Subject: LGNZ release of Castalia reports, context and response

Dear Members

We've had requests from you to share the Castalia reports LGNZ commissioned at the start of the Three Waters Reform process. We are of course happy to do so (please see attached), but it is important to read these reports in the context in which they were commissioned including the timing and the subsequent responses to this work.

In essence, the Castalia reports were done under tight constraints, commissioned by LGNZ outside of Steering Committee work programme with only publicly available information... They were extremely valuable at a point of time in shaping LGNZ's thinking and ensuring our focus was directed to the key parts of the policy development process that needed attention. Throughout the reform process a range of external expertise informed analysis and the Castalia reports proved useful as policy has been developed. Some of the issues they raised are outlined below.

Context

As LGNZ engaged in the very early stages of the Three Waters Reform work we sought independent guidance from economic water experts to advise us what parameters to consider when assessing water service delivery models. In addition, we commissioned a high-level scan of different policy options available to decision-makers (options analysis), and a review of the Water Industry Commission for Scotland's (WICS) Phase 1 modelling.

That advice is summarised as follows:

- **Parameters for evaluating water service delivery models:** An overview of what parameters and institutional setting to consider when assessing different reform models, and their relative weighting. This was used to shape how LGNZ assessed elements of the Government's proposal;
- **Comparative analysis of institutional forms for proposed New Zealand reforms:** This high-level comparative analysis reviewed a cross-section of different water services models considered by Castalia to be applicable to the New Zealand context (and their respective pros and cons), ranging from council-owned, to outsourcing, and amalgamated water provision under public and private ownership; and
- **Analysing economies of scale in New Zealand water services:** This was a review of the results from the WICS Phase 1 modelling that informed early reform consideration by the Steering Committee. The initial WICS analysis was flagged as being "indicative" as it was based on the high level publicly available data available in 2018 LTP data. The Castalia review of the Phase 1 work was limited as they only had access to the outputs of the model, not the proprietary methodology and underlying code itself.

Subsequent responses

LGNZ found the Castalia reports useful to assess, test, challenge and strengthen the model put forward by the government. They helped us focus our thinking so we were able to concentrate on the key elements that we needed to "get right" if the Government's preferred model was to be viable. This resulted in robust discussion at the Steering Committee. These factors included:

- Access to scale benefits being a key requirement (including the reality that this would mean cross subsidisation), but recognising that there were limits on the benefits of scale;
- A clear need for an economic regulation (which requires entities of scale to be viable);

- The ability to raise debt capital (and assurance from the credit agencies on balance sheet separation); and
- The need to independently test the WICS modelling and calibrate the model to New Zealand's economic settings.

This initial research and the discussions at the steering group informed a number of reviews being undertaken at Phase 2 of the policy process, including:

- Farrierswier's review of the WICS model, specifically the methodology and underpinning assumptions applied by WICS and the extent to which this is reasonable to inform policy advice (see here).
- Beca's review of the standards and practices in the United Kingdom three waters industry and the relevance to New Zealand (see here).
- Deloitte's study of the economic impacts of reform and the potential opportunities and challenges for affected industries (see here and here).
- Shadow ratings assessment from Standard&Poors (which verified the financial aspects of the model and the balance sheet separation arrangements)

These reports, as well as the data gathered in partnership with councils as part of the RFI process, were used to develop the WICS Phase 2 report (see here, with supporting materials here, here, here, here and here).

Other parts of the suite of options in the Castalia advice were of limited use given the fixed preferences of local and central government decision-makers, specifically a strong preference for public ownership (as opposed to private ownership which was canvassed by Castalia), as well as substantive questions over the viability of the outsourcing model in sparsely populated areas. The Castalia report also, due to the stage of the policy process that we were at, focussed on institutional arrangements rather than the broad system-based reform, including the new role of Taumata Arowai.

To summarise, LGNZ confirms we found real value in the Castalia reports at a particular point of time. We do however urge members to read these Castalia reports within the context and stage of the process in which they were commissioned (Phase 1 of the policy process), the constraints on the authors, and the subsequent work which has been done to address the matters raised therein.

Yours sincerely

LGNZ

Parameters for Evaluating Aggregated Water Service Delivery Models

22 July 2020

Executive Summary

The New Zealand Government is proposing significant reform of water service delivery. Currently, water services are almost all provided by 78 local authorities directly. In 2017 operational failures in water abstraction and delivery in Havelock North caused up to four deaths and 5,000 cases of serious illness. An Inquiry identified systemic failure. Cabinet agreed to commence comprehensive reforms in 2018, prioritising regulatory reform (a new drinking water quality regulator) to be followed by changes to service delivery arrangements.

The Government has identified affordability of services and capability of service providers as key challenges for the sector. The Department of Internal Affairs (DIA), which is leading the policy reform process, has settled on amalgamation to achieve greater scale as the preferred reform model. Officials' advice and Cabinet discussions have focussed on the models adopted in Scotland and Tasmania. In each of those jurisdictions multiple water providers were successively amalgamated into a single provider. We understand that DIA officials and Ministers favour an amalgamated model of three to 12 water providers where the water assets and operations of local authorities are aggregated into regional water corporations.

The Government's policy process appears flawed and is focusing on high-risk options that may not deliver benefits

The policy development process so far has not followed the standard process for reforms of this sort. An early focus on only one among a range of important factors—economies of scale—has contributed to premature emphasis on a preferred model following a relatively cursory review of the international experience. Not following standard policy processes creates a risk that the model selected could fail, and lead to reforms that do not meet the agreed public policy objectives, or that produce unintended consequences. To avoid such outcomes, we recommend that Local Government New Zealand (LGNZ) and its members steer the debate in the direction of a standard policy process.

The standard policy process would identify the problem, state the objectives and then develop a theory of change around the outcomes sought. It would identify several options which could achieve the desired results, establish criteria by which to evaluate

the options, and involve stakeholders to develop a consensus on the option best suited to the country's needs.

We recommend the following six parameters to inform choices between institutional forms:

- Does the model achieve economies of scale and scope?
- Is the water delivery service accountable to customers?
- Does the model improve competence of management and operations?
- Are providers able to reliably raise the finance needed for investment?
- Are incentives aligned with objectives?
- Will the model be flexible and adapt to change and new information?

Economies of scale and scope

Economies of scale generally exist in natural monopolies because unit costs tend to fall as the firm's production increases. However, economies of scale in water services need to be carefully examined. Caution is especially warranted when examining evidence of economies of scale in water services to find cost savings as a reason for amalgamation.

Economies of scope are also less clear cut with water services. Economies can exist where water services are provided alongside other services (such as with many council water services currently).

Accountability of water delivery services to customers and communities

Accountability to customers and communities is important to ensure the water services are provided at the desired quality and cost level. Institutional structuring options provide varying degrees of accountability. These include municipal democratic control, regulation, corporatisation and direct ownership.

Improvements in competence of management and operations

Competent and sophisticated management and operations is essential to safe and efficient water services. There are various ways of achieving this including scale, competition, regulation, outsourcing and competition.

Reliable access to finance for investment

Water providers need access to adequate finance for investment needs. Various barriers currently exist preventing water services in New Zealand from efficiently financing investment. Overseas institutional models avoid these barriers through revenue financing, and stand-alone corporate structures.

Alignment of incentives with objectives

Incentive alignment is important for the short- and long-term. More care is required to align the incentives of management and those charged with governance with the public policy objectives over the long-term. Regulatory and institutional design support incentive alignment to varying degrees.

Flexibility and adaptability to change and new information

Water services involve expensive, long-lived assets that require long-term investment and stewardship. Nevertheless, water services need to be flexible and adapt to change and emerging new information, such as changes in customer preferences, society's expectations and growth. Institutional design can help preserve this flexibility.

Castalia team

You asked us to provide more information on our Castalia experts working on this assignment. David Ehrhardt is one of the world's leading experts on water utility structuring and regulation. He has advised clients over a 25 year career on significant regulatory and institutional reform projects in New Zealand (with Watercare), England, Australia (Melbourne and Tasmania), South Africa (Cape Town), Oman, and many other countries. David is Castalia's CEO and is based in Washington, DC. Dylan James has more than 20 years of experience as a regulatory, policy, and strategy specialist, and has advised on major institutional reform projects for water in New Zealand, the Pacific and Middle East. Andreas Heuser has over 15 years' experience as a legal, policy and economic advisor to governments and infrastructure investors, specialising in institutional economics. Erwin Ricketts has experience in economic, regulatory, and machinery of government issues. Biographies are in Appendix A.

1 Introduction

Cabinet has decided to develop options to reform New Zealand's drinking, waste and stormwater ("three waters") service delivery and funding system. Amalgamation along the lines of the experience in Scotland (Scottish Water) or Tasmania (TasWater) is Government officials' preferred option.

LGNZ is engaged in discussions and policy development with its members and the central Government on these reforms. LGNZ expects to participate directly in the Government's policy development steering group with the Department of Internal Affairs that will develop the reform options.

LGNZ engaged Castalia to assist it to better understand the key parameters for three waters reform, drawing on Castalia's international experience.

This note presents key parameters that we recommend be used in evaluating amalgamation and other reform options. These parameters are based on analysis of the reform objectives (section 2), the Government's preferred model and the policy process followed so far (section 3). The parameters themselves are presented in section 4. Appendix A presents biographical sketches of the Castalia experts responsible for this report.

2 Reform Objectives for Water Services

Stakeholders have set out various objectives for the reforms:

Cabinet's objectives for water reform

Cabinet[1] identified seven objectives, namely:

- Improve safety and quality of water services and environmental performance of wastewater and stormwater systems
- Ensure New Zealanders have equitable access to affordable three waters services
- Improve coordination of resources and unlock strategic opportunities for larger scale infrastructure
- Increase resilience of three waters services to short- and long-term risks
- Improve financial sustainability of three waters services
- Address affordability and capability challenges faced by small suppliers and councils
- Improve transparency and accountability of costs and performance.

LGNZ has particular objectives for the reform process

LGNZ advised us that the local government's objectives are fourfold:

- Aggregated water entities remain governed by community preferences, interests and needs, being the ultimate equity holders of the three waters assets
- Transition to a new regime is as smooth as possible
- Any new model improves the allocative efficiency in the overall system as well as responsiveness to change in the urban environment
- Impact on local government is considered and, where necessary, remedied.

Single overarching objective can improve clarity when assessing options

The Cabinet and LGNZ objectives are useful for setting out the specific things that have motivated the desire for reform (for example, drinking water safety and improving access to lowest-cost finance) or which must not be lost in the reform process (for example, community responsiveness, financial wellbeing of local authorities).

Numerous discrete objectives can lead to confusion. We therefore also suggest a single overarching objective that is consistent with and encompasses the numerous objectives of Cabinet and LGNZ. This is:

Provision of safe, resilient, reliable, and customer responsive water services, at least cost.

[1] Cabinet Paper, 28 January 2020, "Three waters service delivery and funding arrangements: approach to reform, Office of the Minister of Local Government"

3 Government's Preferred Model and Process Creates Risks

The Government appears to be focussing on a preferred option of aggregating water operations of local authorities into new autonomous statutory corporations with responsibility for water services across a region. The new corporations would be owned by the local authorities that make up the region. Shareholding would probably be based on assets currently owned by the constituent local authorities, adjusted for factors such as population. Each corporation would have a board, members of which would be selected for relevant professional competence. The reforms also envisage creation of a national drinking water safety regulator (Taumata Arowai) to enforce standards. Regulatory arrangements for pricing and other aspects of quality regulation have not yet been decided.

Government appears already settled on amalgamation and potential benefits of scale

DIA, which is leading the policy process, has identified greater scale and amalgamation as a preferred delivery model. Officials' advice, research and analysis, and Minister's attention, has centred on the Scottish Water model and TasWater reforms. In Scotland all water services have been amalgamated under a single utility, following successive amalgamation processes from the 1940s when up to 210 drinking water organisations were rationalised to the relevant local authorities to provide water. In the 1990s water services were merged into three regional public service providers. In 2002, the three providers were merged into one corporation: Scottish Water. Tasmania has also undergone considerable consolidation. Prior to 2009, 29 councils provided water services. Reforms led to three regional water corporations from 2009 to 2013 and a shared services provider. These were merged into a single state-wide entity (TasWater) in 2013.

Government risks carrying out poor policy process

By focussing on a particular criterion (scale via amalgamation), and focussing on only a limited set of international examples, the Government risks poor outcomes for the water sector. A better policy process would follow this model:

- State the case for change: What problems are we trying to fix?
- State the reform objectives: What outcomes do we want to achieve?
- Develop a theory of change: How will the proposed interventions cause the desired outcomes?

DIA's theory of change in water service delivery needs to be fully tested

DIA's theory of change is that improving institutions or the sector operating model will improve outcomes. However, a challenge to a rational policy process is that it is often not obvious which institutions will produce which outcomes, creating risk of faulty reasoning such as:

- Water sector institutions need to be reformed to achieve better outcomes (agreed premise)

- Therefore, DIA's proposed institutional reform should be implemented (false conclusion).

LGNZ should insist that reform options are evaluated against agreed criteria or parameters

Typically, in arguments like this, the person questioning aspects of the proposed reform is characterized as a defender of the status quo. Since it is agreed that the status quo is unsatisfactory, this discredits that person's arguments. To avoid this losing situation, we recommend that LGNZ insist that a range of options be developed, and evaluated against agreed criteria. These criteria cannot simply be the *objectives* of the reform. Various institutional options could be put forward by proponents who *claim* that their preferred model will achieve the objectives. The real requirement is for criteria to judge which institutional forms are most likely to achieve the agreed objectives.

