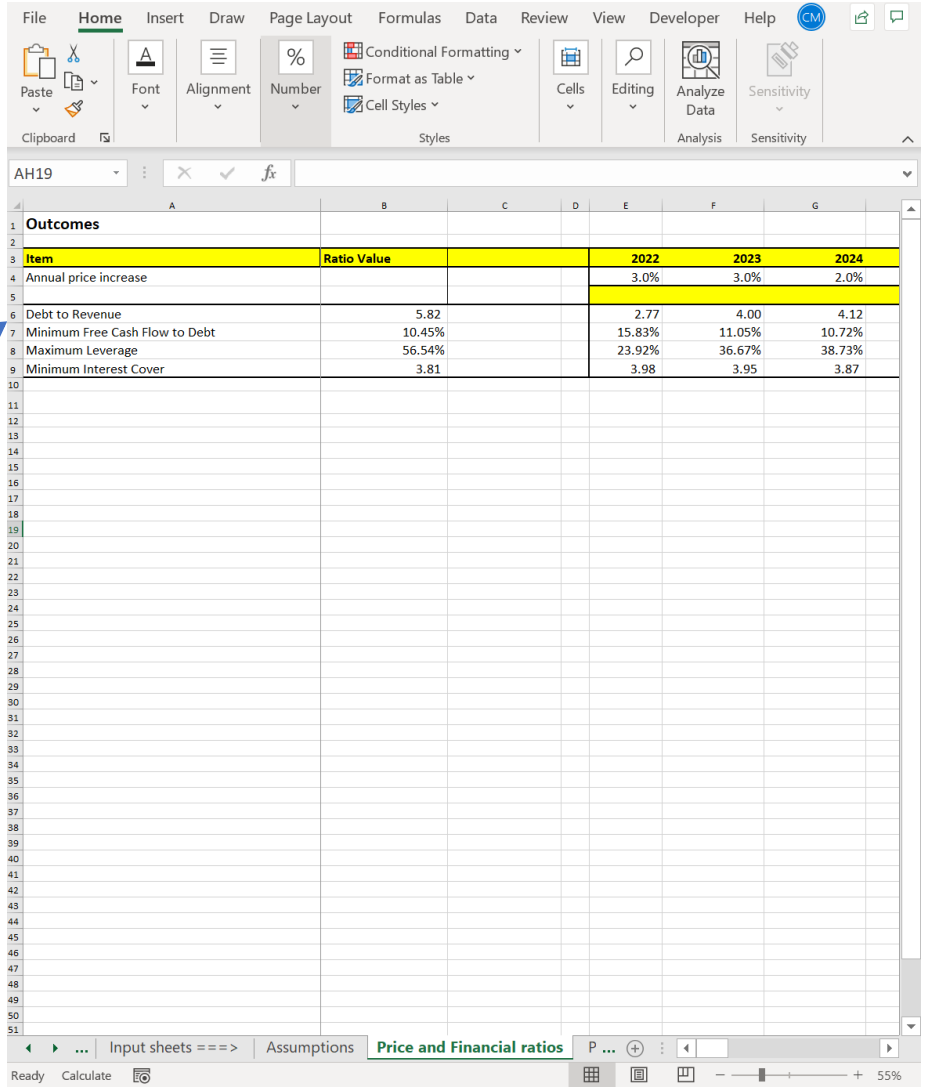
Average cost per household in 2020		
Revenue in 2020	$ 1,002,514,235	See data sheet
Assumed revenue from households	70%	New Zealand wide assumption based on the observed split in Great Britain
Assumed household connected properties	639,205	See data sheet
Estimated average cost per household in 2020 (current dollars)	$ 1,098	
Inflation factor (projected outturn to current dollars)	1.00	
Estimated average cost per household in 2020 (current dollars excluding Goods and Service Tax)	$ 1,098	
Average cost per household in 2031		
Revenue in 2031 in projected 2031 prices	$ 1,451,887,116	See data sheet
Assumed revenue from households	70%	New Zealand wide assumption based on the observed split in Great Britain
Assumed household connected properties in 2031	786,203	See data sheet
Estimated average cost per household in 2031 (projected 2031 dollars)	$ 1,293	
Inflation factor (projected outturn to current dollars)	1.27	Assumed inflation of 2.2% per annum from DIA's commercial and financial advisors
Estimated average cost per household in 2031 (current dollars excluding Goods and Service Tax)	$ 1,018	
Average cost per household in 2051		
Revenue in 2051 in projected 2051 prices	$ 2,680,090,912	See data sheet
Assumed revenue from households	70%	New Zealand wide assumption based on the observed split in Great Britain
Assumed household connected properties in 2051	1,189,389	See data sheet
Estimated average cost per household in 2051 (projected 2051 dollars)	$ 1,577	
Inflation factor (projected outturn to current dollars)	1.96	Assumed inflation of 2.2% per annum from DIA's commercial and financial advisors
Estimated average cost per household in 2051 (current dollars excluding Goods and Service Tax)	$ 803	

The model outputs are calculated by inputting prices that allow for a level of financial strength consistent with an investment grade credit rating…

In the ‘Price and Financial ratios’ tab…

…Input prices here…

…To be consistent with a funds flow from operations to debt ratio of around 10%, in line with what would be appropriate for a regulated three waters entity…

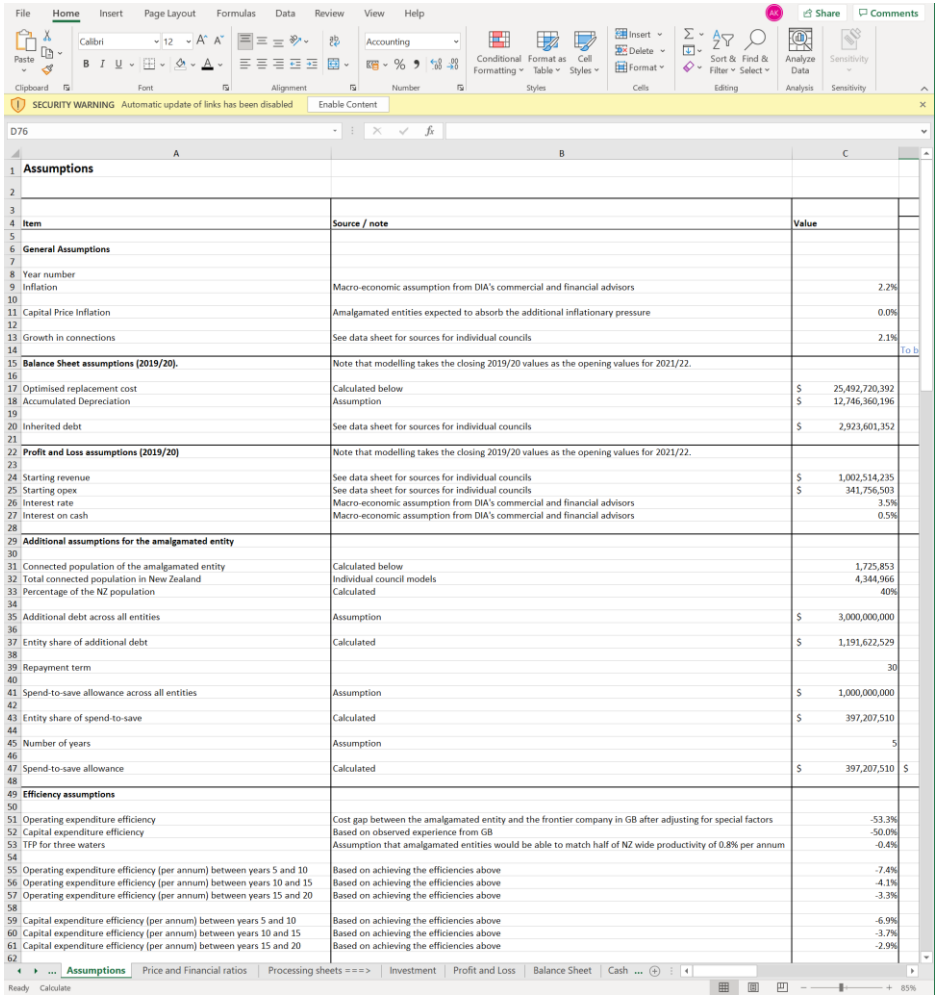


…Repeating these steps any time the model assumptions are updated…

The ‘Assumptions’ tab covers:

- The starting financial position of the council (revenues, debt and operating costs).
- Investment forecasts, including economic depreciation based on council reported asset values.
- Macro-economic assumptions such as inflation, interest rates and growth in the customer base.

The inputs for Entity A are set out in the next section…



Item	Source / note	Value
Assumptions		
General Assumptions		
Year number		
Inflation	Macro-economic assumption from DIA's commercial and financial advisors	2.2%
Capital Price Inflation	Amalgamated entities expected to absorb the additional inflationary pressure	0.0%
Growth in connections	See data sheet for sources for individual councils	2.1%
Balance Sheet assumptions (2019/20).	Note that modelling takes the closing 2019/20 values as the opening values for 2021/22.	
Optimised replacement cost	Calculated below	$ 25,492,720,392
Accumulated Depreciation	Assumption	$ 12,746,360,196
Inherited debt	See data sheet for sources for individual councils	$ 2,923,601,352
Profit and Loss assumptions (2019/20)	Note that modelling takes the closing 2019/20 values as the opening values for 2021/22.	
Starting revenue	See data sheet for sources for individual councils	$ 1,002,514,235
Starting opex	See data sheet for sources for individual councils	$ 341,756,503
Interest rate	Macro-economic assumption from DIA's commercial and financial advisors	3.5%
Interest on cash	Macro-economic assumption from DIA's commercial and financial advisors	0.5%
Additional assumptions for the amalgamated entity		
Connected population of the amalgamated entity	Calculated below	1,725,853
Total connected population in New Zealand	Individual council models	4,344,966
Percentage of the NZ population	Calculated	40%
Additional debt across all entities	Assumption	$ 3,000,000,000
Entity share of additional debt	Calculated	$ 1,191,622,529
Repayment term		30
Spend-to-save allowance across all entities	Assumption	$ 1,000,000,000
Entity share of spend-to-save	Calculated	$ 397,207,510
Number of years	Assumption	5
Spend-to-save allowance	Calculated	$ 397,207,510
Efficiency assumptions		
Operating expenditure efficiency	Cost gap between the amalgamated entity and the frontier company in GB after adjusting for special factors	-53.3%
Capital expenditure efficiency	Based on observed experience from GB	-50.0%
TFP for three waters	Assumption that amalgamated entities would be able to match half of NZ wide productivity of 0.8% per annum	-0.4%
Operating expenditure efficiency (per annum) between years 5 and 10	Based on achieving the efficiencies above	-7.4%
Operating expenditure efficiency (per annum) between years 10 and 15	Based on achieving the efficiencies above	-4.1%
Operating expenditure efficiency (per annum) between years 15 and 20	Based on achieving the efficiencies above	-3.3%
Capital expenditure efficiency (per annum) between years 5 and 10	Based on achieving the efficiencies above	-6.9%
Capital expenditure efficiency (per annum) between years 10 and 15	Based on achieving the efficiencies above	-3.7%
Capital expenditure efficiency (per annum) between years 15 and 20	Based on achieving the efficiencies above	-2.9%

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The next five slides set out the assumptions used and source of assumptions for the analysis of costs and prospects for Entity A…

Parameter	Value	Source
		See the data sheet in the appendix for the source for each council in the amalgamation scenario.
Starting financial position		
Three Waters Revenue in 2019/20	NZ$1,003 Million	
Borrowing	NZ$2,924 Million	
Additional borrowing raised upon reform	NZ$1,192 Million	
Operating costs	NZ$342 Million	
Customer base assumptions		
Starting connected population: water	1,720,039	
Starting connected population: wastewater	1,731,667	
Annual growth in connections	2.1%	

Investment is a key driver…

Parameter	Value		Source
Investment assumptions	Low	High	
Growth and enhancement investment	NZ$23,510 Million	NZ$31,030 Million	See the data sheet in the appendix for the source for each council in the amalgamation scenario.