4 Key Parameters to Assess Best Practice Water Services

We have identified six key parameters that LGNZ could use to evaluate policy proposals for reforming the water sector. These parameters reflect how global best practice achieves the objective identified above.

4.1 Does Proposed Model Achieve Economies of Scale and Scope?

Economies of scale and scope can provide benefits in the delivery of water services. However, it is important to assess the specific facts of the case, and in the case of reform, judge the actual economies being generated (if any) from the reform interventions.

Economies of scale in water services can reduce costs per customer but the evidence needs to be fully explored

When a firm's scale of production leads to lower average costs, there are economies of scale. Economies of scale are often assumed to exist because water services are generally monopolies with high fixed costs, and additional transmission of water (production) is thought to not add significantly to costs.

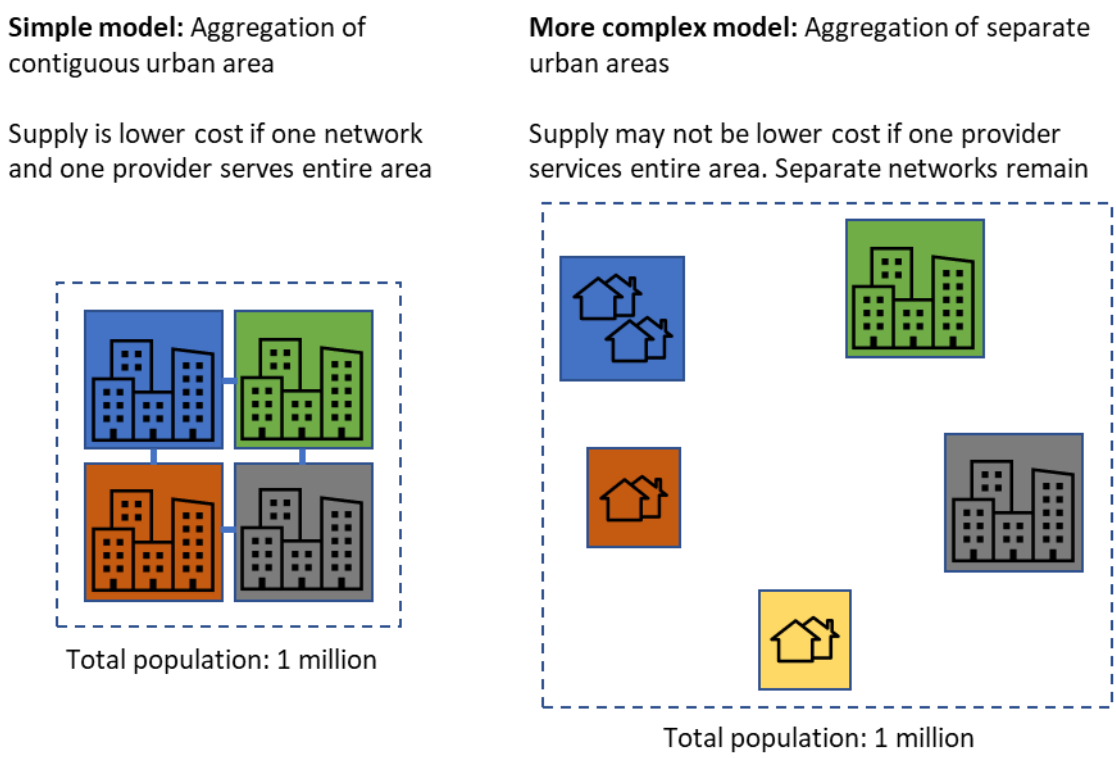
However, there are two key questions to ask when evaluating economies of scale in water utilities for structural reforms and amalgamations:

- What is the relevant output to measure to assess existence of economies?
- Are the physical water networks being assessed contiguous or separate?

The relevant output for assessing the existence of economies of scale in a structural reform is the number of connections: Does an increase in number of connections lower the average cost of provision? Here, the evidence needs to be carefully examined. It is not immediately obvious that increasing the number of connections (which have associated capital costs) drives increasing returns to scale. There may be savings in operating costs (for example corporate head office services) on a per customer basis as the number of connections increases. However, this is likely to be a small proportion of the total cost per customer.

It is important to know whether the physical water networks are contiguous or separate because amalgamating networks in a single urban area has different costs to networks separated by long distances. It is not clear that aggregating water services of several discontinuous urban areas (for example, towns in the lower South Island) with vast distances between water networks would deliver economies of scale benefits. Figure 3.1 illustrates two models.

Figure 4.1: Two Types of Economies of Scale from Aggregation in Water Services



The relevant literature for the amalgamation proposal in New Zealand would be on amalgamations of networks that remain discrete (no one is proposing to physically join the water networks of New Zealand's small towns that are not already physically connected). The relevant literature for New Zealand would exclude literature that just shows that serving a larger densely populated area has lower average costs than serving a smaller one. From our review of DIA's evidence base, it seems that this distinction has not been made.

The evidence base ought to include empirical assessment of whether increasing numbers of connections under one water service provider lowers average costs. Data Envelopment Analysis (DEA) one such empirical technique. DEA involves plotting a series of efficiency measures to define an efficiency frontier. For a given case, this frontier can be used to judge if water services become more or less efficient after reforms. DEA could be carried out across countries as well. While there would be a considerable amount of data collection, a lot of this has already been done (for example, OFWAT has data for England and Scotland going back to privatisation). Robust cross-country DEA would be expected to reveal the extent of efficiency benefits over time from actual amalgamations. For example, we would expect such DEA to reveal if Tasmania's amalgamations delivered efficiency benefits over time. DEA analysis could show if the course of reforms from 29 to three to one utility over the 11- year period improved efficiency or not.

In conclusion, economies of scale are important because they can drive down costs where they can be achieved. The focus in the New Zealand policy debate will need to be empirical. There has to be evidence that amalgamation will achieve average cost

reductions (accounting for improvements in quality due to other factors such as additional investment).

Economies of scope can exist at both small and large scales

Economies of scope are a proportionate saving in cost from producing two or more distinct goods. In water services this could be a cost saving from one service provider delivering both the clean drinking water and wastewater services. Economies of scope in water services are more often assumed than empirically verified. For example, it is assumed that coordinating network expansion of both drinking and waste water services would deliver economies of scope.

Economies of scope also exist between water services and other municipal services. This can be true at both small and large entities. Some small councils in New Zealand have one person responsible for "infrastructure" that typically covers water and roads (for example, Buller, Carterton, and South Wairarapa District Councils). Furthermore, New Zealand stormwater networks are closely linked to road engineering and building functions. Removing water services from local authorities could reduce economies of scope.

In conclusion, economies of scope can reduce the average cost of water services. Therefore, close attention will need to be paid to the risk that separating water services from local authorities could increase costs as scope economies are reduced.

4.2 Do Water Services Provide Accountability to their Customers and Communities?

There is a cost and quality trade-off in the provision of water services. It is important that service providers remain accountable to customers for where the service sits on the cost and quality continuum. Customer accountability gives customers the ability to act on concerns and receive the level of service they want for a given price.

Despite common perceptions, water services can be provided over a range of different quality levels. These include:

- Drinking water standards (from minimum health standards to mineral content and taste)
- Wastewater contaminant standards
- Water availability (quantity and seasonal availability)
- Customer service quality.

Water service quality can be highly variable, even above safe minima. Water service can even take on luxury good characteristics. Customers in high-income areas may wish to use more water for gardens (and be willing to pay to avoid sprinkler bans). In contrast, customers in low-income areas may be happy with simply safe, available drinking water. Some consumers may value friendly customer service and prompt attention to faults. In New Zealand, there are differences in how some Iwi wish to have their cultural values in water and waterways reflected. For example, many find discharge of treated wastewater into waterways abhorrent.

Consumers also want to ensure that water services are provided at a fair price. It is therefore important that the cost/quality trade-off is made by an entity, or in a way,

that provides accountability to customers. There are several high-level ways to achieve this:

- Local government (current model)
- Independent regulator
- Regional/council-owned entity
- Direct ownership by consumers.

Provision by local authorities (similar to current model) has democratic accountability

Direct ownership and operation of water services by councils/municipalities provides strong customer and community accountability. The customers in the community can have a more direct link to the provider, and can vote for local government representatives that will ensure price and service levels are met. This ensures those charged with governance of the service are incentivised to ensure the water utility serves the community well, and those that fail to do this may be voted out. However, there is some risk that accountability for water services is subservient to political pressures related to other municipal services.

Independent regulation of water service providers has some commercial and indirect democratic accountability—only if the regulator performs well

Regulation is a way of providing public accountability by (natural) monopoly service providers. Regulation can set prices and quality levels. One of the best-known water regulators is OFWAT in the United Kingdom which regulates over 20 public, semi-public and privately-owned utilities. It can enforce regulatory action amounting to many hundreds of millions of pounds in fines.[2] However, when regulators perform poorly, for example by failing to take into account regional preferences, the only recourse available to customers is usually indirect or costly. Customers can vote or complain via democratic representatives in national elections. It is difficult to make water service and price issues stand out alongside the many other national level political issues. Finally, regulators were originally created to modify the behaviours of for-profit companies where the profit incentive provides a driver for efficiency. In the absence of profits (like the proposed New Zealand model), the regulator model may not work as well.

Regional or state-owned entities can have commercial accountability to shareholders, but only limited democratic accountability

Water services can be owned at a regional level and operated under commercial mandates as statutory entities (like SOEs). This model can provide commercial accountability to shareholders (which might represent the interests of the community) and via statutory obligations through public financial reporting and Board accountability to the public-sector shareholders.

Regional or state-owned entities have been tried in the past under the Water Board model in England and Wales. This reflected a general trend in developing countries

[2] For example, Thames Water was ordered to pay penalties and payments to customers amounting to GBP 120 million in 2018, about 6 percent of its annual revenues

from the 1950s to 1980s to integrate water utilities under regional corporations. The model was followed in the developing world in the 1970s.

One notable example of centralisation into regional entities but with a time limit is from the developing world. Brazil undertook centralisation of water utilities with World Bank support in the 1970s. The government encouraged municipal governments to delegate control of their water and sanitation services to newly created state utilities (CESB in Portuguese).[3] Municipal governments did this by issuing concession contracts with fixed terms (usually 15-30 years). Concessions are agreements which delegate the provision of public services from government. The private party assumes operational and maintenance obligations and receives fees or tariffs. These are common in many civil law countries (France and Portugal for example). Despite some successes, by the mid-1990s, many CESBs were unprofitable and inefficient due to a wide range of political and economic factors. Some municipalities chose not to renew the concession contracts with the CESB when they expired, and instead appointed private concessionaires to operate the water services.[4]

Direct ownership by consumers can provide more direct accountability

Cooperative ownership models where consumers own the utility (like many small private water schemes) provide more direct accountability. Corporate governance structures (constitution, Board oversight, shareholder meetings) provides a mechanism for this accountability. Around 20 of the local electricity distribution monopolies in New Zealand are owned by trusts that represent the ownership interest of consumers. The trusts hold elections in the community for trustees. The trustees represent the community's interest in governing the utility.

Conclusion on customer and community accountability

In conclusion, there are various institutional options to give customers and communities accountability for price and quality preferences in water services. The institutional design options need to be evaluated for the extent to which they are likely to be effective in the New Zealand environment.

4.3 Does Model Improve Competence of Management and Operations?

Competent and sophisticated management and operations occur when management meets organisational objectives, uses available resources efficiently, maintains high levels of employee performance and professionalism, and provides excellent service to customers. This is essential to safe, resilient, reliable water services at least cost. Management and operational competence involve basic safety matters, such as ensuring filters are changed or chlorine drips discharge at the correct rate.

Competence can be improved via the following ways:

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[3] *Public-Private Partnerships (PPPs) and Concessions of Public Services in Brazil*, Cesar A Guimaraes Pereira (2014); *Building Regulatory Bodies in the Brazilian States*, Adam Joseph Cohon (2013), at page 26.

[4] For example, Sao Paolo's SABESB which otherwise relatively successful even had some municipalities elect not to renew the concession contract. SABESB is listed on NYSE, although the majority of shares are still held by the government.

- Scale: Castalia's analysis[5] identified that water asset management competence among New Zealand local authorities and providers is correlated with size and scale
- Competition between water services: Whereas a single water service can tend toward a bureaucratic culture, multiple providers that compete to attract skilled staff can result in improved competence.
- Outsourcing: Utilities can hire skilled managers and operations specialists to carry out particular functions, for example where network size does not justify a full-time position
- Regulatory enforcement: Well-designed regulation can enhance competence if fines or public reprimand incentivise behavioural change
- Profit incentives: Where profits can be generated from improving services, this incentivises managerial and operational competence.

In conclusion, institutional options should be evaluated according to the likelihood and extent that competence of management and operations is improved. There are several ways to achieve this, not all of which necessarily follow from increased size.

4.4 Are Providers Reliably Able to Raise Finance Needed for Investment?

Water providers require access to the lowest, risk-adjusted cost finance available on terms that align with their capital and operating cost needs. The cost of finance is set by the market, and reflects the market's assessment of the provider's ability to earn revenues to repay its lenders. Water services involve high cost assets with long lives and lumpy investment. Financing instruments like bonds need to reflect a long-term investment horizon.

Financing barriers can prevent efficient investment, including investment for future growth. For example, the water services of many councils in New Zealand are constrained in accessing finance due to overall indebtedness levels of the council's consolidated balance sheet, and caps imposed by credit rating agencies that, if breached, would increase the cost of debt.

Financing models exist that overcome these barriers. Revenue bonds are one example because these link interest payments directly to the revenues of the project being financed. Creditors hold security over the pledged revenues. These bonds are uniquely rated by credit ratings agencies and other creditors. Stand-alone, non-consolidated water utilities are common overseas. These can access debt under general obligations bonds at higher levels than New Zealand water services. This is because creditors and the wider market believe that municipal or state governments will not bail out the utility.

In conclusion, access to adequate finance is essential to meeting investment needs. Various barriers can artificially constrain water services' borrowing. Reform options

[5] Castalia. (2017). Three waters asset management maturity in New Zealand. Available at: www.dia.govt.nz/diawebsite.nsf/Files/Three-watersdocuments/$file/Castalia-ThreeWaters-Asset-Management-Maturity-in-NZ-(final-report)-Oct-2017.pdf

should be assessed for the extent to which water service providers can access finance that reflects the riskiness and revenues of the water business and its projects alone.

4.5 Are Incentives Aligned with Objectives?

This criterion refers to the institutional settings that incentivise those charged with governance and management of the water service to make decisions that achieve the overarching objective. The incentives can be short- or long-term. Ideally, both short- and long-term incentives are aligned with the objectives.

Short-term incentives of governance and management can be aligned via performance contracts and financial targets. Institutional incentives generally arise from accountability to shareholders. A profit motive generally ensures short-term incentives are aligned.

Long-term incentives can also be aligned, with more care. Long-term incentives are a challenge in any institution, especially where assets have long-lives and investment needs are over decades. One key issue is ensuring long-term capital investment is sufficient. The benefits of capital investment in water services can emerge over long periods of time, well after management personnel have moved on. Therefore, institutional settings, such as ownership interests or regulation, need to ensure that management are incentivised to make costly capital expenditure even where the benefits will not produce immediate returns. Regulation can ensure long-term incentive alignment via statute. For example, the Commerce Commission must "promote the long-term benefit of consumers"[6] when regulating electricity lines, gas pipelines and telecommunications businesses, and other monopolies with long-term asset lives.

In conclusion, incentive alignment can follow from financial or contractual incentives in the short-term, and require more care in the long term through institutional design.

4.6 Will Model be Flexible and Adapt to Change and New Information?

Flexibility and adaptability to change and new information is desirable in water service providers. While water services are generally long-lived and high capital cost businesses, technology, customer preferences, and society's expectations can change. For example, growth or decline can change investment needs. Society's environmental expectations can change, for example the change from historical attitudes to discharge of waste into the environment. These changes or new information require water services to adapt in response.

Providers that are closer to customers can generally adapt more easily due to better local knowledge and understanding. Institutional settings can also ensure dynamism and responsiveness to customer demands over time. The example of Brazilian municipalities in section 4.2 above shows how time limitations on institutional arrangements can be valuable.

It may also be desirable for changes over time in the boundaries between service providers, or their respective size and scale. Rather than locking in geographical

[6] Part 4, section 52A (Purpose of the Part), Commerce Act 1986.

boundaries as permanent features, it can be desirable to preserve the option for water services to change size and form over time. For example, as Auckland grows beyond the geographical boundaries of the historical Auckland region, it might make sense for parts of the water systems in Waikato or Northland to join the Auckland system.

In conclusion, institutional settings should be assessed on the extent that these are responsive to change and new information.

Appendix A—Castalia Water Sector Experts

Our team includes David Ehrhardt, Dylan James, Andreas Heuser and Erwin Ricketts. Short biographies are set out below:

David Ehrhardt, Chief Executive

Mr. David Ehrhardt is Castalia's Chief Executive and a recognized expert in developing innovative thinking on sector reforms and private sector participation.

David is among the world's leading authorities on water sector restructuring. Qualified in both law and economics, he wrote the World Bank's Sourcebook on Urban Water Governance, authored the Explanatory Notes on Water Regulation, and played a major role in drafting the Water PPP Toolkit. In his 25 years of advising on institutional and regulator reform in the water sector, he has worked for leading utilities, regulators, governments, and private investors.

He has designed capital expenditure plans, and advised on financing and deliver those plans, so as to meet service coverage and security goals at least cost. He has assisted Essex Water and Severn Trent in the United Kingdom, Melbourne Water and the Hobart Water Board in Australia, and Watercare in New Zealand in these matters.

As an institutional and organizational specialist, David has developed management turn-around plans, business plans, and institutional reforms for more than 30 water utilities. Mr Ehrhardt is also highly experienced in evaluating water investments from an economic and financial perspective, and is recognized as a world leader in design of PPP contracts, particularly in the water sector.

David began his career at the New Zealand Treasury working on the privatization of the electricity sector and design of energy markets.

Dylan James, Director

Mr. Dylan James has more than 20 years of experience as a regulatory, policy, and strategy specialist, particularly in regulatory design and evaluation, environmental regulation and cost benefit analysis. Qualified in economics and business strategy, Dylan also advises companies and Governments on the economic and financial viability of infrastructure investments by assisting with demand assessments, financial analysis, and asset valuations. His work has included a range of commercial strategy, regulatory, and investment advice.

Dylan has recently delivered economic evaluation projects on water quality regulation for the Ministry for the Environment, economic evaluations of options in the wholesale reform of the Sultanate of Oman's water sector, analysis of asset management sophistication in the water sector for Department of Internal Affairs, evaluation of wastewater treatment options in Cook Islands as well as a range of projects for World Bank, Asian Development Bank, Otago Regional Council, New Zealand Treasury, and the Ministry of Business, Innovation and Employment. Dylan applies his well-developed understanding of microeconomics to the problems faced in environmental regulation, infrastructure and government sectors to help clients make good strategic, policy, and investment decisions.

Andreas Heuser, Manager

Mr. Andreas Heuser, is an institutional economics, policy and legal specialist, with a focus on utilities, urban infrastructure and natural resource economics.

Andreas has deep experience in institutional design and regulatory policy. He has managed a range of infrastructure advisory projects in New Zealand, the Pacific and South East Asia since joining Castalia. In the water sector he has managed high-profile projects assessing economic impact of proposed freshwater regulation reforms in New Zealand for Local Government New Zealand and the Ministry for the Environment. He managed a project to evaluate wastewater treatment options in Cook Islands. Andreas has wide infrastructure economics experience in leading design of a social infrastructure PPPs in the Pacific, managing the preparation of a renewable energy strategy for the Government of Laos, and a Pacific-wide exercise identifying infrastructure investment opportunities for a global investor.

Andreas was previously with New Zealand Treasury where he guided contentious policy reforms in urban planning and in funding and financing of water and roading infrastructure. He is a qualified lawyer and has advised infrastructure investors on international arbitration disputes in the oil and gas and transport sectors in Europe.

Erwin Ricketts, Senior Analyst

Mr Erwin Ricketts brings four years of experience advising on economic, regulatory, and machinery of government issues. His experience spans New Zealand's primary sector and natural resource sectors having worked in both the New Zealand Treasury and the Ministry of Business, Innovation, and Employment.

Recently, he has advised on the review of Crown Minerals regime and the development of New Zealand's minerals and petroleum resource strategy. Through this work he has advised on long-term risk and resource allocation issues intersecting Government and non-Government interests. This has included leading a review to diagnose issues and improve the way that petroleum infrastructure decommissioning liabilities are shared between Government and private actors.

Erwin has provided value for money and strategic alignment analysis of proposals in support of formulating several New Zealand Government Budgets, and in the allocation of the $3 billion Provincial Growth Fund. These proposals have spanned the agricultural, fisheries, forestry, biosecurity, energy, and regional economic development sectors.

Confidential

Comparative Analysis of Institutional Forms in Water Services for Proposed New Zealand Reforms

Draft Report to Local Government New Zealand

September 2020

Acronyms and Abbreviations

ACUA	Departmental Water and Sewerage Companies (*Empresas Departamentales de Acueducto y Alcantarillado*)
Capex	Capital Expenditure
CAR	Autonomous Regional Corporations (*Corporaciones Autonomas Regionales*)
CRA	The Potable Water and Basic Sanitation Regulation Commission (*Comisión de Regulación de Agua Potable y Saneamiento Básico*)
DNP	The National Planning Department (*Departamento Nacional de Planeación*)
DWI	Drinking Water Inspectorate
ESP	Corporate Subsidiary for Water Services (*Empresas de Servicios Públicos*)
INSFOPAL	Central Government Agency (*Instituto de Fomento Municipal*)
LGNZ	Local Government New Zealand
MVCT	Housing and Territory Ministry (*Ministerio de Vivienda, Ciudad y Territorio*)
Ofwat	The economic regulator of the water sector in England and Wales
PBSR	Public Sector Borrowing Requirements
RWA	Regional Water Authority
SSPD	Superintendancy of Domiciliary Public Utilities (*Superintendenica de Servicios Sanitarios*)
Taumata Arowai	Water Services Regulator
WASA	District of Columbia Water and Sewer Authority

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Executive Summary

The Government is proposing institutional reform to improve water services across New Zealand. A new drinking water regulator has already been created–Taumata Arowai. Water services in New Zealand are currently owned and operated by the 67 local government territorial authorities (councils) with a small minority of exceptions.

The proposed institutional reform is the Government response to the 2017 Inquiry into Havelock North Drinking Water. This inquiry investigated operational failures in water abstraction and delivery in Havelock North which caused up to four deaths and 5,000 cases of serious illness.

A range of problems have been identified within the New Zealand water sector. These include poor environmental outcomes from effluent and stormwater run-off and risk of failures of decaying infrastructure. The underlying causes include a lack of finance for new infrastructure and maintenance and providers that lack specialised management and technical personnel and systems.

In mid-2020, the Government invited councils to opt-in to a funding package of $761 million to join a reform process. The reform process has focussed on a particular reform model. The proposed model involves the amalgamation of council-owned water services into a smaller number of regional publicly-owned entities. The intention of the proposed amalgamations is to realise significant economic, public health, environmental, and other benefits over the medium to long term.

The reform process is being led by a Joint Steering Committee of officials, advisors, and stakeholders, including the Department of Internal Affairs, Local Government New Zealand (LGNZ), Society of Local Government Managers, Taumata Arowai, and Treasury.

Need for a robust policy development process

Robust reform processes require the following steps: diagnose the problem; state the reform objectives; consider a range of reform options; evaluate and consult on the options; select the option most likely to achieve the objectives. Evaluation of the options is best done with an agreed set of evaluation criteria. Consultation is crucial, as successful implementation typically depends on the cooperation of stakeholders.

LGNZ is contributing to this policy process. The paper Parameters for Evaluating Aggregated Water Service Delivery Models dated 22 July 2020 offered a clear objective statement and suggested criteria to be used in evaluating reform options. The paper Analysing Economies of Scale in New Zealand Water Services dated September 2020 examined the extent to which economies of scale—one of the stated driver of reform—could be achieved in New Zealand. The current paper extends LGNZ's contribution to the policy processes by offering four reform options and evaluating them against the reform outcomes identified in Evaluating Aggregated Water Service Delivery Models and the institutional effectiveness criteria proposed earlier. Each of the options is described in general terms and explored by examing the international evidence on what a reform of this type has achieved elsewhere. This analysis draws on and complements other contributions to the process, including: Frontier Economics (2019) review of reforms in Australia (Tasmania and Victoria), United

Kingdom (England, Wales and Scotland), Republic of Ireland, and New Zealand (Auckland and Wellington); and Martin Jenkins (2020) review of Scottish Water, regional Victoria, Welsh Water (Glas Cymru), Watercare Auckland, and the Ontario Clean Water Agency.

Four institutional models and reform episodes

Table 0.1 sets out the four institutional models, summarising each one's relevance to New Zealand, and the reform episode involving that model presented in this report.

Table 0.1: Institutional Models and Relevance for New Zealand

Institutional Model	Relevance to New Zealand	Reform studied
Local government responsibility	The status quo model in New Zealand. Widely used around the world. Reforms of regulation, governance, and finance that strengthen existing service providers which remain the local government's responsibility should be considered.	Colombia reform of local government responsibility for water services in the 1990s, involving the creation of independent regulator, governance reform, and improved financing mechanisms
Regional publicly-owned corporations	The Government's proposed model.	England and Wales amalgamations to create Regional Water Authorities in 1973
Regional privately-owned corporation	Investor-owned model is standard for network service providers around the world (in New Zealand, electricity network utilities follow this model). In England, it was privatization with regulation, not simply regional amalgamation, that delivered the greatest benefits.	English privatisation of Regional Water Authorities in 1989
Local government delegation of service provision to third-party provider	Utilises highly specialised and skilled water service companies to provide asset management sophistication and assist with financing. Widely used in the European Union and elsewhere.	Papakura, New Zealand reform to delegate water services to a third-party provider under a concession contract in 1997

Details on these options are provided in section 2.

Extent to which the reform episodes achieved desired outcome

All four reform cases sought similar outcomes to New Zealand: assurance of drinking water quality, improved environmental outcomes; increased efficiency; ability to finance investment; and service and affordability for customers. Table 0.2 summarises the extent to which these goals were achieved, the impact on local government, in each reform episode.