A critical aspect of investment planning for the longer term relates to asset replacement and the economic depreciation of the assets…

Parameter	Value		Source
Asset replacement assumptions	**Low**	**High**	
Asset value	NZ$23,963 Million	NZ$27,022 Million	See the data sheet in the appendix for the source for each council in the amalgamation scenario.
Percentage of asset value related to short-medium life assets (existing assets)	28%	28%	
Percentage of asset value related to long life assets (existing assets)	72%	72%	
Percentage of asset value related to short-medium life assets (new assets)	52%	52%	
Percentage of asset value related to long life assets (new assets)	48%	48%	
Average asset life for short-medium life assets	24	34	RFI Table J1; NZ average with asset lives capped and collared at +/-20% the average in Australia and Great Britain.
Average asset life for long life assets	84	112	RFI Table J1; NZ average with asset lives capped and collared at +/-20% the average in Australia and Great Britain.

The amalgamation scenario also allows for spend-to-save operating expenditure in the first five years…

Parameter	Value	Source
Projected operating expenditure		
Allowed for new operating costs as a percentage of enhancement and growth investment	0%	See comments later.
Annual change in starting operating expenditure	2.1%	In line with the annual growth in connections.
Additional spend-to-save operating expenditure	NZ$397 Million	Assumption based on the spend-to-save allowance for Scottish Water in 2001 adjusted for relative population and inflation and expressed in NZ$.

The final group of assumptions cover macro-economic factors…

Parameter	Value	Source
Economic assumptions		
Operating expenditure inflation rate	2.2%	Estimates from the DIA's commercial and financial advisers.
Capital expenditure inflation rate	2.2%	See comments later
Interest rate on existing and new borrowing	3.5%	Estimates from the DIA's commercial and financial advisers.

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Starting with operating expenditure, WICS' analysis has used tried and tested regulatory models to establish the scope for operating expenditure efficiency…

- In the mid-to-late 1990s, Ofwat developed models to measure relative operating cost efficiency for the water companies in England and Wales.
- To ensure that the comparisons were like-for-like, Ofwat sought to account for the operating characteristics of the companies that it regulated that were outside of the control of management.
- The models are based on well established relationships between factors such as population, geography, topography, assets and the level of operating costs.
- By controlling for such factors outside the control of management, any difference in costs between companies can reasonably be put down to (relative) effectiveness.
- The models have stood the test of time – they remained largely unchanged when used by Ofwat between 1997 to 2009. The only minor change took place in 2008 when a cost driver changed in two of the models (water distribution and water resources and treatment). WICS has run both versions for New Zealand.
- WICS has also run an amended suite of models that include base data from the New Zealand Three Waters industry. There are only minor differences in the results between these different approaches.
- For its advice in 2001 and its Final Determination in 2005, WICS used these models to set an operating cost reduction target for Scottish Water.
- The models have also been applied in other jurisdictions, including Eire, Northern Ireland, New Zealand (Watercare), Australia (Sydney Water), The Netherlands and in other jurisdictions in Europe (work for the European Commission). The relationships between these factors and operating costs have been shown to hold in **all** these jurisdictions.

We updated the models to include New Zealand Council performance information. For water…*

Ofwat 2004 Model	R^2	Regression equation	Change made to reflect RFI information	Revised model	R^2
Water resources and treatment	0.38	(0.5 + 5.9 * proportion of supply from rivers + 22.4 * number of sources divided by distribution input) * resident population	Added New Zealand as a single entity	(0.3 + 6.1 * proportion of supply from rivers + 23.5 * number of sources divided by distribution input) * resident population	0.42
Water distribution	0.33	e^(-5.2 + 6.1 * proportion of large mains) * resident population	Added New Zealand as a single entity	e^(-5.1 + 5.4 * proportion of large mains) * resident population	0.28
Water power	0.99	e^(-8.9 + 0.9 * ln(distribution input * average pumping head))	Added New Zealand as a single entity	e^(-9.0 + 0.9 * ln(distribution input * average pumping head))	0.98
Water business activities	0.96	e^(-3.6 + 0.9 * ln (number of billed properties))	Added New Zealand as a single entity	e^(-3.7 + 0.9 * ln (number of billed properties))	0.96

*Supporting material 2 (Appendices 1 to 3) provides more detail on all of the models.

And wastewater and stormwater…*

Ofwat 2004 Model	R^2	Regression equation	Change made to reflect RFI information	Revised model	R^2
Sewer business activities	n/a	Unit cost model	Added each council as a data point	Unit cost model	n/a
Sludge treatment and disposal	n/a	Unit cost model	Added each council as a data point	Unit cost model	n/a
Small works	n/a	Unit cost model	Added each council as a data point	Unit cost model	n/a
Sewer network	0.52	e^(-5.9 + 1.6 * (holiday population/resident population) + 0.8 * ln(resident population/ length of sewers) + 0.2 * ln(area of sewer district/length of sewers)) * length of sewers	Used Ofwat 2004 Model	e^(-5.9 + 1.6 * (holiday population/resident population) + 0.8 * ln(resident population/ length of sewers) + 0.2 * ln(area of sewer district/length of sewers)) * length of sewers	0.52
Large works	0.70	e^(-1.7 + 0.8 * ln(population equivalent of total load * 60) + 0.1 if tight effluent consent for both BOD5 and suspended solids + 0.4 if activated sludge used at works)	Used Ofwat 2004 Model	e^(-1.7 + 0.8 * ln(population equivalent of total load * 60) + 0.1 if tight effluent consent for both BOD5 and suspended solids + 0.4 if activated sludge used at works)	0.70

*Supporting material 2 (Appendices 1 to 3) provides more detail on all of the models.

To explain how they work, the models predict the 'efficient' level of operating costs given an entity's operating characteristics…

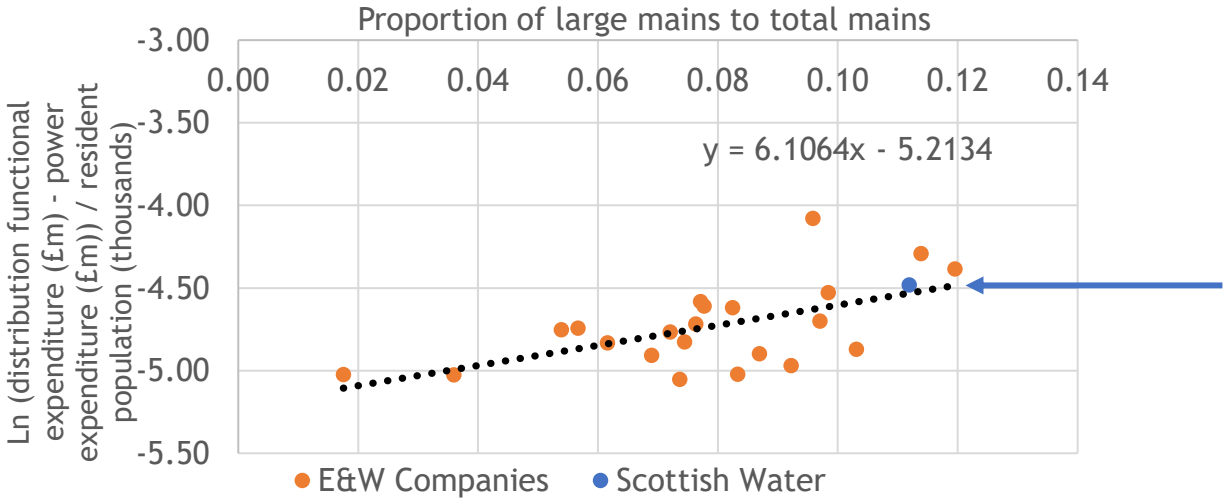
- We use a combination of econometric and unit cost models
- In simple terms (and without getting into the detailed maths), the econometric models take the form of y = c + a(x1) +b(x2)
- Where:
  - y is the predicted cost
  - a and b are coefficients
  - x1 and x2 are the entity's operating characteristics
  - c is a constant
- The output of the model gives values of a, b and c
- We then "plug in" the company's operating characteristics (x1 and x2) in order to predict their 'efficient' level of operating costs

To illustrate with water distribution as an example…

- The water distribution model provides the following equation:

  Y = -5.21 + 6.1 x proportion of large diameter mains to total mains

- This shows a positive relationship between having large mains and expenditure which is expected given that large diameter mains are more expensive to operate and repair.
- Using an entity's actual proportion of large mains, the model predicts an efficient level of costs given that entity's characteristics (the dotted line below).



The dotted line represents the predicted efficient cost for each company

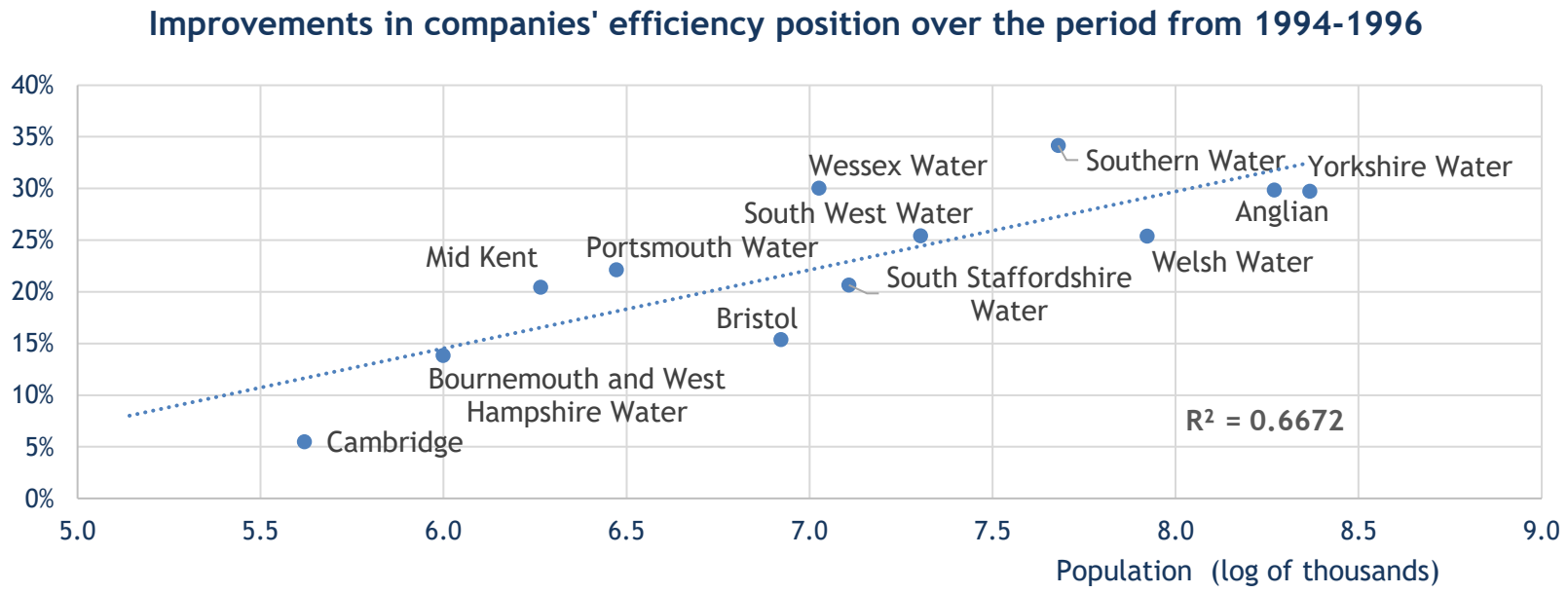
The efficiency gap is based on the divergence between the entity's predicted and actual costs…

- The predicted costs from each of the nine models are added to provide the total predicted costs for the entity.
- An efficiency score is then calculated for each entity based on the ratio of the entity's observed operating costs (post adjustments for company-specific factors) and their predicted efficient costs. For example:
  - an entity with observed operating costs in line with their predicted efficient costs would have an efficiency score of 100.
  - an entity with observed operating costs of NZ$90m and a predicted efficient costs of NZ$100m would have an efficiency score of 90.
- The entity's efficiency score is then compared to the efficiency score of the benchmark entity. For example:
  - if Scottish Water, for example, has an efficiency score of 110 and the 'benchmark' entity has an efficiency score of 90, we would assess the efficiency gap as 18%. This is calculated as (110 – 90) / 110 = 18%.
- The efficiency gap is then estimated for each entity behind the 'benchmark' company.