Table 0.2: Reform Episodes Assessed Against Desired Outcomes

	Colombia (1990s–present): Local Government-Owned and Operated	England and Wales (1973–1989): Regional Publicly-Owned Corporations	England and Wales (1989–present): Regional Private Sector Company	Papakura (1997–present): Local Government Delegation of Service Provision to 3rd Party
Drinking Water Outcomes	Drinking water quality improved. Challenges in rural areas remain.	Persistent failure to meet quality standards over the 1970s and 1980s.	Water quality standards improved – between 1994 to 2003, breaches of water quality declined by 86 percent.	Papakura's drinking water has consistently met drinking safety standards.
Environmental Outcomes	Treatment of wastewater improved significantly, though more is needed.	Pollution continued in river and coastal waters post reform. Significant failures to meet discharge standards.	Environmental (bathing) waters meeting standard increased from 78 percent in 1990 to 99 percent now.	The concessionaire has met the environmental management conditions set in its contract.
Cost and Efficiency outcomes	Capital expenditure increased. Tariffs now approximate cost recovery.	Initial fall in capital investment in 1970s, followed by reversion to pre-reform level in 1980s. Rate of return targets achieved through job cuts in 1980s.	Productivity and capital investment increased. £50 billion invested in infrastructure in water assets.	Papakura's water and wastewater charges are lower than in other parts of Auckland.
Financial Outcomes	Reforms have created many methods for water utilities to access finance.	Struggled to access finance due to fiscal limits. Resorted to financing capex directly from users charges.	Unlimited access to debt and equity provided by capital markets.	Financing of local network expansion is wholly provided by developers (not partially provided by the local authority unlike other partis of Auckland).
Customer Outcomes	Access to drinking water and sanitation increased. Bills rose but remain affordable.	Bills held constant in real terms during the 1970s, but increased in real terms throughout the 1980s.	Bills rose 42 percent in the 20 years after privatisation to help fund asset investment.	Customer satisfaction reached 97 percent in 2019. Charges remain below Auckland's average.
Local Govt Impacts	Municipalities retain the power to appoint board members to water utilities, promoting accountability to customers and coordination in local planning.	Despite initial promises, local government lost any ability to appoint board members in 1983. The assets were later sold but the proceeds were not given to the local authorities.	Privatisation did not result in any further impacts on local governments, which lost governance and ownership rights in the earlier amalgamation.	Auckland Council retains ownership of water assets. Local government's autonomy is constrained by the terms of the contract.

The reform episodes illustrate the strengths and weaknesses of each model. A theme that cuts across is the value of effective external regulation. In Colombia, regulation contributed to significant improvements within a local-authority controlled setting. In contrast, in England and Wales, amalgamation without external regulation failed to deliver most of the benefits sought.

Finance is another cross-cutting theme. The 1973 amalgamations in England failed to improve access to finance because borrowings of Regional Water Authorities (RWAs) consolidated into the public sector borrowing requirement (PSBR). Government limits on borrowing eventually starved the RWA's of finance, forcing them to push up user charges to pay directly for the capital expenditure needed. Privatization took the water sector off the government's books, enabling unconstrained access to finance, (though with higher tariffs). In Colombia, the reforms boosted national government's contribution to financing the sector, through an improved system of inter-governmental fiscal transfers, and the use of a development finance entity (FINDETER). These fiscal measures were successful in crowding in substantial commercial finance.

The Papakura case shows how delegation to a specialised third-party company provided high drinking water and environmental standards and lower than average charges. This option is already available to local governments in New Zealand (under section 136 Local Government Act 2002).

More details on the reform episodes are provided in section 3.

Assessment of institutional models against indicators of effectiveness

A handful of reform cases does not provide enough data to confidently choose the most appropriate model. A complementary approach is to assess institutional models against criteria of institutional effectiveness, developed from economic and management theory, for the case at hand.

Table 0.3 below offers a summary assessment of each of the models against criteria developed in the first paper—the likelihood that a model will achieve: economies of scale and scope; accountability to customers; competence of management and operations; ability to access finance; and strong, aligned incentives. An indicative color-coding is offered: green indicates that good performance could be expected on this indicator; salmon represents there is a risk; and light red is used where theory suggests the model is not well suited to promoting this aspect of institutional effectiveness.

In New Zealand, economies of scale achievable through institutional reform will be mostly in management and procurement (not infrastructure).[1] Three models: regional public corporations; regional private companies; and delegation to a third-party provider, are better suited to enabling such economies than a purely local government system. Against this must be set the economies of scope that local governments achieve. It should also be noted that local governments may cooperate to achieve

[1] Castalia (2020), Analysing Economies of Scale in New Zealand Water Services: Report to Local Government New Zealand

economies of scale, as happened in England before 1973; as is common in Colombia; and as the local authorities in the Wellington region have done.

Table 0.3: Institutional Models Assessed Against Indicators of Effectiveness

	Local Government Responsibility	Regional Publicly-Owned Company	Regional Private Sector Company	Delegation of Service to a Third-Party Provider
Economies of Scale	Does not facilitate economies of scale.	Can achieve economies in management and procurement.	Can achieve economies in management and procurement.	Economies of scale may be available where third-party provider can operate over multiple concessions.
Economies of Scope	Can result in economies of scope with other council activities.	If the regional corporation is limited to the Three Waters, there can be no economies of scope.	If the regional company is limited to the Three Waters, there can be no economies of scope.	Economies of scope available where the provider can offer other utility services.
Accountability to Customers	Elected officials accountable to voters. Water issues can be election issues.	National regulation and governance can promote good service, but the system is not directly accountable to customers as water issues will seldom determine national elections.	National regulation and governance can promote good service, but the system is not directly accountable to customers, as water issues will seldom determine national elections.	Municipal decision-makers still directly accountable to customers, but responsiveness may be constrained by term and duration of contract.
Competence of Management and Operations	May be hampered by insufficient scale of operations and limits on ability to pay for specialised skills, in the smaller service providers.	Greater scale should make it easier to afford the required specialised skills and systems. Risk of public sector limits on pay and incentives remain.	Can achieve scale needed. No artificial limits on pay or incentives.	Accesses world-class management systems, and IP. Achieves required scale across multiple operations. No limits on pay or incentives. Global career prospects.
Ability to Access Finance	Access to finance constrained for small services and those whose parent government is close to its borrowing capacity.	Can access finance if creditworthy and borrowing do not require national government guarantee or consolidate into public sector debt.	Ready access to commercial debt and equity.	Ready access to commercial debt and equity.

Incentive Alignment	Elected officials directly accountable. However, public sector constraints may limit ability to transmit incentives through the organisation.	Highly dependent on governance and ability to create incentive contract with management team and staff.	Incentives are aligned, provided that economic regulation is effective.	Incentives are aligned, provided good contractual design.

Direct customer accountability is provided by the local government model. When water service is a problem in a community, and local government is responsible, the matter often becomes an election issue. Customers are empowered to change their water service arrangements at the ballot box. Where service is delegated to a third-party provider, the local authority decision-makers are still accountable through the ballot box, but their ability to respond may be limited by the terms and duration of the contract. The regional corporations typically involve central government control through national regulation (and governance in the case of a public corporation). If central government makes good decisions, customer interests will be served. However, direct accountability to consumers is weak, since it is unlikely that national elections will turn on water service matters.

Access to finance is difficult for small local authority water services and for those whose parent government is close to its debt ceiling. Regional corporations offer the possibility to do better, largely because of their greater scale. However, if the regional corporations' borrowings are counted as part of either national or local government debt, fiscal constraints may cut off access to finance, as happened to the Regional Water Authorities in England and Wales. Regional private companies, and concession contracts with third-parties, offer access to finance limited only by the ability of operating cashflows to pay back loans and provide dividends.

Aligning incentives throughout an organisation is key to performance. Proven models of regulation and concession contract design exist to harness the profit motive of a private company to the public benefit. When profits are maximised by maximising public benefits, the board and management of the companies can use private sector management techniques to align incentives through the organisation. Alignment of incentives in public sector organisations is more difficult. There is no single metric of performance, and often greater difficulties in offering financial rewards for good performance. Between the publicly-owned models, the direct accountability of elected officials for water sector performance assists in aligning incentives. In contrast, regional public water companies may suffer from having neither a clear financial goal nor clear democratic accountability, making it harder to measure performance and align management and staff incentives.

1 Introduction

The Government is reforming the water sector in response to an Inquiry[2] and problems with management and technical capability in the delivery of water services in New Zealand. The Government has advanced proposals to amalgamate local water services into regional publicly owned companies. This option has been presented to stakeholders and in public as the preferred initial option.[3]

This paper is a contribution to the policy development process. It goes beyond the set of options analysed by the Government so far, presenting four major institutional forms used in the delivery of water services (section 2).

We assess reform episodes of water services around the world using case studies. The case studies describe the pre-reform situation, the institutional reform process, and then the impact that reform had on key water outcomes. This is a before and after reform comparison of water service outcomes (section 3).

We then assess the institutional options against indicators of institutional effectiveness earlier submitted to the Joint Three Waters Steering Committee Secretariat. These are based on standard management and institutional theory (section 4). Finally, we briefly conclude the results of the analysis (section 5).

[2] The Government Inquiry into the Havelock North Drinking-water Outbreak

[3] Department of Internal Affairs (2020), Three Waters Reform Programme: A proposal to transform the delivery of three waters services. Retrieved from: https://www.dia.govt.nz/diawebsite.nsf/Files/Three-waters-reform-programme/$file/Slide-pack-from-July-Aug-2020-workshops.pdf

2 Institutional Models Relevant to New Zealand Water Sector Reform

We have selected four major institutional models of water services for this report. In this section, we put forward these models as potential options for New Zealand. We chose these four models because they are successful internationally and relevant to the New Zealand policy reform process.

2.1 Local Government Responsibility

Local government responsibility for water services is a relevant option for New Zealand's policy reform process because it could be retained with some improvements. It is also a very common model around the world. In any policy reform process, it is important to consider whether the status quo can be improved, rather than wholesale institutional reorganisation reforms, which tend to be disruptive, costly, and can lead to unintended consequences.

The model has been used in England (prior to 1973), Scotland (prior to 1994), and is still the dominant model in many countries including the United States, France, Germany, and many other countries. The wide use of the model suggests that many jurisdictions, with which New Zealand compares itself, consider that the local government model meets public policy objectives.

The model involves the local or municipal government owning the assets and managing operations of the water services directly. Management of the water services is typically carried out by salaried employees. In many cases, a wholly-owned subsidiary company of the local government is used. Varying proportions of specialist services may be contracted out (outsourcing). Funding of the water services can come from tariffs for services, or property taxes, or both.

Financing of the water services is generally provided with a combination of "pay as you go" tax revenue financing and longer-term debt finance. Debt can be general obligations debt—that is, bonds backed by the general credit and taxing power of the local government entity. In some cases, municipalities issue revenue bonds, that is, bonds secured by a stream of revenues (typically tariffs) to the water service provider. Revenue bonds are commonly used by publicly-owned utilities in the United States.

The local government elected members typically hold the management of the water service to account. In some cases, a dedicated water subsidiary company is used with its own board that oversees management. Local government elections enable voters to hold those charged with governance of the water subsidiary company to account.

2.2 Regional Publicly-Owned Companies

Regional publicly-owned companies have been used in several countries where water utilities have been formed by the amalgamation of municipal or other utilities.

This model was used in England and Wales between 1973 and 1989. It was used in Scotland from 1967 to 1973 with 13 regional boards and from 1973 to 2002 with three regional boards. Tasmania used this model from 2008 to 2013. It is used in regional Victoria, Australia, parts of the Philippines, and by Watercare (prior to the Auckland

Council being formed, at which point it strictly speaking became the local government's responsibility).

The regional publicly owned corporation model is proposed by the Government as a solution for New Zealand's water services.

Under this model, a public corporation owns and operates water services for a region of multiple local government entities. The corporate form may be a company law company, statutory corporation, or a specific corporate form (as in Texas or the Philippines).

Water assets are owned by the corporation, separate from the relevant local, federal, or national government balance sheet. However, in some cases, the corporation may be consolidated into the owner. The corporation is typically managed by an executive team accountable to a board. The board is typically appointed by some level of government (either municipal, state, or national level).

The regional corporation model is funded through tariffs for services or charges based on property value or both. Financing is sourced from the government (as with Scottish Water, Irish Water, and TasWater), banks, or capital markets.

2.3 Regional Private Sector Company

Private investor-owned and regulated utility companies are common around the world. The regional private sector company is used in England. The model involves private ownership of water assets and networks for profit. In England, the nine private regional water companies are subjected to economic regulation by Ofwat.

The regional private sector is relevant because Fronter Economics evaluated it in their report for the New Zealand review process. That report discussed useful lessons for New Zealand from the English regional private sector company model. However, it is important when analysing the English water companies to fully disentangle the effects of amalgamation (in 1973) from privatisation and regulation (in 1989). Many electricity distribution networks, including in New Zealand, are investor-owned.

Private provision of water services involves a private, for-profit company that owns the water network, production, and treatment assets and provides services to customers. Water services are generally natural monopolies. Private, for-profit, natural monopolies are usually regulated to avoid excessive returns by overcharging or lowering the quality of service.

2.4 Local Government Delegation of Service Provision to Third-Party Provider

Delegation of service provision to a third-party provider is a common model for water services around the world and is relevant for New Zealand.

The model has been successfully used for over 200 years in many civil law countries and in some common law countries. Concessions are common in France, Spain, and Portugal as well as countries with similar legal traditions such as Brazil, Philippines, and Colombia. In France, 75 percent of water and 50 percent of sanitation services are

provided by third-party providers, primarily by two of the world's largest water services firms, Veolia Water and Suez Environment.[4]

The model is relevant to New Zealand because it offers one way to improve the specialist skills and asset management expertise available to water services here. Many participants in the New Zealand policy reform discussion recognise that asset management sophistication and specialist skills are lacking in many New Zealand water service providers. The Havelock North Inquiry concluded that attracting skilled staff was difficult for some water providers and contributed to poor water quality outcomes across the country.

The model is also relevant because there is precedent for its use in New Zealand in Papakura. Outcomes on a range of measures appear to have been positive.

The model involves the local government tendering a concession contract to a private operator. The operator is called a concessionaire. The concessionaire is responsible for investing in the improvement and maintenance of infrastructure, and in return it receives payment through user fees or tariffs. At the end of the concession period (usually 15 to 30 years in the water sector), the assets return to public ownership.[5]

[4] International Office for Water (2009), Organization of Water Management in France, p. 29.

[5] See further, Cesar A Guimaraes Pereira (2014), Public-Private Partnerships (PPPs) and Concessions of Public Services in Brazil.

3 Assessing Institutional Reform Episodes Against Desired Outcomes

We evaluate four reform episodes to see if the change to the particular institutional models achieved the outcomes that are sought in New Zealand.

The four case studies cover the following reform episodes:

- **Colombia**, where local government responsibility was reformed in the 1990s and the many local government owned and operated water service entities were subjected to a re-designed regulatory regime
- **England and Wales**, where in 1973 a large number of water undertakings and entities were amalgamated into 10 Regional Water Authorities (RWAs)
- **England**, where from 1989 the RWAs were privatised into regional private companies and subjected to price and quality regulation, and improved drinking water and environmental regulation
- **Papakura**, where in 1997 the District Council delegated the management and operation of its water services to a third-party private provider.

We identify episodes where the institutional form of water services changed and assess (where possible) the impact that reform had on key water outcomes identified by the Government. This is a before and after reform comparison of water service outcomes. A visual representation of our approach is contained in Figure 3.1.

Figure 3.1: Castalia's Approach to Analysing Impact of Changes in Water Services Institutional Models

3.1 Colombia Reform of Local Government Responsibility for the Water Sector

In the 1990s, Colombia reformed its water sector. This was part of a wider decentralisation process. The reforms codified local government ownership of water services and introduced regulatory and policy reform.

There are other jurisdictions with local government responsibility for water services (such as the United States) that might have more in common with New Zealand. However, despite being an emerging market economy, Colombia is an illustrative case study in water reform. Colombia instituted the reforms to bring in independent regulation, financing, and governance reforms while strengthening the role of local government in water service provision. The centralisation of control and funding of

water services in the lead up to the reforms has similarities to the proposed amalgamations in New Zealand.

Pre-reform situation in Colombia's water sector

Prior to the 1990s, most of the country's water services were directly managed by the central government agency Instituto de Fomento Municipal (INSFOPAL). INSFOPAL was established in 1950 to finance and carry out water, sanitation, and public waste management projects and support municipal water services. The relative weakness of the municipal utilities meant that by the 1960s, INSFOPAL would directly operate the water services for most areas around the country.

In 1974, water departmental companies (ACUAs) were established to run municipal water services as direct branches of INSFOPAL.

Only the large cities such as Bogotá, Medellin, and Cali had water services independent of INSFOPAL.

By the late 1980s, acute problems had developed across the sector:

- Smaller municipalities had poor water service quality and coverage.
- Water services were badly governed. ACUA management was often driven by political, rather than technical and administrative considerations.
- Water services were inefficient. Water metering was poor, and unaccounted for water was high.
- Many water services were financially unsustainable. Political incentives kept tariffs too low, which led to inadequate cost recovery.
- Investment levels were low.

Colombia's 1990s reforms introduced a comprehensive regulatory regime, requirement for corporatisation, and strengthened the local government role

The reforms of the sector dissolved INSFOPAL in 1987 and codified that the responsibility for water services should sit with municipalities. However, at the same time, the central government recognised that many of the municipalities were failing to deliver adequate services under the prior regime. Therefore, a different approach was necessary.

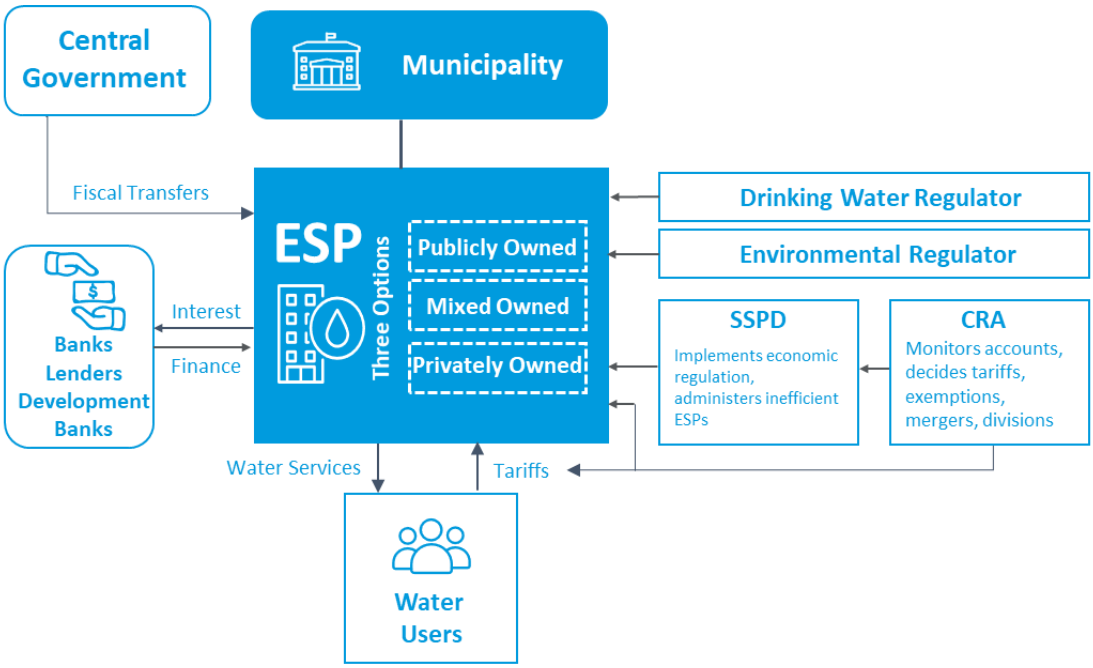
The government permitted corporatisation. Municipalities (with very few exceptions) were required to utilise a corporate subsidiary (the Empresas de Servicios Públicos or ESP corporate form) to provide water services. The ESP form introduced flexibility. Municipalities could retain municipal ownership, contract with a private ESP for services, or partially privatise (retaining some shareholding). The ESPs can access private finance (equity and debt).

A new regulatory framework was also introduced. A dedicated economic regulator called the Commission for the Regulation of Water Supply and Sanitation (CRA) had responsibility to monitor the efficiency of water services. It could enforce mergers, divisions, and step in and administer water providers if necessary. The CRA was also made responsible for administering a new tariff methodology which set tariffs to recover costs plus a return on capital. This methodology was a mechanistic formula which relied on financial information provided by water providers. Some flexibility was

also incorporated into the regime whereby municipalities could apply to the CRA for tariff modifications.

A new regulatory agency tasked with implementing and monitoring compliance with the economic regulations set by the CRA was also introduced—the Superintendency of Domiciliary Public Utilities (SSPD). It was given powers to inspect water services, monitor performance and implement specific corrective measures set by the CRA, and directly administer and liquidate poor performing water providers. New drinking water quality and environmental regulators were also introduced.

Figure 3.2: Illustration of Water Sector Regulators in Colombia



Colombia's reforms successfully improved water sector outcomes

Colombia's regulatory reforms led to improvements across its water sector: water coverage and quality improved, and providers financial position greatly improved compared to the pre-reform period.

Access to services greatly increased following the reforms

Overall, access to water has increased in Colombia since the reforms.[6] Also, overall, water services are available with a higher quality of service.

Since the year 2000, basic assess to drinking water has improved from 90.0 percent to 97.3 percent of the population. Over the same period, access to sanitation increased from 71.6 percent to 89.6 percent.[7] Of those with access to water and sanitation services, average continuity of service ranged between 95 and 98 percent.

[6] Machado and Vesga (2016), Water and Sanitation Sector: A Colombian Overview.

[7] WHO UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (2019), Estimates on the use of water, sanitation and hygiene in Colombia.

Drinking water quality and environmental outcomes

Drinking water quality improved in many parts of Colombia in the 1990s compared to the period before the reforms.[8] There are still water quality issues in some rural municipalities.

In the 2000s, attention shifted to the wastewater sector, leading to improvements there too. New wastewater treatment plants were built following the reforms. The vast majority of wastewater was historically not treated, and existing treatment plants did not operate efficiently. In 2000, the Ministry of Development estimated that Colombia's treatment plants treated less than 1 percent of total urban wastewater. This has significantly improved to 41 percent in 2018.

Investment and financial performance

Investment in water assets increased considerably following the 1990s reforms, tripling across small-tier municipalities. There were three major reasons for this.

- The reformed regulatory regime required tariffs to reflect costs (plus a cost of capital) which enabled utilities to recover adequate income
- Government support was made available, including intergovernmental fiscal transfers to municipalities and funding from a national development bank (which also accesses international development funding) called FINDETER[9]
- Utilities gained greater access to commercial finance. Guaranteed fiscal transfers from the national government improved the credit rating of the utilities, and mechanisms (such as pooled water bonds) were introduced to help finance smaller utilities.

Access to reliable financing

Colombian water utilities have access to a wide range of sources to finance their investments. This is due to the reforms which introduced guaranteed transfers for water providers, and special financing mechanisms Colombia introduced to assist smaller water providers.

Domestic banks are the primary source of finance: between 2009 and 2019, bank loans represented 61.3 percent of sector debt. Some of the larger ESPs have tapped into capital markets as an alternative to the banking system. For example, *Empresa de Acueducto y Alcantarillado de* Bogotá, the ESP that services the city of Bogotá, has issued over US$1.1 billion worth of bonds since 2001.

Smaller providers have encountered difficulty accessing capital markets directly. However, Colombia subsequently introduced a range of measures to assist them. These include a trust consortium that organises investment and finance for multiple

[8] Andres et al (2010), Charting a New Course: Structural Reforms in Colombia's Water Supply and Sanitation Sector, World Bank PPIAF p. 122.

[9] FINDETER provides wholesale finance and risk-mnagement products to commercial banks, encouraging them to lend to water utilities and other sectors of national importance.

municipalities and a pooled water bond scheme that enables smaller municipalities to access capital markets.

Colombia also made use of some development financing from organisations such as the World Bank. However, development finance now makes up only a small proportion of the total financing mix for the water sector.

Local government control of water services

The ESP model has enabled municipalities to retain considerable control and flexibility over water services. Control is important to hold the ESPs accountable to the interests of voters and customers. Municipalities exercise control over the private ESPs through contracts. Publicly owned ESPs (and mixed ownership ESPs) can be controlled via board member appointments. These appointments can be politicised: ESP boards tend to change when the municipal government changes. This also has benefits because water service providers are responsive to customer demands and priorities as expressed through the political process.

The SSPD has a monitoring enforcement role to ensure compliance with rules set by the CRA. The SSPD can step in as a monitor or manager in case of persistent underperformance.

The Colombian model also enables flexibility for bottom-up mergers where municipalities voluntarily wish to regionalise services. Top-down mergers are also possible where the CRA compels a regional merger that would reduce cost of service.

3.2 Creation of Regional Water Authorities in England and Wales

In 1973, England and Wales amalgamated numerous municipal and other water service providers into 10 Regional Water Authorities (RWAs). This resulted in poor outcomes.

This case study focusses on the 1973 period of reform because this was the major period of amalgamation in England (and Wales). Frontier Economics' report covered the performance of English water utilities but combined the effects of privatisation (which occurred in 1989) with amalgamation (which occurred 16 years earlier). By separating the amalgamation reform episode, it is possible to more clearly see the results of an amalgamation similar to that currently proposed for New Zealand, and to distinguish those results from the results of privatisation and regulation.

Before 1973 a diverse range of entities provided water services

Prior to the reform, there were 157 water undertakings and 1,398 sewage and sewage disposal authorities as well as 29 river authorities. England and Wales also had 33 private water supply companies (called Statutory Water Companies) that had their origin in the nineteenth century and were created under private Acts of Parliament. Most of the water services were provided directly by local authorities or through joint undertakings and boards[10].