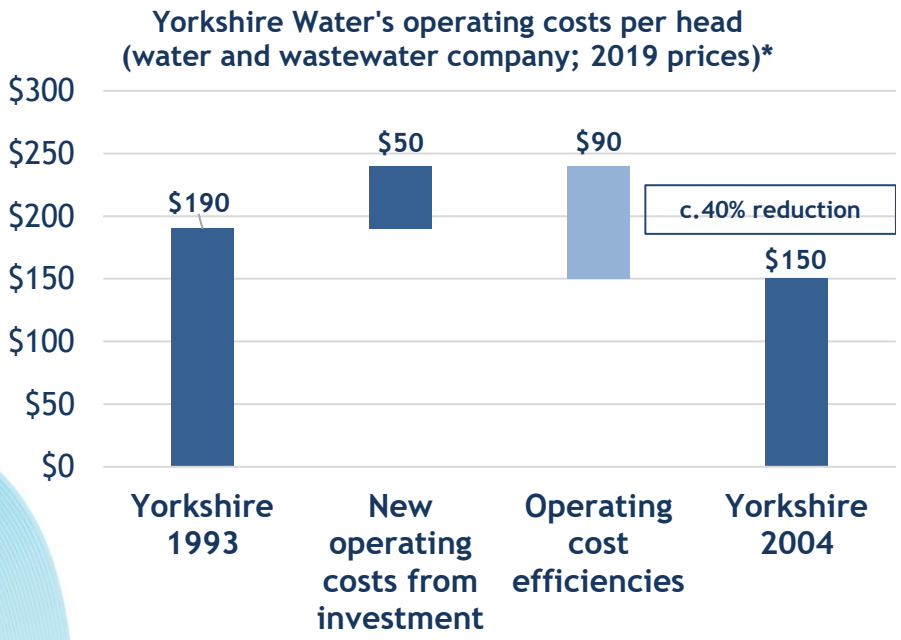
The strength of the technique is down to its simplicity - when compared to other statistical techniques used by economic regulators such as panel models and Stochastic Frontier Analysis (SFA), the underlying maths is very simple.

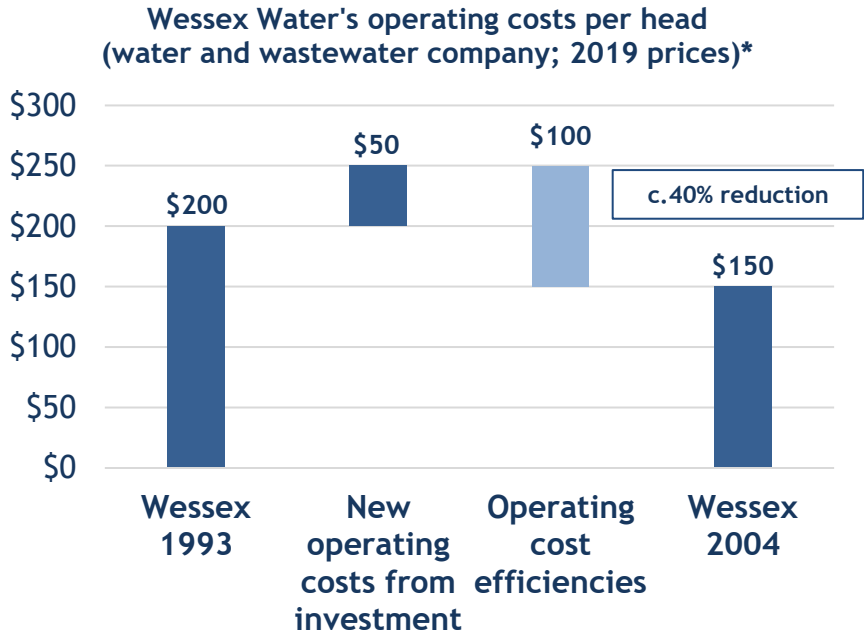
In assessing the scope for efficiency improvement, it is important to take into consideration the scale of organisations…

- Using the gap predicted by the models and comparing to observed performance, there appears to be a clear pattern where smaller entities achieve a smaller gain in efficiency than larger entities.
- Companies serving less than about 800,000 people (not connections!) have done much less well – they only managed to close between 10% and 50% of what the best performing larger companies have been able to realise.

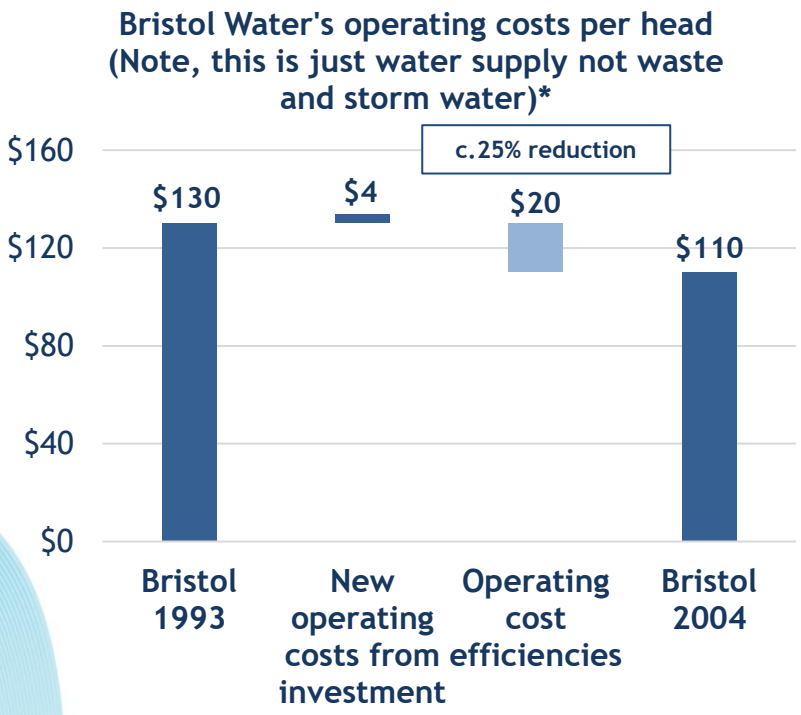


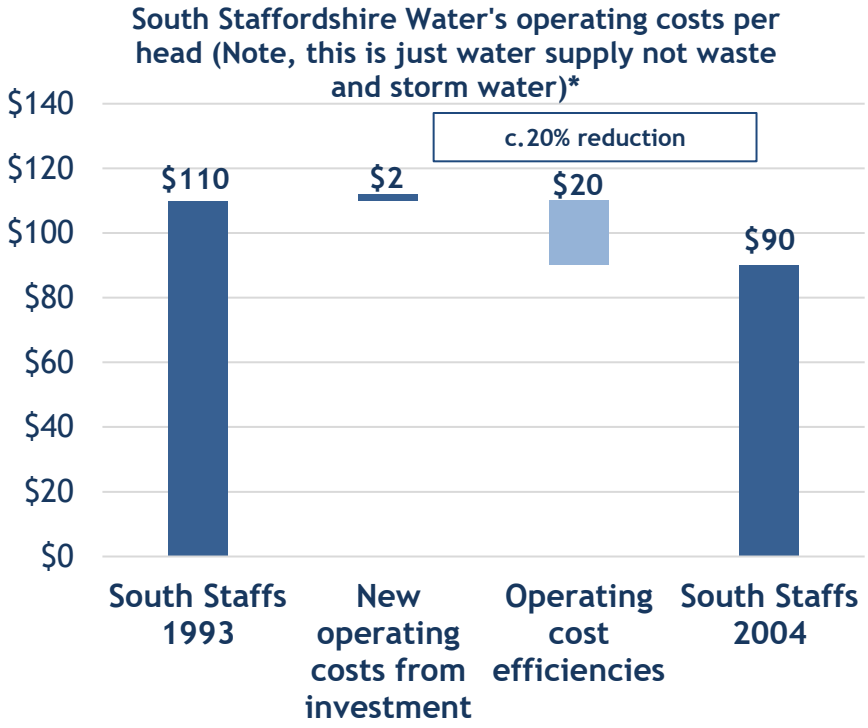
The larger water and wastewater companies in England and Wales achieved operating cost per head reductions of around 40% after privatisation...





Even the best of the smaller companies have been unable to match such reductions, they lack economies of scale and scope...





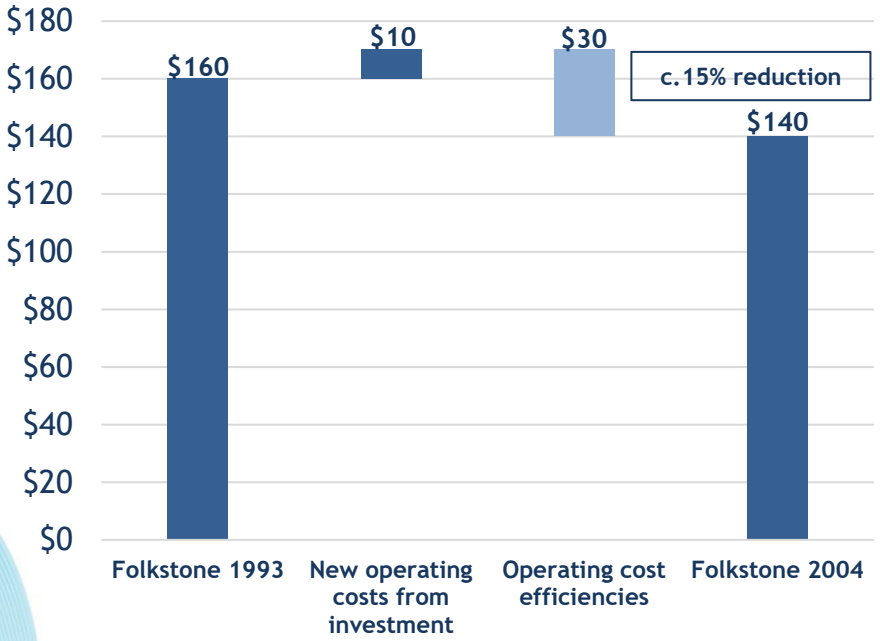
*numbers may not add due to rounding.

IMPORTANT NOTE: The NZ$110 and NZ$90 units costs are for water only. Typically water unit costs are never more than 50% of total unit costs for a three waters services provider. Doubling these unit costs implies three waters unit costs of NZ$220 and NZ$180 relative to the NZ$150 achieved by Scottish Water, Yorkshire and Wessex. This implies a gap of at least 20%.

The smallest companies found it even more difficult to reduce their costs. They have since merged with larger entities...