A number of Government working parties found that the industry structure of a large number and size of water service entities was incapable of meeting future water

[10] These joint undertakings and boards were mostly the result of early corporatizations and mergers of municipal water utilities, generally undertaken voluntarily through cooperation between adjacent local governments.

demand and address the problem of pollution control.[11] Prior to reform, the budgets of local government-owned water service entities were not ring-fenced. Local authorities could determine whether to use income from water services for any of the local government's capital and operating expenditure needs.[12]

Policy proposals at the time considered that a smaller number of entities that could integrate the management of water resources through more centralised decision-making was needed:

> *The government considered that integrated water resource management could be best achieved by a total of between six and fifteen vertically integrated regional monopolies, providing all the required services to their customers, from extraction of raw water, delivery of processed water, to collection, treatment and discharge of wastewater and management of the quality and quantity of water resources. The discussion document outlined the boundaries of between seven and 13 possible water authorities.*[13]

Reform to regional publicly-owned corporations integrating all three water functions along river basin boundaries with centralised control

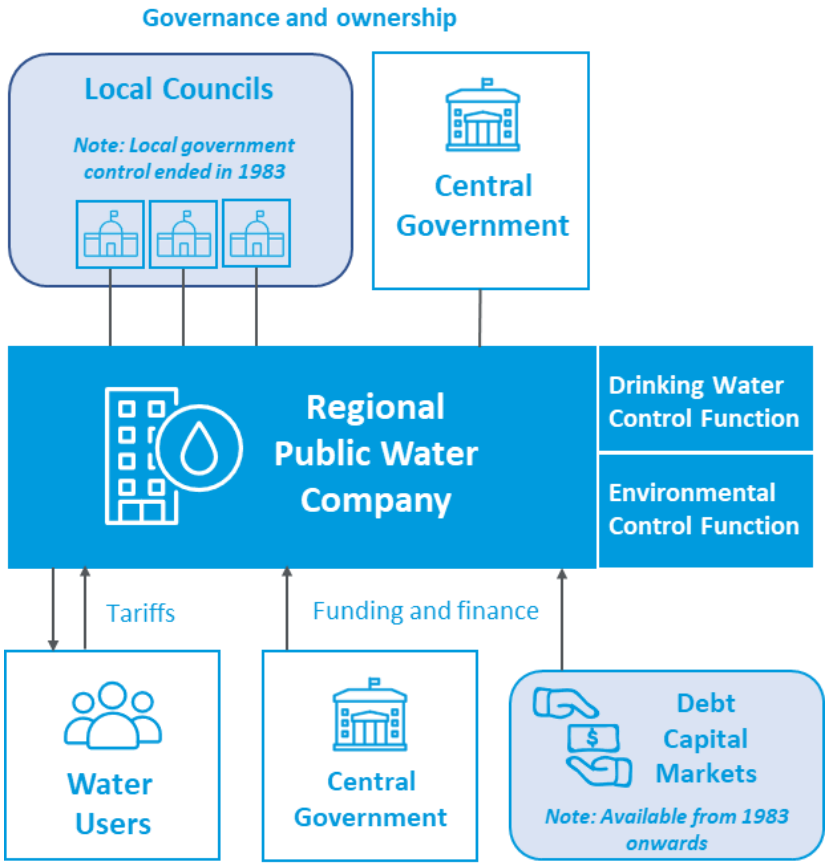
Following the policy review process, the government enacted the Water Act 1973. This created 10 new Regional Water Authorities (RWAs), composed of local authority-owned and joint undertaking water service entities. The Statutory Water Companies remained as private entities. The RWAs were controlled in their investment, planning, and coordination by the central government. Figure 3.3 illustrates the RWA model.

[11] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 11

[12] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 16

[13] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 13.

Figure 3.3: Regional Water Authorities in England and Wales



The RWAs boundaries mostly aligned with the 10 major river basins of England and Wales. The RWA boards were initially composed of a majority of directors appointed by the constituent local authorities. The central government appointed the Chairs.

RWAs had to set water charges on a cost-recovery basis and had to meet modest return on capital targets set by central government. The RWAs raised capital for investment by borrowing from central government. The RWA's borrowing was consolidated into the central government's balance sheet, in the UK this was called the public sector borrowing requirement (PSBR).

The 1973 Act created a new Central Water Policy Planning Unit that coordinated planning for water resources, water quality, pollution prevention, and carried out research. The central government held the right to review and approve investment and operating plans and programmes. Central government also held the power to give environmental consents to the RWAs for discharges of effluent and for major investment projects.

The RWAs took on responsibility for pollution monitoring and enforcement control previously held by 29 river control authorities. The RWAs were also responsible for managing and controlling their own discharges from wastewater facilities. When the UK joined the European Community in 1973, it had to enact legislation to implement European Community directives on water quality and environmental standards. The Control of Pollution Act 1974 enacted the directives and treated pollution and waste together as a unified concept and covered waste on land, the pollution of water, noise,

and pollution of the atmosphere.[14] However, these rules were not actually made binding until 1985.

In the late 1970s, a range of problems manifested in RWAs, including poor environmental outcomes and barriers to necessary investment.

In response, in 1983, central government enacted a range of changes that reduced the role of local government and centralised control. From 1983, the right to appoint directors to RWAs was taken from local authorities and vested completely in central government. The central government believed that smaller, executive type boards would improve efficiency. Consumer Consultative Committees were introduced to provide some representation of water users.

The 1983 changes attempted to make RWAs operate in a more commercial manner.[15] The government tried to introduce long-run marginal cost pricing for tariffs. During the 1980s tariffs increased, and investment rose. However, the tariffs did not rise enough to reflect the long-run marginal costs of supplying water services.[16] This was in part due to the government reining tariffs back.[17] RWAs were permitted to borrow directly from private capital markets after 1983, as well as from central government (which was consolidated into the PSBR), however, financing overall fell after 1983.

Performance of the reformed RWAs was poor across a range of outcomes

The RWA performed poorly. Drinking water and environmental outcomes did not improve. Investment could not be funded from revenues. Access to finance was constrained. Customer outcomes were poor and local government was ultimately disenfranchised in its oversight of water services.

Drinking water quality and environmental outcomes

Drinking water quality was poor following the reform to RWAs. The quality decline was due to the failure to maintain and invest adequately. For example, poor water quality, low pressure and interruptions, and high levels of corrosion were reported in 1986 in a review by the National Economic Development Office.[18] Water quality failed to meet European Commission Drinking Water Quality Directive standards throughout the 1970s and 1980s.

Environmental outcomes worsened. A 1985 river quality survey confirmed an obvious effect on water quality of the underinvestment.[19] Coastal waters were also polluted. Only 67 percent of coastal bathing waters met European Community's bacteriological standard. By 1988, 20 percent of all major sewerage works were failing their discharge standards. Significant new investment to clean up wastewater was necessary at that stage.[20]

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[14] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 20

[15] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 27

[16] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 165

[17] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 165

[18] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 22

[19] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 165

[20] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 165

Investment and financial performance

RWAs were underfunded for the cost of services and the level of investment required. User charges were too low and government funding was insufficient.

The central government required RWAs to keep bills in line with inflation for the initial years of the RWA reforms. The central government also encouraged the water authorities to address social welfare issues in its pricing policies. Bills were averaged across all customers within an authority's region of supply, resulting in cross-subsidies between urban (relatively cheaper) and rural (relatively more expensive) customers.

Bills were levied based on property values, rather than linked to consumption. Water meters were not widespread. Following the 1983 reform the RWAs were able to increase water charges at a rate higher than the retail price index and borrow more.

Access to reliable financing

The central government constrained the investment programmes of RWAs. The RWAs had inherited debt totalling £22 billion (in current prices)[21] and had continuing capital investment requirements. The RWAs were financed (exclusively until 1983) from the central government balance sheet—the PSBR. The 1970s were a period of government deficits and therefore, the government constrained maximum annual capex and placed limits on the amount to be allocated to reserves.

The UK government (through the Secretary of State for the Environment) monitored performance and had to set rate of return targets, which mostly averaged around 1-2 percent per annum

For a brief period in the early 1980s the boards over-achieved financial targets, which came about through streamlining and job cuts (20 percent reduction staff was achieved).[22] This occurred in part because of the 1983 Water Act reforms which permitted RWAs to access private capital markets.

The period of underinvestment up to 1983 was followed by an attempt to increase capital expenditure. Between 1979/80 and 1986/87 there was a 30 percent increase in the level of capital expenditure in the sector. Although the 1983 reforms did enable some increase in investment, it was still inadequate. The Government frequently cut borrowing through changes to the RWAs external financing limits.[23] UK Treasury rules effectively blocked the RWAs from accessing commercial finance during the 1980s as well. In order to avoid impacting the government balance sheet, RWAs were forced to fund themselves entirely from tariffs on a pay-as-you-go basis. This led to excessive increases in prices and loss of intergenerational equity.[24]

Local government control of water services

The initial reform in 1973 that formed RWAs provided for local government appointees to hold a majority on RWA boards. Local governments were promised governance input in order to secure agreement to consolidate the water sector. The

[21] Ofwat (2006), The Development of the Water Industry in England and Wales, p. 22

[22] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 166

[23] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 165

[24] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 p. 169

Water Act 1983 changes severed any connection between local government and the RWAs.

Local government reacted angrily to the loss of governance and oversight and the water assets. Water assets worth billions of dollars were transferred to the RWAs without compensation. There was an attempted concession during the passage of the 1983 Water Act to allow a minority of board members to be appointed by local government. However, this was removed by central government and and local government played no part in RWA governance or management after 1983.[25] The later privatisation and on-selling to investors, resulting in proceeds to the national government and the local governments getting nothing.

3.3 England Privatisation and Regulation of Water Sector to Regional Private Companies

Given what had emerged as the impossibility of the RWAs funding the necessary environmental and drinking water improvements without threating achievement of the government's deficit-reduction goals, it was decided to privatise the RWA's service provision functions to enable them to access the capital they needed. The 10 RWAs were privatised in 1989 into investor-owned and independently regulated water companies. The UK government wanted to introduce private capital and improve the performance by introducing a profit incentive (subject to regulation). The reforms improved outcomes across a range of measures.

Reform to private regional company introduced new regulators and enabled easier access to capital for investment

The 1989 privatisation turned all 10 RWAs into investor-owned companies, listed on the London Stock Exchange. The floatation proceeds were used to pay the government for the assets of the RWAs (for £7.6 billion). The £4.9 billion of debts of the RWAs were assumed by the government. The government also made a cash injection to the companies of £1.5 billion (all 1989 prices).[26]

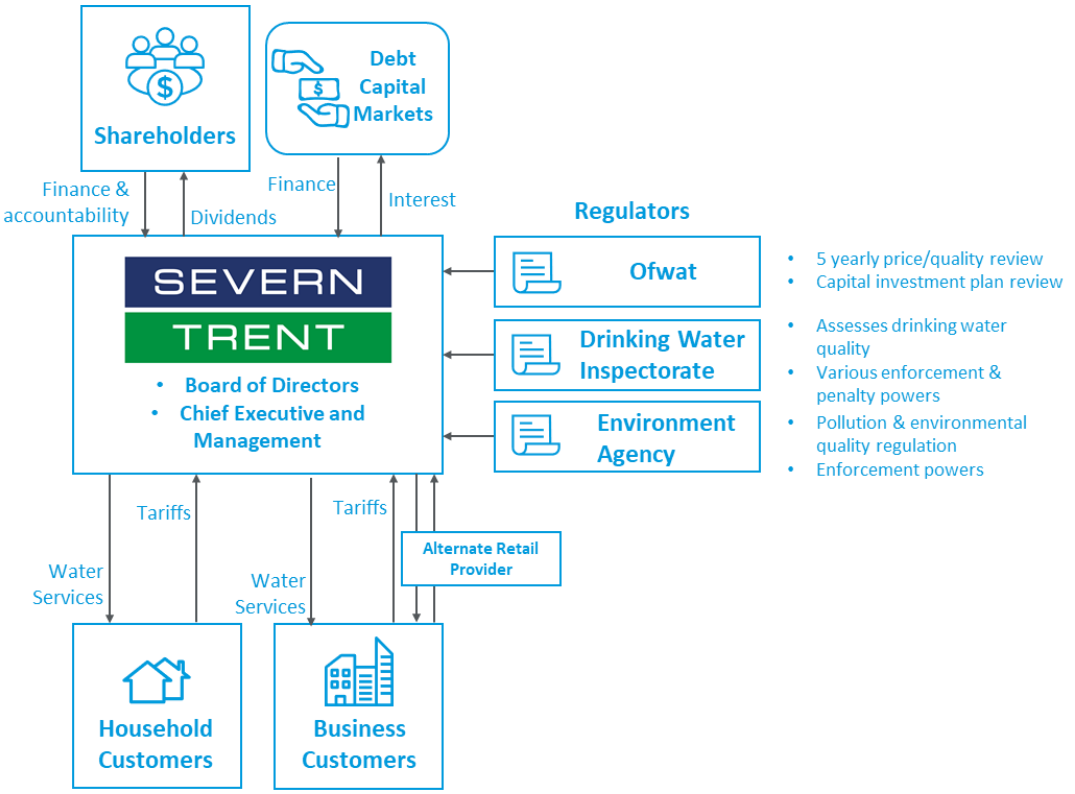
The government created new regulators. The Water Services Regulation Authority or Ofwat was established to regulate prices and quality. The Drinking Water Inspectorate (DWI) was created in 1990 to regulate drinking water quality. The National Rivers Authority (now Environment Agency in England) was made responsible for environmental pollution, flood management, freshwater fisheries monitoring, water resource management, and conservation of the natural environment.

The newly privatised regional companies could access debt capital markets for finance. The companies could also increase charges within a price cap set at the rate of inflation plus a "K-Factor". The K-factor provided the real-terms tariff increases needed to finance the companies' capital expenditure programmes (after considering projected operating efficiencies). The first price caps were set by the government at privatisation. Subsequently, Ofwat reset the price caps every 5 years.

[25] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 pp. 164-166

[26] Ofwat (2016), The Development of the Water Industry in England and Wales, p. 22

Figure 3.4: Illustration of Institutional Settings for Regional Private Sector Company (Severn Trent example)



Private regional company model resulted in mostly improved outcomes

We describe the outcomes in the years following privatisation as follows.

Drinking water quality and environmental outcomes

Drinking water quality across England and Wales improved significantly post privatisation. The DWI noted an improvement in compliance with drinking water quality standards across the 1990s. The number of breaches of water quality rules declined by 86 percent from 1994-2003.[27] Compliance with drinking water standards reached 99.88 percent in 2002.[28]

Overall, English water utilities steadily improved on their delivery of customer outcomes after privatisation. Ofwat measures 17 indicators weighted by importance for customers, such as rate of leakages, low pressure, wastewater compliance, and responsiveness to complaints. Ofwat noted a constant improvement in the initial years after privatisation. Scores have stabilised around the top end of the scale.[29]

Environmental outcomes improved markedly following privatisation in England. This was a consequence of improved investment and better regulatory setting, monitoring, and enforcement. Wastewater treatment and disposal performance improved leading

[27] Ofwat (2016), The Development of the Water Industry in England and Wales, p. 78.

[28] Ofwat (2016), The Development of the Water Industry in England and Wales, p. 78.

[29] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector: Report for DIA, pp. 40-43.

to significant improvement in bathing water[30] quality. Seventy eight percent of 'bathing waters' met minimum standards in 1990 and this has risen to 99 percent currently.

Investment and financial performance

The privatised water companies increased capital investment in the years immediately following privatisation, and improved productivity. Around £50 billion was invested in new assets and rehabilitation and renewal of existing assets. After the initial uplift, greater proportions of this capital expenditure went on service quality improvements, with smaller increases in general capital maintenance. The private companies then sustained higher levels of capital expenditure than prior to privatisation until the mid-2000s.[31]

English water businesses outperformed the Ofwat operating expenditure efficiencies significantly in the 1990s after privatisation. The efficiency gains subsequently levelled off.

Access to reliable financing

Since privatisation in 1989, the private sector companies have financed their own investments in water assets. The private sector companies have been successful at financing their investments:

- The privatised water companies (including the smaller ones) have been successful in accessing bond markets.
- By 2004, total net debt of the industry was £20.8 billion, equivalent to a gearing level of 60 percent.
- Severn Trent, for example, has a net gearing ratio of 88 percent and a Standard and Poor's rating of BBB+.

The companies' shares have generally performed well since flotation. A minority of the private England and Wales water companies raised additional equity capital to finance expenditure. United Utilities, for example, completed a fully subscribed rights issue of £1 billion in 2003.

Access to services and customer outcomes

Customer bills increased after privatisation. Average household bills were 42 percent higher in real terms 20 years after privatisation.[32] However, most sources (including the UK government's *Official History*) acknowledge that the UK government (which controlled the predecessor RWAs) had underinvested in water services and kept charges too low. Overall, customer services improved, as evidenced by Ofwat's reporting on service quality measures.[33]

[30] This is the UK term for what is known as the water quality levels for swimming in New Zealand.

[31] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector: Report for DIA, p. 26.

[32] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector: Report for DIA

[33] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector: Report for DIA, p. 24.

Local government control of water services

The privatised water companies had no direct impact on UK local government functions. As noted above, this is because the formation of the 10 regional water boards preceded the privatisation by 17 years and any local government involvement ended in 1983.

However, at the time of privatisation, some local authorities contemplated legal action to "recover their assets". This followed resentment from the Water Act 1983 reforms that effectively took any oversight and decision-making powers for water services for the Regional Water Authorities off local government.[34]

3.4 Papakura Local Government Delegation of Water Services to Third-Party Private Provider

In 1997, the then Papakura District Council delegated its water services to a third-party provider via a concession contract. The Papakura concession is still in place today and it has resulted in positive investment and customer outcomes.

Papakura District Council sought to improve the cost effectiveness of water services prior to 1997

Prior to 1997, water and wastewater services were provided directly by Papakura District Council. This meant the Council was responsible for managing and operating these services, including financing and investment in water infrastructure.

In 1996/97 (the financial year prior to the concession), water supply accounted for NZ$2.9 million, and sewerage accounted for NZ$3.0 million of the Council's operating costs. These costs accounted for almost 40 percent of the Council's total operating costs (NZ$15.4 million).[35]

Unlike the other reform episodes considered in this report, such as England and Wales, and Colombia, Papakura's water services were in a reasonable state at the time of reform in 1997. Its water infrastructure assets were in median condition, and appropriate capital investment had been made in the system.[36]

The Council proactively explored delegation as part of a wider drive to use the private sector for the delivery of services. The Council's stated philosophy was to use the private sector if it could provide better and more cost-effective services.

A concession contract for the provision of services was awarded to a specialised operator in 1997

In 1997, the Council tendered for and then awarded a contract for services to the joint venture company United Water International Pty Limited (the concessionaire). United Water comprised French specialist water company Veolia plus Thames Water (one of the privatised English water utilities) and Australian engineering firm Kinhill Engineers. The concession has now been completely taken over by Veolia.

[34] Parker (2012), The Official History of Privatisation, Vol. II: Popular Capitalism, 1987-97 pp. 165

[35] Auditor General (1998), Report on Papakura District Council: Water and Wastewater Franchise, p. 15

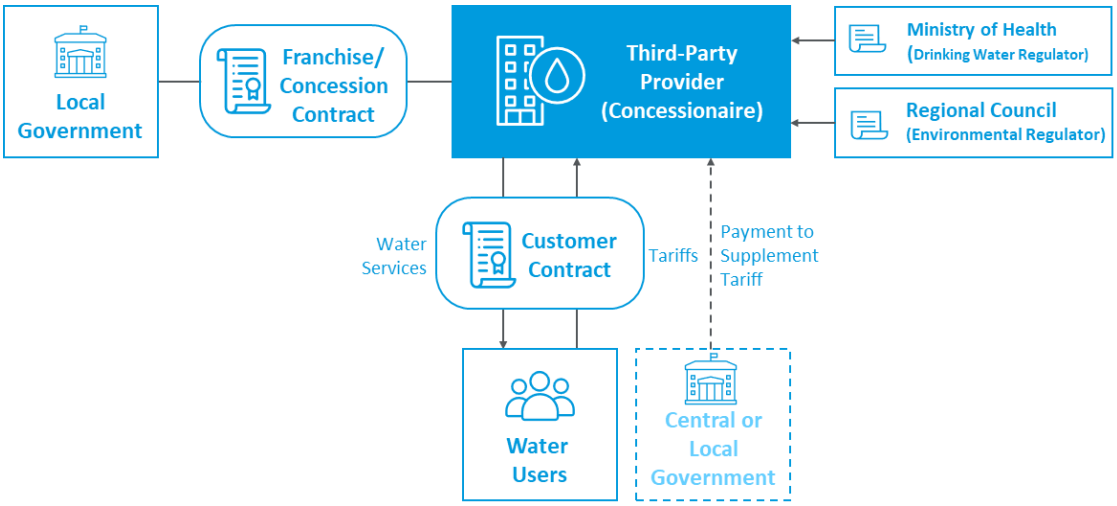
[36] Auditor General (1998), Report on Papakura District Council: Water and Wastewater Franchise, p. 46

The contract requires Veolia to maintain and operate all aspects of the water services. Veolia is responsible for keeping the asset condition better than when it began the concession. The average asset condition is measured every 5 years. Veolia finances asset renewals. All operations are carried out by Veolia (including administration and billing). It oversees additions to the water and wastewater delivery network within the Papakura district to ensure that developers meet asset condition standards. The network additions then become Veolia's responsibility to maintain and operate. When Auckland Council was created under the legislative amalgamation of six Auckland region councils, the Papakura concession remained in place.

The water and wastewater networks (that is, the assets) remain the property of the council (now Auckland Council, after the merger). The bulk water is provided to the concessionaire by Watercare. The treatment and disposal of wastewater is also carried out by Watercare at plants outside the old Papakura boundary, which is consistent with the situation pre-dating the concession. The concessionaire was required to maintain prices below the Auckland region's average. However, it had the right to pass on wholesale water charge increases and wastewater treatment costs.

The main source of income for a concessionaire is a tariff or user fee. Figure 3.5 illustrates the model.

Figure 3.5: Illustration of Third-Party Delegation to Third-Party—Papakura Model



Papakura's delegation model has resulted in positive outcomes

Papakura has enjoyed a continuation of high quality of water and wastewater services since delegation occurred in 1997.

The network has also expanded under Veolia. At the commencement of the concession, Papakura had 12,300 metered properties and 160km of water mains. Veolia now provides maintenance services over 17,000 connections and 361km of water mains plus 268km of wastewater networks.

Drinking water quality and environmental outcomes

Papakura's drinking water was consistently rated as safe following the appointment of a concessionaire. The drinking water regulator commended Papakura in 2004 (the

earliest that drinking water testing records are available online) for the "continued perfect bacteriological compliance record." Other councils had lower scores and continued incidents.[37]

Most wastewater for Papakura is in fact treated and disposed of by Watercare outside of the district (which was the case prior to the concession). There was no noted change in environmental performance after the reform.

Access to services and customer outcomes

Under Veolia's concession contract, it can recovers charges from users at fees equal to or below the Auckland average.[38] The Papakura concession has resulted in residents of the former Papakura District enjoying water and wastewater services at a price below the Auckland average.[39] In Papakura, residents seem to be satisfied with the performance of the water services. Veolia reports 97 percent customer satisfaction.[40]

Access to reliable financing

Papakura's delegation of water services to Veolia has extended the scope of financing somewhat. Watercare finances bulk water investment because it remains responsible for bulk water supply (and investment and maintenance) from when the concession contract was signed.

Local network investment in maintenance and renewals is made by Veolia. Network additions are financed by the developers carrying out new development. The developer must build the expansion to specifications set by Veolia. Those assets then vest with the local authority, but Veolia has responsibility (like for the rest of the network) to operate and maintain those assets. In Papakura, Veolia seeks to ensure that all of the costs are financed by the developer. In other local authority areas, the amount of financing can be less than the costs because local authorities might be incentivised to encourage (that is subsidise) building development.[41]

The advantage of this arrangement is that the local council does not have to directly finance renewals of water infrastructure or partially finance network additions.

Local government control of water services

The Papakura concession contract leaves the relevant local government entity with contractual monitoring duties, rather than management and operational functions

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[37] Ministry of Health (2004), Annual Review of Drinking-Water Quality In New Zealand, available at: https://www.moh.govt.nz/NoteBook/nbbooks.nsf/0/F3C43A29707C2DA84C2565D7000E0E66/$file/annual-review-of-dw-quality2004.pdf

[38] Veolia's fees and charges are published here: https://www.veolia.com/anz/sites/g/files/dvc2011/files/document/2019/06/2019%20-20%20Customer%20Charges-Domestic.pdf

[39] Veolia (June 2019), Domestic Customer Charges Papakura 2019/2020, available at: https://www.veolia.com/anz/sites/g/files/dvc2011/files/document/2019/06/2019%20-20%20Customer%20Charges-Domestic.pdf

[40] Veolia (2016), Municipal, Papakura Concession, New Zealand Auckland Council: Water Network Operations and Maintenance. Available at: https://www.veolia.com/anz/sites/g/files/dvc2011/files/document/2017/10/Municipal_-_Papakura_NZ-_Water_Network_O_M_Final_-_APPROVED_for_external_use.pdf

[41] Based on conversation with Watercare senior executive.

(and the associated costs). The council (now Auckland Council) retains ownership of the assets, including improvements to assets. Upon expiry of the concession in 2027, the assets will revert to the council (unless a further concession or extension is signed).

Benefits to local government include the franchise fee (NZ$13 million from the concessionaire upon contract award) and the reduction in costs of operating the water services.

The local government retains ultimate control over the water assets and services. In case of a serious breach of the concession agreement, local government can step back in and either appoint a new concessionaire, or take over management and operations directly.

3.5 Conclusion on Reform Episodes

The Colombia case study highlights that it is possible to use regulatory, governance, and financing reforms to improve drinking water quality and wastewater treatment while retaining local government responsibility for water and wastewater services.

The RWA case study shows that amalgamation into large entities and the imposition of central government control has risks. The RWAs raised finance from the central government and became part of the PSBR (deficit) which led the government to limit how much they could borrow. This left the RWAs unable to finance necessary investment. Drinking water and environmental outcomes were poor as a result. Local government was promised a governance role in exchange for ceding their assets. The local authorities were later excluded from that role. The UK government later sold the RWAs as privatised entities and kept the sales proceeds.

The privatisation of English water companies in 1989 shows that a combination of independent regulation and privatisation can deliver drinking water and environmental outcome improvements, by providing strong efficiency incentives and enabling unconstrained access to finance. Tariff increases were required to fund the new investment.

Delegation of services to a specialist provider in Papakura delivered continuous high drinking water outcomes and low bills with high levels of customer satisfaction. The council avoided costs of water provision and gained access to a highly specialised global firm. The financing of new local network infrastructure is fully provided by developers, rather than partially by councils as is the case in some areas of New Zealand.

A summary table of the impact of the reform episodes on the outcomes identified by the Government is set out below.