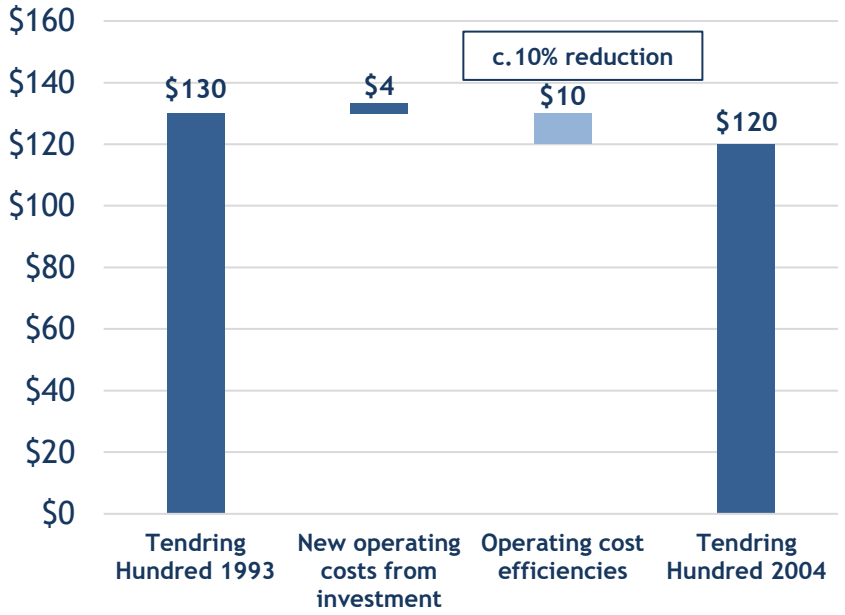
water industry commission FOR SCOTLAND

Folkstone Water's operating costs per head (Note, this is just water supply not waste and storm water)*



*numbers may not add due to rounding.

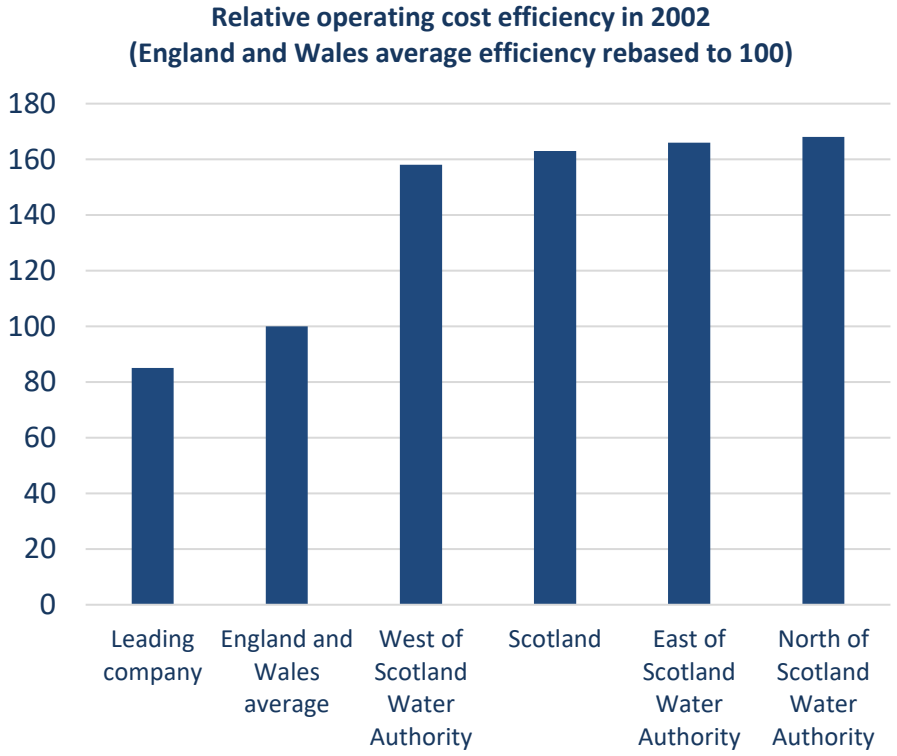
Tendring Hundred Water's operating costs per head (Note, this is just water supply not waste and storm water)*



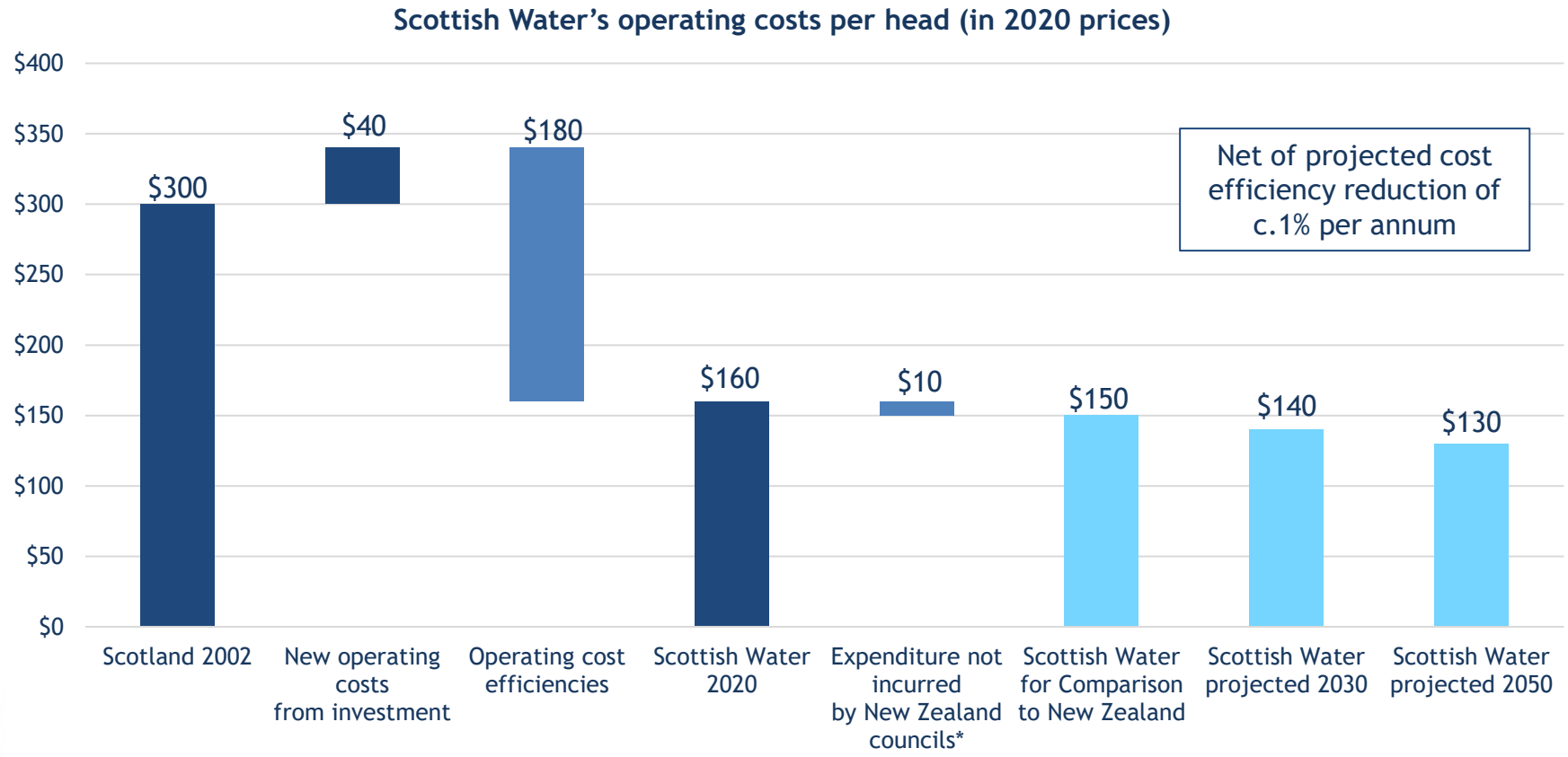
IMPORTANT NOTE: The NZ$140 and NZ$120 units costs are for water only. Typically water unit costs are never more than 50% of total unit costs for a three waters services provider. Doubling these unit costs implies three waters unit costs of NZ$280 and NZ$240 relative to the NZ$150 achieved by Scottish Water, Yorkshire and Wessex. This implies a gap of 60%.

Scotland was no different to the larger companies in England and Wales. When Scottish Water was formed, it was very inefficient when compared to the privatised companies in England and Wales…

- In 1999, WICS estimated that charges would have to be twice as high in the North of Scotland Water Authority as in the other two areas. History tells us that this estimate was very optimistic. Assuming efficiencies had been achieved, charges would have been almost four times higher! Confirmed optimism bias…
- The Scottish Government could not accept such charge differentials and opted to merge the three authorities to create Scottish Water. Scottish Water currently serves 5.2 million customers.
- The Scottish water industry's relative position in operating expenditure was poor back in 2002. It lagged 40% (against the average) and 50% (against the leader) behind the private sector companies in England.
- **The efficiency gap with England and Wales was greater because this assessment covers only costs, not levels of service.**

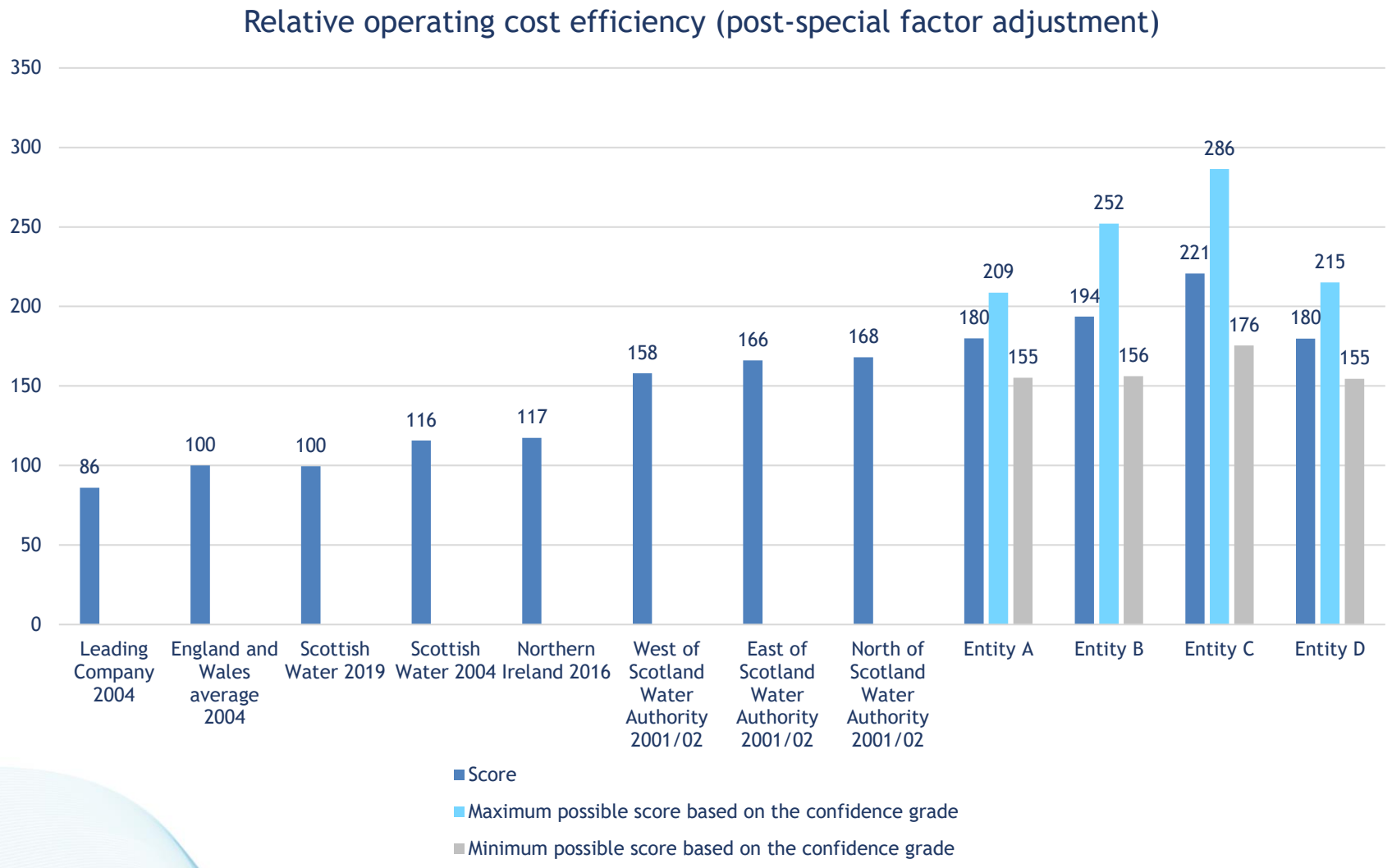


Scottish Water has subsequently reduced its operating costs per head by over 50% (and improved levels of service)…



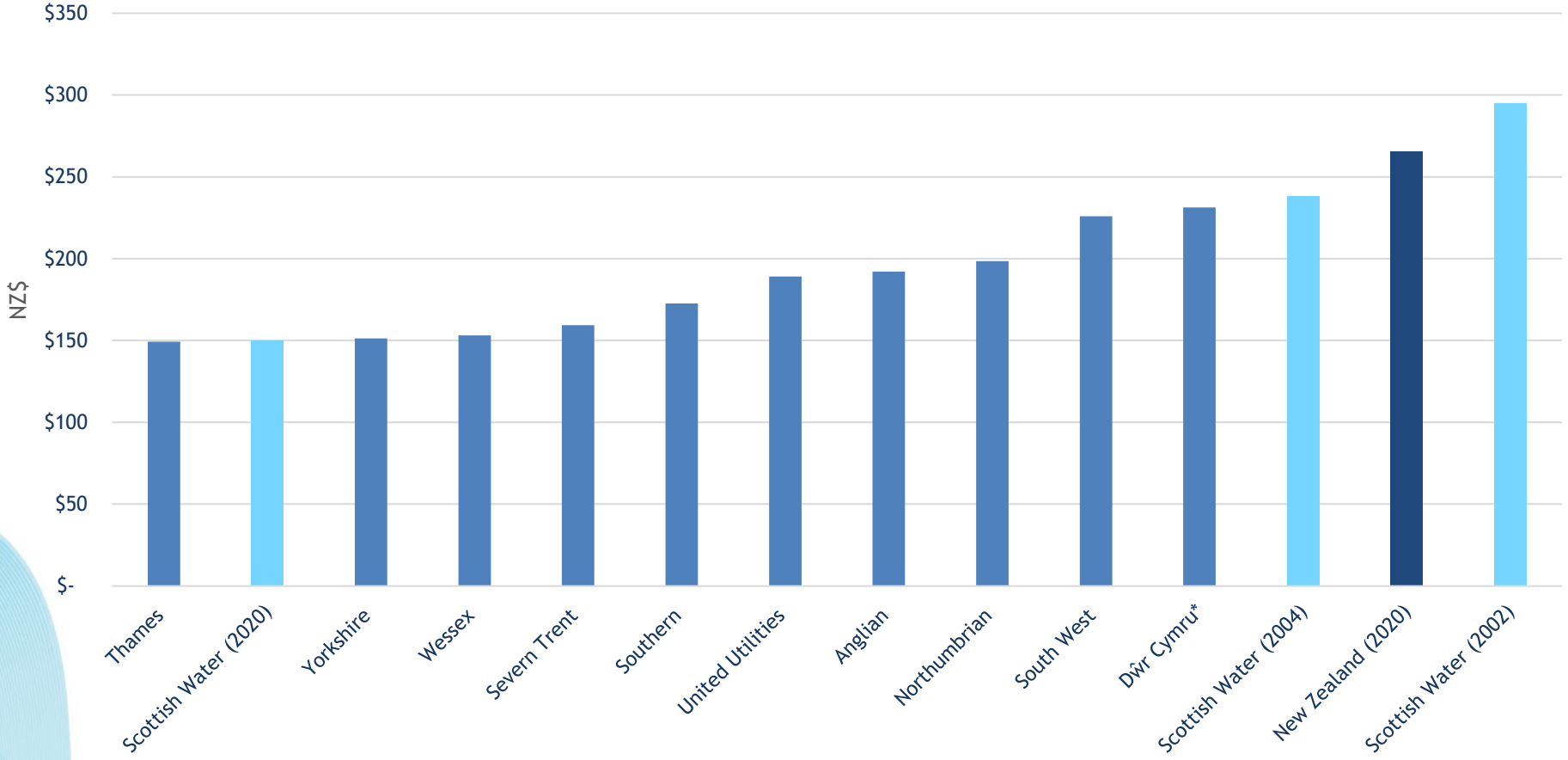
* Includes cost of regulation and the cost of additional sampling.

The Three Waters Industry in New Zealand is in a broadly similar position as Scotland in 2002…



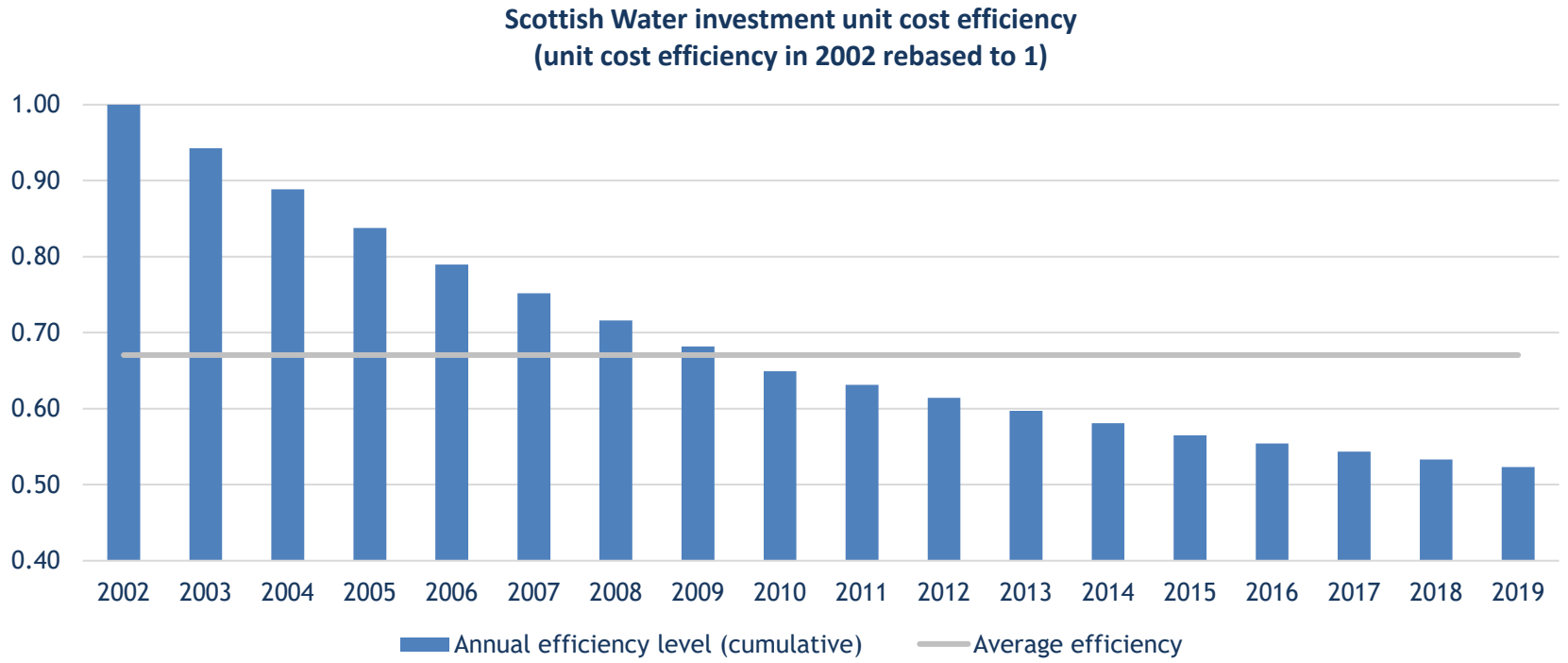
And if we look at a simple per connected citizen basis then the answer is not that different…

Operating costs per connected citizen in 2004 (2020 prices)



*Dŵr Cymru is a company limited by guarantee with no shareholders. A quirk of the Ofwat regulatory regime means that Dŵr Cymru receives funding for dividends that it does not pay. As a public interest company its board has chosen to expense additional asset renewal. This is reflected in its higher operating cost.

Turning now to capital expenditure, Scottish Water's investment unit costs are now over 45% lower than in 2002. Moreover, Scottish Water has committed to achieving an annual 0.75% real improvement in capital expenditure unit costs each year until 2040 – as such, costs will have reduced by 52% over 30 years…



WICS has taken a necessarily high level approach to assessing the scope for capital expenditure efficiency…

- WICS has shown how the water industry in Scotland has improved its unit cost capital expenditure efficiency substantially over the last twenty years. Scottish Water's unit costs are now some 50% lower than in 2002 – or around 30% on average over the period. This is broadly similar to the operating cost reductions that Scottish Water has achieved since 2002.
- In WICS' view, the improvement in capital expenditure efficiency is a function of several factors:
  - Economy of scale
  - Clarity of policy priority
  - Robust water quality and environmental regulation
  - Economic regulation and
  - Excellence in management.
- The first four of these factors are not currently in place in New Zealand. As such, WICS would suggest that it is reasonable to assume that the New Zealand industry's current capital expenditure efficiency performance is unlikely to be any better than that in Scotland in 2002 when Scottish Water was established.
- This has had two implications for our analysis of the Three Waters in New Zealand. WICS had to ensure that:
  - The modelled capital expenditure requirement had to reflect the improvement that was likely to be required; and
  - WICS had to judge how quickly the gap should be narrowed.
- WICS' modelling of required investment reflects the observed efficiency improvement of the Scottish water industry in terms of its unit capital expenditure. It seems reasonable to expect a reformed three waters industry in New Zealand to match the efficiency improvement of the industry in Scotland and by the water and sewerage companies in England and Wales. As such, the efficiency improvement required is the cost and quality differential in unit capital costs between what WICS estimates is currently achieved in New Zealand and what has been achieved in the UK.
- WICS has modelled scenarios where New Zealand matches the timescale of the observed improvement in the UK. This improvement is modelled from 2025. Councils, where of sufficient scale, receive a proportionate share of the potential scope for efficiency identified. Councils report a continuing pressure on capital expenditure inflation. WICS has capped the impact of capital expenditure inflation on Councils at 1% per annum. Amalgamated entities, in common with standard regulatory practice, are expected to absorb this additional inflationary pressure.

This results in the following efficiency challenge for Entity A…

Parameter	Value	Source
Efficiency assumptions		
Operating expenditure efficiency	53%	Results for the amalgamated entity from the operating cost expenditure models set out on the previous slides.
Capital expenditure efficiency	50%	Based on experience in GB.
Total factor productivity	0.4%	50% of New Zealand wide TFP – see comments on the next slide.

WICS applies the efficiency challenge from 2025 onwards…

- There appears to be no obvious reason why well managed and governed New Zealand entities could not match the performance of the British companies. Economy wide productivity in New Zealand is broadly comparable to Scotland.
- WICS applies the cost reduction challenge from 2025 onwards. In line with regulatory precedent in Great Britain, WICS models that amalgamated entities close 60% of the assessed efficiency gap in the first five-year period, 60% of the remaining efficiency gap in the next five-year period and close the remaining efficiency gap in the following five-year period. This means that the full efficiency gap is closed by 2040. In Scotland, the gap was closed in 8 years.
- In addition, and in line with regulatory precedent, WICS assumes that entities improve at a rate of 50% of New Zealand wide total factor productivity. This results in an ongoing total factor productivity challenge of 0.4% per annum. It is important to note that this is not because we consider that TFP is 0.4% per annum. Rather, it is standard regulatory practice to set a TFP challenge lower than the reported TFP in order to provide scope for outperformance (in regulatory jargon, it is the 'carrot' incentive to complement the big 'stick'!).
- The scope for cost reduction will, however, require a commitment to a full package of reform: investment; financial freedoms, clarity in objective setting, empowered regulation and incentivised management.
- They also require management to face a 'hard budget constraint' and not have an easy 'out' from the scrutiny and pressure of both quality and economic regulation.

This presentation provides an audit trail for the amalgamation analysis…

- Financial model for amalgamated entity
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WICS used Monte Carlo simulation analysis to show the sensitivity of key assumptions in its analysis of how individual Councils could be impacted by responding to the challenge of providing a sustainable three waters service.

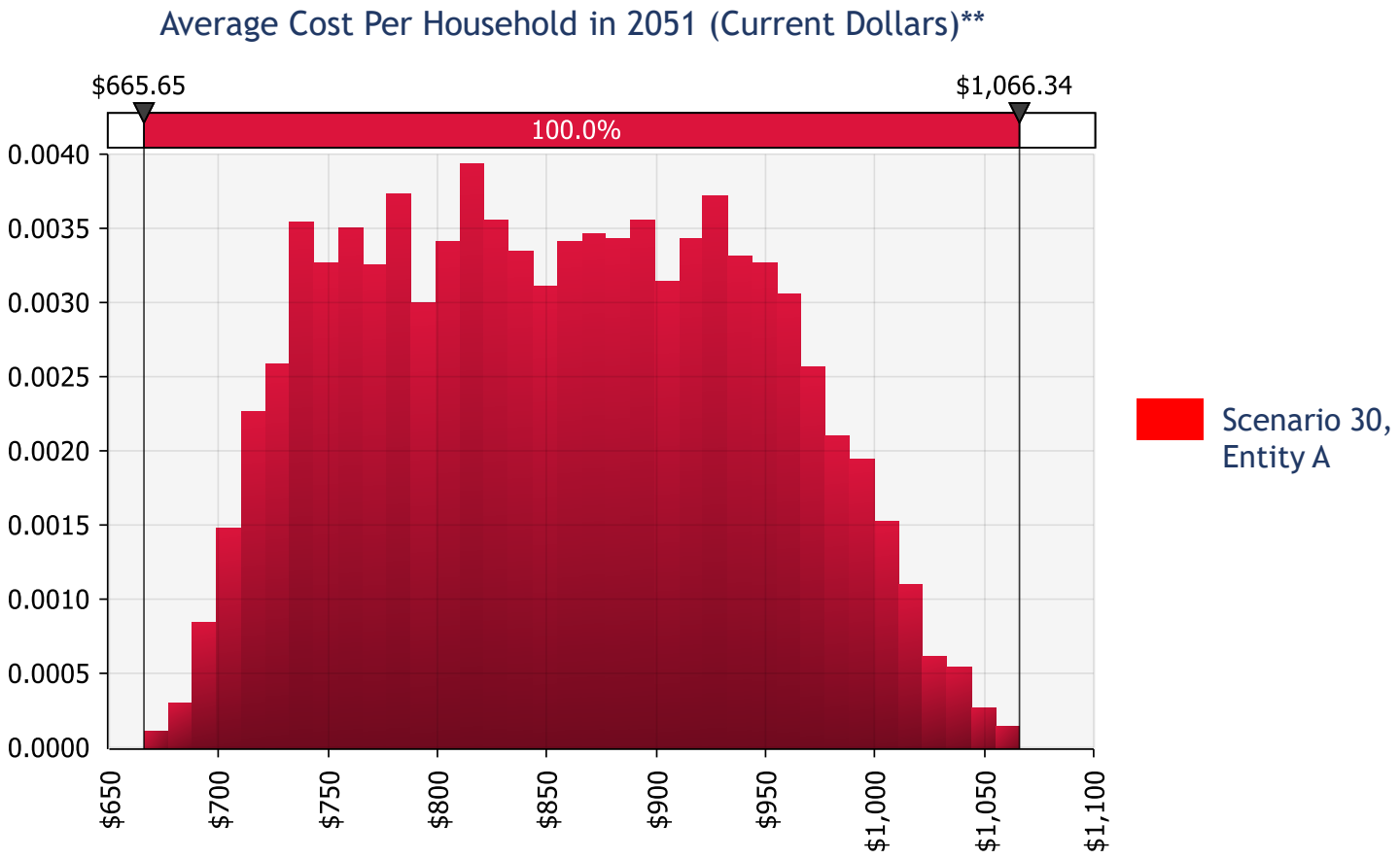
- Monte Carlo simulation allows for the full range of realistic possibilities for all the key inputs to an analysis to be tested.
- It combines all possibilities in a range from the lowest to the highest to be combined with other input ranges, again from lowest to highest.
- This allows for a range of possible outcomes to be determined. These can be either normal distributions or be considered as equally likely across the full range analysed.
- As such, this analytical technique allows analysis of the likely prospects of an individual Council to be tested relative to the appropriate amalgamation scenario. It allows the full range of plausible outcomes for an individual Council to be compared with the full range of possibilities for the appropriate amalgamated entity.
- When considering these comparisons, it is important to consider all that is being analysed in the range of potential outcomes identified. For example, the higher the investment programme, the higher prices will be. Similarly, the lower additional new operating costs are, the lower prices will be. So, for example, the implications of higher levels of investment can be somewhat offset by a lower rate of new operating costs per dollar invested.
- In effect, the range of outcomes generated by a Monte Carlo analysis of potential average costs per household will have the most favourable possible outcomes on the left hand side of a distribution. All the least favourable options will be combined in outcomes on the right hand side of the distribution.

Assumptions for amalgamated Entity A (Scenario 30)…

Parameter	Phase Two modelled value	Low value	Rationale	High value	Rationale
Speed of gap closure	15 years	15 years	Approach taken by Ofwat in the 1990s.	8 years	What Scottish Water actually achieved.
Efficiency gap (operating expenditure)	53%	35%	A lower efficiency challenge than that calculated by taking the most favourable options available under the confidence grades provided.	53%	A regulatory interpretation of the available evidence. Based on an expectation that the regulated entity should still be capable of outperforming.
Efficiency gap (capital expenditure)	50%	35%	Best outcome from taking most favourable options available under the confidence grades provided.	50%	A regulatory interpretation of the available evidence. Based on an expectation that the regulated entity should still be capable of outperforming.
Investment	NZ$27bn	NZ$16bn	RFI G tables.	NZ$30bn	Modelled value plus additional 10% to reflect Maori expectations.
Asset lives	Reported average	Reported average	RFI J tables.	Scottish asset lives minus 10%	10% adjustment reflecting seismic resilience issues.

Red colouring indicates the least favourable options for the amalgamated entity – the combination of all of these factors would be represented by the right hand side of the modelled range.

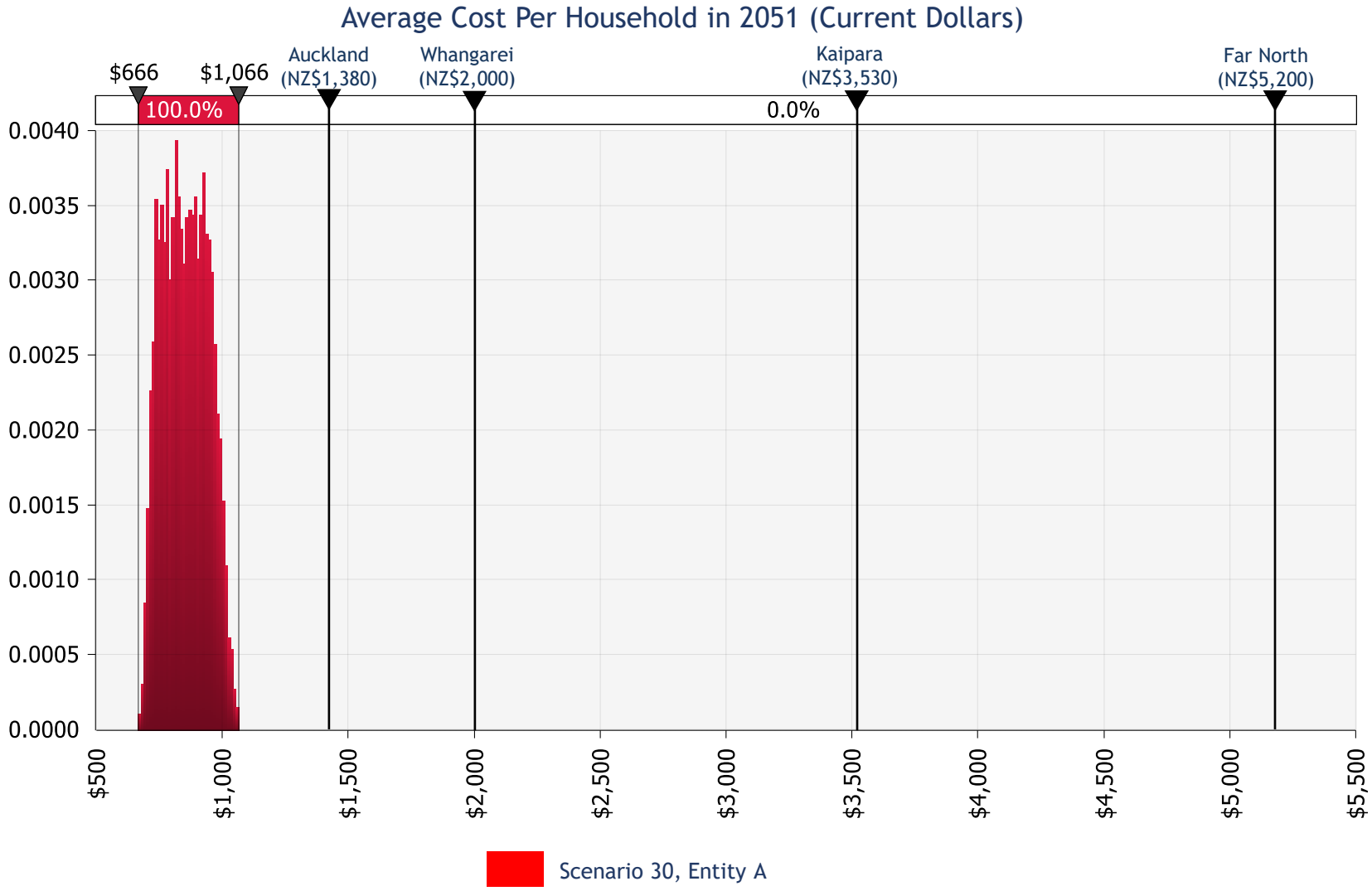
Modelling these ranges for the amalgamated Entity A gives this range of outcomes…*



* The Monte Carlo simulation runs the model several thousand times - each time selecting a unique value from the range defined for each input. This provides an overall range for the average cost per household. As a new Monte Carlo simulation was required for each council scenario, there can be minor variations in the range for bills for each amalgamated entity.

** These average costs are all presented exclusive of Goods and Services Tax (GST).

Adding the lowest average cost per household in the counterfactual for the councils in the amalgamated entity…*



* The lowest average cost per household arises from the most favourable possible combination of inputs and relates to the left hand side of the distribution for each council on a stand-alone basis. These are shown in the individual slide-packs for each council.

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WICS has re-run the Monte-Carlo simulation and has reduced the efficiency challenge applied to operating expenditure…

- The highest possible average cost per household under amalgamation (i.e. the extreme right of the blue curve) is consistent with a cost reduction challenge of around 35%. This was based on the lowest possible cost gap to the companies in Great Britain given the confidence grades from the RFI.

- As a thought experiment, WICS examined how much it could reduce the efficiency challenge applied to operating expenditure before the average cost per household for the amalgamated entity and the individual councils begin overlapping – i.e. the point at which the red curve touches the minimum cost per household among the councils.

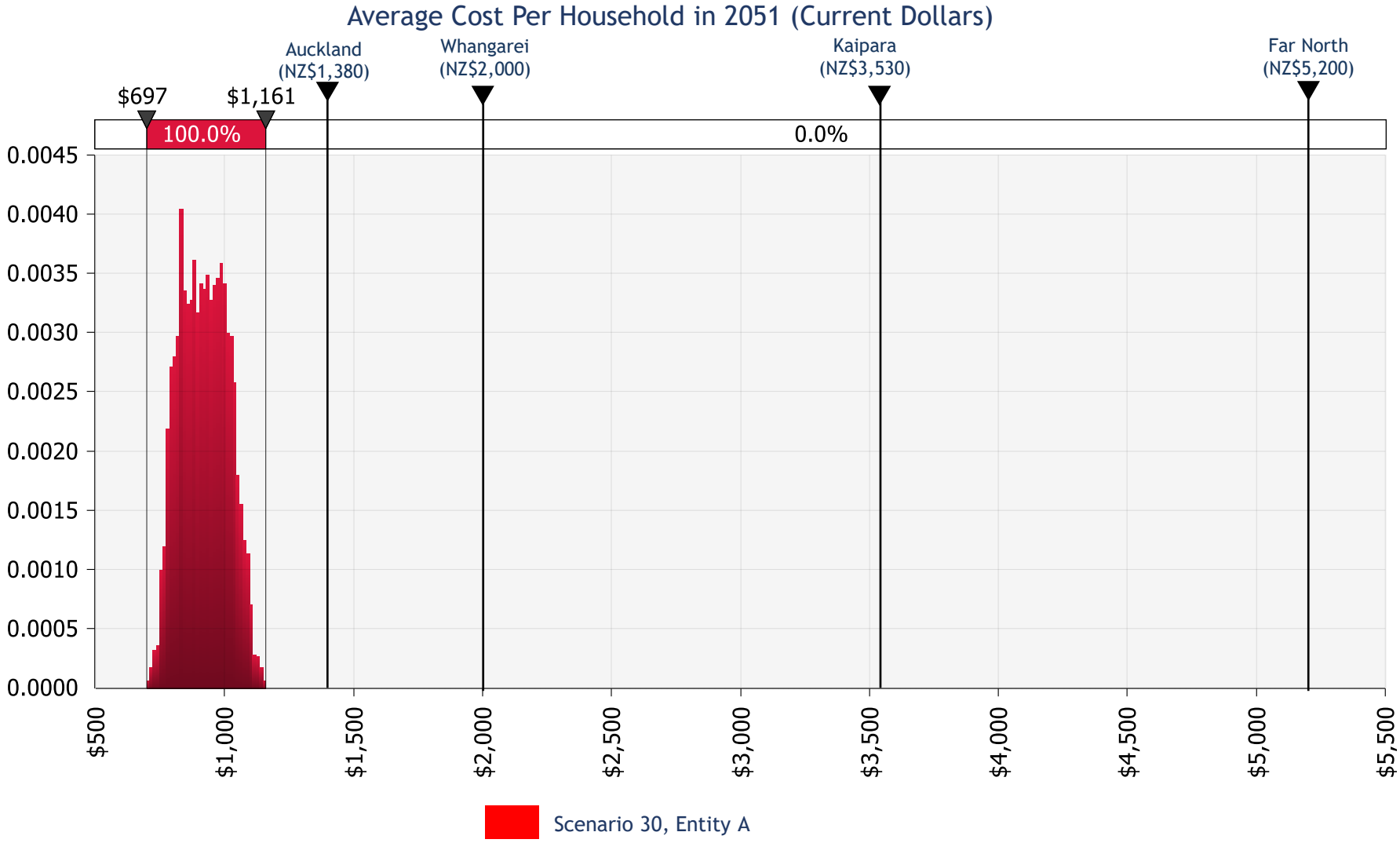
Reducing the efficiency challenge applied to operating expenditure to 0% for the amalgamated entity would still not give any of the councils any prospect of being financially better off…*

Parameter	Previous range		Revised range		Rationale
	Low value	High value	Low value	High value	
Speed of gap closure	15 years	8 years	15 years	8 years	No change.
Efficiency gap (operating expenditure)	**35%**	**53%**	**0%**	**53%**	**The low value is now set to 0%.**
Efficiency gap (capital expenditure)	35%	50%	35%	50%	No change.
Investment	NZ$16 Billion	NZ$30 Billion	NZ$16 Billion	NZ$30 Billion	No change.
Asset lives	Reported average	Scottish asset lives minus 10%	Reported average	Scottish asset lives minus 10%	No change.

Red colouring indicates the least favourable options for the amalgamated entity - the combination of all of these factors would be represented by the right hand side of the modelled range.

*This sensitivity analysis differs from the sensitivity analysis undertaken in the equivalent presentations prepared for individual councils. In those presentations, the efficiency challenges applied to operating and capital expenditure were both reduced.

Further modelling of the amalgamated entity reveals that there is no operating expenditure efficiency scenario that would give the councils a chance of being better off under the counterfactual…*



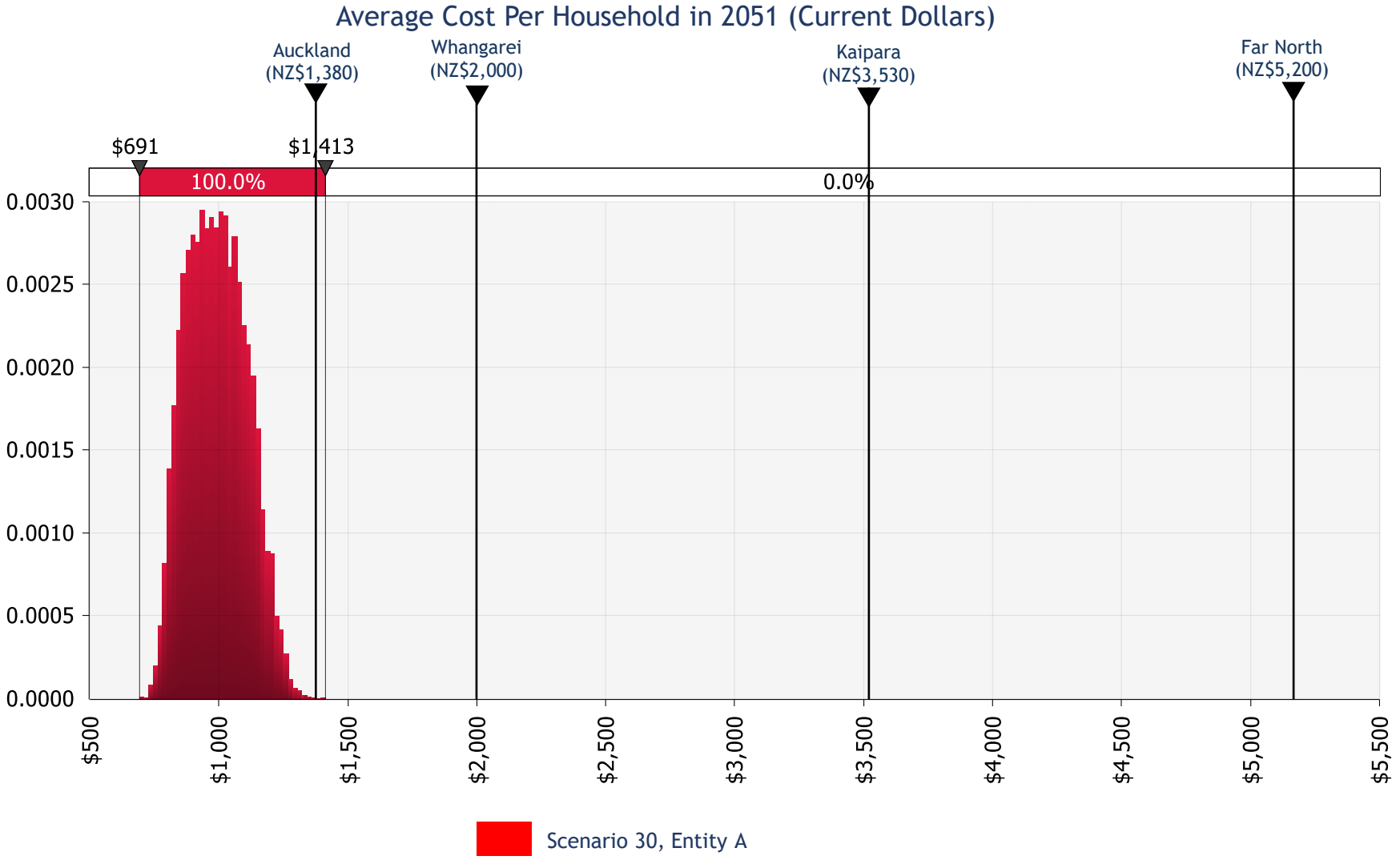
* The lowest average cost per household arises from the most favourable possible combination of inputs and relates to the left hand side of the distribution for each council as a stand-alone basis. These are shown in the individual slide-packs for each council.

Alternatively, the efficiency challenge applied to operating and capital expenditure for the amalgamated entity would have to be less than 15% if any of the councils on a stand-alone basis were to have any prospect of being financially better off …

Parameter	Previous range		Revised range		Rationale
	Low value	High value	Low value	High value	
Speed of gap closure	15 years	8 years	15 years	8 years	No change.
Efficiency gap (operating expenditure)	**35%**	**53%**	**15%**	**53%**	**The low value is now set to 15%.**
Efficiency gap (capital expenditure)	**35%**	**50%**	**15%**	**50%**	**The low value is now set to 15%.**
Investment	NZ$16 Billion	NZ$30 Billion	NZ$16 Billion	NZ$30 Billion	No change.
Asset lives	Reported average	Scottish asset lives minus 10%	Reported average	Scottish asset lives minus 10%	No change.

Red colouring indicates the least favourable options for the amalgamated entity - the combination of all of these factors would be represented by the right hand side of the modelled range.

The results of reducing the efficiency challenge applied to operating and capital expenditure to 15% are set out below…*



* The lowest average cost per household arises from the most favourable possible combination of inputs and relates to the left hand side of the distribution for each council as a stand-alone basis. These are shown in the individual slide-packs for each council.

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So to summarise…

- Modelling suggests that there is a very low probability that residents served by Entity A would not be better off under a successful implementation of the proposed reforms to the Three Waters in New Zealand. They will likely be considerably better off financially.
- Residents served by Entity A would therefore be more able to afford initiatives to respond to climate change, enhancing seismic resilience and Iwi and Māori aspirations – all of which have not been incorporated into our modelling.
- Amalgamation offers other benefits to residents. These include an improved:
  - environment;
  - level of water quality;
  - level of resiliency; and
  - ability to respond to growth.

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This presentation provides an audit trail for the amalgamation analysis…

- Appendices
  - Data sheets for each input

Three waters revenue in 2019/20…

Council	Value	Source
Auckland Council	NZ$915 Million	For Auckland Council (stormwater): RFI Table F10; Line F10.62. For Watercare: RFI Table F10; Lines F10.62 + F10.70.
Far North District Council	NZ$15 Million	RFI Table F10; Lines F10.62 + F10.70.
Kaipara District Council	NZ$14 Million	RFI Table F10; Lines F10.62 + F10.70 - F10.61.
Whangarei District Council	NZ$58 Million	RFI Table F10; Lines F10.62 + F10.70.
Total for amalgamated entity*	NZ$1,003 Million	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Opening borrowing in 2019/20…

Council	Value	Source
Auckland Council	NZ$2,820 Million	RFI Table F3; Line F3.20.
Far North District Council	NZ$33 Million	RFI Table F3; Line F3.20.
Kaipara District Council	NZ$60 Million	RFI Table F3; Line F3.20.
Whangarei District Council	NZ$10 Million	RFI Table F3; Line F3.20.
Total for amalgamated entity*	NZ$2,924 Million	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Additional borrowing raised upon reform…

Council	Value	Source
Connected population of the amalgamated entity	1,725,853	Average of water and wastewater population. See next slides.
Total connected population in New Zealand	4,344,966	Individual council models; Original source is the RFI Tables A1 and A3.
Percentage of the NZ population	40%	Calculated from the above lines.
Additional borrowing raised across all entities	NZ$3,000 Million	Assumption.
Entity share of additional borrowing	NZ$1,192 Million	Pro-rata share of additional borrowing raised calculated as 40% of the NZ$3,000 Million.

Operating expenditure in 2019/20…

Council	Value	Source
Auckland Council	NZ$295 Million	For Auckland Council (stormwater): RFI Table E2b; Line E2b.21. For Watercare: RFI Table E1 and E2; Lines E1.22 + E2.21.
Far North District Council	NZ$21 Million	RFI Table E1, E2 and E2b; Lines E1.22 - E1.19 + E2.21 + E2b.21.
Kaipara District Council	NZ$6 Million	RFI Table E1, E2 and E2b; Lines E1.22 + E2.21 + E2b.21.
Whangarei District Council	NZ$19 Million	RFI Table E1, E2 and E2b; Lines E1.22 + E2.21 + E2b.21.
Total for amalgamated entity*	NZ$342 Million	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Starting connected population for water in 2019/20…

Council	Value	Source
Auckland Council	1,629,000	RFI Table A1; Line A1.43.
Far North District Council	22,360	RFI Table A1; Line A1.47.
Kaipara District Council	8,630	RFI Table A1; Line A1.43.
Whangarei District Council	60,049	RFI Table A1; Line A1.47.
Total for amalgamated entity*	1,720,039	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Starting connected population for wastewater in 2019/20…

Council	Value	Source
Auckland Council	1,629,000	RFI Table A3; Line A3.58.
Far North District Council	29,641	RFI Table A3; Line A3.58.
Kaipara District Council	13,827	RFI Table A3; Line A3.58.
Whangarei District Council	59,200	RFI Table A3; Line A3.58.
Total for amalgamated entity*	1,731,667	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Annual growth in connections…

Council	Value	Source
Auckland Council	2.1%	RFI Table G1; Calculated from additional properties connected in the year (line G1.3b) divided by properties served in 2019/20.
Far North District Council	1.0%	RFI Table G1; Calculated from additional properties connected in the year (line G1.3b) divided by properties served in 2019/20.
Kaipara District Council	1.6%	RFI Table G1; Calculated from additional properties connected in the year (line G1.3b) divided by properties served in 2019/20.
Whangarei District Council	1.7%	RFI Table G1; Calculated from additional properties connected in the year (line G1.3b) divided by properties served in 2019/20.

Annual growth in connections…

Council	Average water and wastewater population (A)	Assumed household occupancy rate (B)	Assumed connected properties in 2020 (C)	Annual growth in connections (D)	Assumed connected properties in 2051 (E)	Annual growth in connections (F)
	Calculated from the previous slides.	Stats NZ.	Calculated as A divided by B.	Brought forward from the previous slide.	Calculated from C and D.	Annualised growth rate calculated from total in columns E and C.
Auckland Council	1,629,000	2.7	603,333	2.1%	1,132,471	
Far North District Council	26,000	2.7	9,630	1.0%	13,125	
Kaipara District Council	11,228	2.7	4,159	1.6%	6,762	
Whangarei District Council	59,625	2.7	22,083	1.7%	37,031	
Total for amalgamated entity*	1,725,853	2.7	639,205		1,189,389	2.1%

*Numbers may not add due to rounding.

Growth and enhancement investment for Auckland Council…

Parameter	Value		Source
Investment assumptions	**Low**	**High**	
Growth investment pre-cap	NZ$11,590 Million	NZ$11,590 Million	For Auckland Council (stormwater): RFI table G1, line G1.3 adjusted for projected inflation as per the forecast inflation in table G5. As forecasts for stormwater growth investment were not provided for 2032-51, the average annual growth investment over 2022-31 is assumed to continue over 2032-51. For Watercare: RFI table G1, line G1.3.
Enhancement investment pre-cap*	NZ$8,120 Million	NZ$15,040 Million	Based on disaggregated modelling of Council specific information.
Growth and enhancement investment pre-cap*	NZ$19,710 Million	NZ$26,630 Million	Calculated.
Investment cap per connected citizen	NZ$70,000	NZ$70,000	In line with investment per connected citizen in the most rural Council areas in Scotland.
Growth and enhancement investment post-cap*	NZ$19,710 Million	NZ$26,630 Million	The investment cap does not apply as investment per connected citizen is below the cap.

*Rounded to the nearest NZ$10m. Numbers may not add due to rounding.

Growth and enhancement investment for Far North District Council …

Parameter	Value		Source
Investment assumptions	**Low**	**High**	
Growth investment pre-cap	NZ$0 Million	NZ$0 Million	No reported growth investment.
Enhancement investment pre-cap*	NZ$1,700 Million	NZ$1,740 Million	Based on disaggregated modelling of Council specific information.
Growth and enhancement investment pre-cap*	NZ$1,700 Million	NZ$1,740 Million	Calculated.
Investment cap per connected citizen	NZ$70,000	NZ$70,000	In line with investment per connected citizen in the most rural Council areas in Scotland.
Growth and enhancement investment post-cap*	NZ$1,700 Million	NZ$1,740 Million	The investment cap does not apply as investment per connected citizen is below the cap.

*Rounded to the nearest NZ$10m. Numbers may not add due to rounding.

Growth and enhancement investment for Kaipara District Council…

Parameter	Value		Source
Investment assumptions	**Low**	**High**	
Growth investment pre-cap	NZ$163 Million	NZ$163 Million	RFI Table G1; Line G1.3 As forecasts were not provided for 2032-51, the average annual growth investment over 2022-31 is assumed to continue over 2032-51.
Enhancement investment pre-cap*	NZ$700 Million	NZ$710 Million	Based on disaggregated modelling of Council specific information.
Growth and enhancement investment pre-cap*	NZ$860 Million	NZ$870 Million	Calculated.
Investment cap per connected citizen	NZ$70,000	NZ$70,000	In line with investment per connected citizen in the most rural Council areas in Scotland.
Growth and enhancement investment post-cap*	NZ$790 Million	NZ$790 Million	The investment cap applies as investment per connected citizen is above the cap.

*Rounded to the nearest NZ$10m. Numbers may not add due to rounding.

Growth and enhancement investment for Whangarei District Council…

Parameter	Value		Source
Investment assumptions	**Low**	**High**	
Growth investment pre-cap	NZ$153 Million	NZ$153 Million	RFI Table G1; Line G1.3 (adjusted for projected inflation in RFI Table G5) As forecasts were not provided for 2032-51, the average annual growth investment over 2022-31 is assumed to continue over 2032-51.
Enhancement investment pre-cap*	NZ$1,170 Million	NZ$1,730 Million	Based on disaggregated modelling of Council specific information.
Growth and enhancement investment pre-cap*	NZ$1,320 Million	NZ$1,880 Million	Calculated.
Investment cap per connected citizen	NZ$70,000	NZ$70,000	In line with investment per connected citizen in the most rural Council areas in Scotland.
Growth and enhancement investment post-cap*	NZ$1,320 Million	NZ$1,880 Million	The investment cap does not apply as investment per connected citizen is below the cap.

*Rounded to the nearest NZ$10m. Numbers may not add due to rounding.

Growth and enhancement investment…Summary

Council	Low	High	Sources
Auckland Council	NZ$19,710 Million	NZ$26,630 Million	See previous slides.
Far North District Council	NZ$1,700 Million	NZ$1,740 Million	See previous slides.
Kaipara District Council	NZ$790 Million	NZ$790 Million	See previous slides.
Whangarei District Council	NZ$1,320 Million	NZ$1,880 Million	See previous slides.
Total for amalgamated entity*	NZ$23,510 Million	NZ$31,030 Million	Calculated as the sum of the lines above.

*Rounded to the nearest NZ$10m. Numbers may not add due to rounding.

Asset values…

Council	Low	High	Sources
Auckland Council	NZ$22,208 Million	NZ$24,218 Million	RFI Table J1; Sum of lines J1.1 to J1.30 (columns I for low and column J for high).
Far North District Council	NZ$500 Million	NZ$1,158 Million	RFI Table J1; Sum of lines J1.1 to J1.30 (columns I for low and column J for high).
Kaipara District Council	NZ$166 Million	NZ$260 Million	RFI Table J1; Sum of lines J1.1 to J1.30 (columns I for low and column J for high).
Whangarei District Council	NZ$1,090 Million	NZ$1,386 Million	RFI Table J1; Sum of lines J1.1 to J1.30 (columns I for low and column J for high).
Total for amalgamated entity*	NZ$23,963 Million	NZ$27,022 Million	Calculated as the sum of the lines above.

*Numbers may not add due to rounding.

Percentage of asset value related to short-medium life assets (existing assets)…

Council	Asset value (A)	Percentage related to short- medium life assets (B)	Asset value related to short-medium life assets (C)	Weighted average percentage (D)
	High range for asset values (which was used to estimate economic depreciation for short-medium life assets).	Individual council models.	Calculated as Column A x Column B.	Calculated as the total of column C divided by the total of column A.
Existing assets				
Auckland Council	NZ$24,218 Million	30%	NZ$7,266 Million	
Far North District Council	NZ$1,158 Million	10%	NZ$116 Million	
Kaipara District Council	NZ$260 Million	10%	NZ$26 Million	
Whangarei District Council	NZ$1,386 Million	10%	NZ$139 Million	
Total for the amalgamated entity*	NZ$27,022 Million		NZ$7,546 Million	**28%**

*Numbers may not add due to rounding.

Percentage of asset value related to short-medium life assets (new assets)…

Council	Enhancement and growth investment (A)	Percentage related to short-medium life assets (B)	Asset value related to short-medium life assets (C)	Weighted average percentage (D)
	Average of the enhancement and growth investment range on previous slides.	Individual council models.	Calculated as Column A x Column B.	Calculated as the total of column C divided by the total of column A.
New assets				
Auckland Council	NZ$23,169 Million	50%	NZ$11,584 Million	
Far North District Council	NZ$1,716 Million	60%	NZ$1,030 Million	
Kaipara District Council	NZ$786 Million	60%	NZ$472 Million	
Whangarei District Council	NZ$1,603 Million	60%	NZ$962 Million	
Amalgamated entity	NZ$27,274 Million		NZ$14,048 Million	**52%**

Additional spend-to-save operating expenditure…

Council	Value	Source
Connected population of the amalgamated entity	1,725,853	Average of water and wastewater population.
Total connected population in New Zealand	4,344,966	Individual council models; Original source is the RFI Tables A1 and A3.
Percentage of the NZ population	40%	Calculated from the above lines.
Additional borrowing raised across all entities	NZ$1,000 Million	Assumption.
Entity share of additional borrowing	NZ$397 Million	Pro-rata share of additional borrowing raised calculated as 40% of the NZ$1,000 Million.

Water Industry Commission for Scotland
First Floor, Moray House, Forthside Way, Stirling FK8 1QZ

E: enquiries@watercommission.co.uk
T: +44(0) 1786 430200
www.watercommission.co.uk
www.scotlandontap.gov.uk
@WICScotland