Table 3.1: Scorecard Rating Ability of Institutional Options to Deliver Desired Outcomes

	Colombia (1990s–present): Local Government-Owned and Operated	England and Wales (1973–1989): Regional Publicly-Owned Corporations	England and Wales (1989–present): Regional Private Sector Company	Papakura (1997–present): Local Government Delegation of Service Provision to 3rd Party
Drinking Water Outcomes	Drinking water quality improved. Challenges in rural areas remain.	Persistent failure to meet quality standards over the 1970s and 1980s.	Water quality standards improved – between 1994 to 2003, breaches of water quality declined by 86 percent.	Papakura's drinking water has consistently met drinking safety standards.
Environmental Outcomes	Treatment of wastewater improved significantly, though more is needed.	Pollution continued in river and coastal waters post reform. Significant failures to meet discharge standards.	Environmental (bathing) waters meeting standard increased from 78 percent in 1990 to 99 percent now.	The concessionaire has met the environmental management conditions set in its contract.
Cost and Efficiency outcomes	Capital expenditure increased. Tariffs now approximate cost recovery.	Initial fall in capital investment in 1970s, followed by reversion to pre-reform level in 1980s. Rate of return targets achieved through job cuts in 1980s.	Productivity and capital investment increased. £50 billion invested in infrastructure in water assets.	Papakura's water and wastewater charges are lower than in other parts of Auckland.
Financial Outcomes	Reforms have created many methods for water utilities to access finance.	Struggled to access finance due to fiscal limits. Resorted to financing capex directly from users charges.	Unlimited access to debt and equity provided by capital markets.	Financing of local network expansion is wholly provided by developers (not partially provided by the local authority unlike other partis of Auckland).
Customer Outcomes	Access to drinking water and sanitation increased. Bills rose but remain affordable.	Bills held constant in real terms during the 1970s, but increased in real terms throughout the 1980s.	Bills rose 42 percent in the 20 years after privatisation to help fund asset investment.	Customer satisfaction reached 97 percent in 2019. Charges remain below Auckland's average.
Local Govt Impacts	Municipalities retain the power to appoint board members to water utilities, promoting accountability to customers and coordination in local planning.	Despite initial promises, local government lost any ability to appoint board members in 1983. The assets were later sold but the proceeds were not given to the local authorities.	Privatisation did not result in any further impacts on local governments, which lost governance and ownership rights in the earlier amalgamation.	Auckland Council retains ownership of water assets. Local government's autonomy is constrained by the terms of the contract.

4 Assessing Institutional Options Against Indicators of Effectiveness

This section evaluates the four institutional options against indicators of institutional effectiveness. In the preceding section we assessed reform episode case studies. Case studies provide an indication of the possible outcomes of reform. All four are highly relevant evidence for the New Zealand policy process.

While useful, case study analysis is limited. There are not enough data points to draw robust conclusions. A model may work in one place and fail in another. Every country's legal system, cultures, institutions, and economy are different. There are many confounding variables: it is hard to know if the changes in water sector performance were caused by the reform, or by other things such as changes in economic conditions, or social attitudes.

Therefore, it is necessary to evaluate the major institutional forms against a broader set of management and institutional theory. This can be done by agreeing to a set of indicators which tend to be associated with or drive high performing institutions in water and similar sectors, and then assessing institutional options using these indicators.

LGNZ proposed a set of institutional effectiveness indicators to the Joint Steering Committee's Secretariat and wider stakeholder ground including DIA, DIA's advisors, SOLGM, and other stakeholders in a note entitled Parameters for Evaluating Water Service Delivery Models dated 12 August 2020. These indicators were developed by Castalia for LGNZ to assist in measuring the fitness of various institutional reform options.

Global experience suggests that the existence of these institutional indicators leads to better performing water service providers. Absence of these indicators tends to lead to poor performing water service providers. We first present a scorecard rating of each institutional model against the indicators in Table 4.1 below. We then describe how each model performs.

Table 4.1: Scorecard Rating Analysing Institutional Options Against Indicators

	Local Government Responsibility	Regional Publicly-Owned Company	Regional Private Sector Company	Delegation of Service to a Third-Party Provider
Economies of Scale	Does not facilitate economies of scale.	Can achieve economies in management and procurement.	Can achieve economies in management and procurement.	Economies of scale may be available where third-party provider can operate over multiple concessions.
Economies of Scope	Can result in economies of scope with other council activities.	If the regional corporation is limited to the Three Waters, there can be no economies of scope.	If the regional company is limited to the Three Waters, there can be no economies of scope.	Economies of scope available where the provider can offer other utility services.
Accountability to Customers	Elected officials accountable to voters. Water issues can be election issues.	National regulation and governance can promote good service, but the system is not directly accountable to customers as water issues will seldom determine national elections.	National regulation and governance can promote good service, but the system is not directly accountable to customers, as water issues will seldom determine national elections.	Municipal decision-makers still directly accountable to customers, but responsiveness may be constrained by term and duration of contract.
Competence of Management and Operations	May be hampered by insufficient scale of operations and limits on ability to pay for specialised skills, in the smaller service providers.	Greater scale should make it easier to afford the required specialised skills and systems. Risk of public sector limits on pay and incentives remain.	Can achieve scale needed. No artificial limits on pay or incentives.	Accesses world-class management systems, and IP. Achieves required scale across multiple operations. No limits on pay or incentives. Global career prospects.
Ability to Access Finance	Access to finance constrained for small services and those whose parent government is close to its borrowing capacity.	Can access finance if creditworthy and borrowing do not require national government guarantee or consolidate into public sector debt.	Ready access to commercial debt and equity.	Ready access to commercial debt and equity.

Incentive Alignment	Elected officials directly accountable. However, public sector constraints may limit ability to transmit incentives through the organisation.	Highly dependent on governance and ability to create incentive contract with management team and staff.	Incentives are aligned, provided that economic regulation is effective.	Incentives are aligned, provided good contractual design.

4.1 Local Government Responsibility

Local government responsibility can perform well against the institutional indicators. The performance depends on the design of the institutions that support local government ownership and operation.

Economies of scale

This model can achieve economies of scale, depending on the specific circumstances of the case. Generally, scale economies are not achievable if the area of service is small. The empirical literature suggests that within countries, utilities that deliver more water do so at lower average cost. However, the optimal size varies by country depending on a variety of factors.

In Colombia, the reformed model introduced regulatory monitoring of the local government-owned water utilities' costs. The regulator can mandate an amalgamation if costs are too high and it forms the view a merger would realise benefits, including economies of scale.

Economies of scope

Economies of scope can exist for local government-owned and -operated water services. For example, the water service can share services with other arms of the local government (such as corporate overheads).

Accountability to customers

Accountability to customers is generally high, with local government responsibility for water services. Elected councillors are responsible for the water service, and therefore can be held to account for poor performance.

However, there are systematic deficiencies that can arise from parochialism. Local authorities may miss opportunities to benefit from cooperation with neighbours. This could be driven by voter antipathy and a political incentive to avoid ceding control of water in one's own area. Moreover, water investments have very long-term payoffs. Local government can tend to favour other investments with more immediate payoffs in cases where water service revenues are intermixed with other revenues.

Competence of management and operations

Smaller local government entities can have difficulty paying market rates to attract and retain staff. There may be issues with more rural locations being less favourable.

The regulatory regime plays an important role in maintaining (and improving) competence levels. Where there is ineffective monitoring of outcomes against standards, operational and management competence can decline. The Havelock North Inquiry found that poor water quality monitoring by the regulator, and an under-resourced inspection regime contributed to lower performance (competence) by operational and management staff in local councils.

Reliable access to finance

The model does not limit access to finance of water utilities per se. However, some local authorities have difficulty efficiently financing investment. In New Zealand, the size of water utilities needs to be relatively large to access finance. The parent entity (local authority) also needs to have readiness for borrowing on its balance sheet. Some

of the larger, fast-growing councils in New Zealand have reached borrowing limits impacting the ability of water services to access finance. If balance sheet consolidation can be avoided, then this is not an issue. Many United States water services are locally owned and operated, for example, and have ready access to finance.

Alignment of incentives

The local government responsibility model requires effective governance and regulation to ensure that managers (and staff) have incentives to perform in the public interest.

Governance bodies that are experienced in monitoring and holding managerial performance to account, and carrying out good financial governance are important to ensure incentives are aligned. Regulatory agencies can also drive incentives of management (and staff) of local government-owned water services to act in the public interest. Regulatory agencies need to be sufficiently resourced and competent for this to work. The Havelock North Inquiry highlighted the risks of ineffective drinking water regulation.

Adaptability to change and new information

Local authorities have a range of options to respond to change and new information. They can merge, outsource services, delegate management, and change delivery technology in response to local demands (expressed directly) and with knowledge of local conditions. The local authorities do not need to get consensus at a national level in order to try something new. This is inherently responsive and adaptable compared to a uniform national (or large regional) system. With more entities under a local government model, there is more chance for learning in the sector through trying many things. This leads to learning what works in different situations by comparing to one local authority's water services to another. There is also more direct accountability to voters for successes (and failures).

In cases where parochial interests might prevent flexibility to change and new information, national level institutions could improve things. Effective oversight and regulation by a different part of government can incentivise or enforce adaptation, such as in Colombia where the regulator can enforce mergers that improve efficiency.

4.2 Regional Publicly Owned Corporation

The regional publicly owned corporation tends to perform poorly against the indicators.

Economies of scale from the act of merger

Water services generally face constant returns to scale. The optimal scale of a water utility varies considerably between countries, according to the empirical literature.[42] Mergers are unlikely to result in economies. Economies of scale are achieved in the (minority of) cases when fragmented physical networks can be connected and managed as a whole. This usually occurs when networks are physically proximate and usually already partially interconnected. Economies of scale may also achieve

[42] Saal et al (2013), Scale and scope economies and the efficiency vertical and horizontal configuration of the water industry: a survey of the literature

management and procurement economies, but the savings are likely to be small relative to the total costs of the fixed network assets.

Economies of scope

Economies of scope may arise from the act of merger where separate water services are then run by the same entity. The empirical evidence on economies of scope is mixed. Some literature suggests economies of scope might be available in the case of vertical integration of bulk water, drinking water, and wastewater, whereas others point to diseconomies.[43] The RWAs in England and Wales were created with a view to achieving scope benefits, however, water quality and environmental outcomes were poor.

The regional public company model may actually achieve diseconomies of scope compared to other models. For example, when water services are separated from local government where shared services and costs exist with other local government functions.

Accountability to customers

Accountability to customers of regional publicly-owned companies depends on governance and regulation mechanisms.

Regional entities have indirect accountability to customers, even if the governance and regulatory institutions are well-designed. In case of poor performance of a regional corporation, there are many layers of governance where consensus needs to be reached on the issue. Customers can raise issues that might be due to poor performance of a regulator with national-level representatives; however, water performance issues compete for the attention of elected members of parliament with many other broader socio-political matters.

In Scotland, Tasmania, and Ireland accountability is reliant on the relevant regulatory mechanism working well, as well as the national (or State in the case of TasWater) government influencing the board of the water entity to bring about change. In England and Wales, the RWAs had weak accountability to customers. Initially, local authorities had limited board appointment rights (councils could appoint a director). This meant that the interests and priorities of residents in a locality were diluted. Later, when the central government consolidated control of the RWAs under the Water Act 1983, the accountability to customers was weakened further.

Competence of management and operations

In order to attract good managers and operational staff and systems, it is necessary to have autonomy to set remuneration levels. Regional public companies may have less autonomy due to central government influence and therefore less discretion to hire the best managers. In cases where fewer regional public companies exist, there will be less rivalry between water utilities to attract Regional public companies tend to improve competence in management and operations where those charged with governance can hold management accountable.

[43] Saal et al (2013), Scale and scope economies and the efficiency vertical and horizontal configuration of the water industry: a survey of the literature

Regulatory oversight can also drive improved competence. For example, in Tasmania, the regulator reports efficiency gains due to management productivity improvements.[44] In Victoria, the regulator reports on outcomes from management and operational competence improvements which can drive improved outcomes.[45]

Reliable access to finance

The publicly-owned regional company model can, in principle, free the utility from external financial constraints (for example, the constraints imposed by debt limits on local or central government), provided that the tariffs recover costs. However, in practice, this model has had mixed success reliably raising adequate finance. Government appointed boards can prevent the regional company from implementing cost recovery tariffs. This was the case with the RWAs. Without tariffs that reflect costs, the utilities' own cashflow cannot support debt and service costs needed to meet capex needs.

It is an established practice (for example, the RWAs, Scottish Water, and Irish Water[46]) for the regional companies to rely on most funding coming from national or state government (or being guaranteed by national or state government). Where regional companies have borrowed independently, this can be consolidated into the national or state debt for accounting or credit rating purposes and result in the national or state government itself being credit constrained.

Alignment of incentives

The model is highly dependent on effective governance and a well-designed regulatory regime to ensure that the incentives of governance, management, and operations are aligned with the objectives. The same points made above, in respect of incentive alignment for managers and staff for the local government responsibility model, apply here.

Adaptability to change and new information

The model tends to be large and has to cover multiple jurisdictions. Usually, regional public companies are created out of contentious reform episodes. It can be difficult to keep different interest groups happy. In a range of cases, the reforms episodes which created the regional companies were not the end state for institutional structuring. Additional reforms were subsequently imposed, for example, in Scotland (three regional companies amalgamated to Scottish Water in 2002) and Tasmania (three regional Tasmanian companies operated from 2008 to 2013 then merged into TasWater).

4.3 Regional Private Sector Company

The regional private sector company performs well, however, this is highly dependent on the quality of the regulatory regime. The English regional water companies are the

[44] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 25

[45] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 25

[46] See for more information Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 47-50

only example in the world of a regional private model, and the regulator Ofwat has mostly provided effective regulation.

Economies of scale

The situation is similar to the regional public company model. Water services generally face constant returns to scale. The optimal scale of a water utility varies considerably between countries, according to the empirical literature.[47] Mergers to create regional private sector companies are unlikely to result in economies. Economies of scale are achieved in (the minority of) cases when fragmented physical networks can be connected and managed as a whole. This usually occurs when networks are physically proximate and usually already partially interconnected. Economies of scale may also achieve management and procurement economies, but the savings are likely to be small relative to the total costs of the fixed network assets.

Economies of scope

Economies of scope may arise from the act of merger where separate water services are then run by the same entity. The empirical evidence on economies of scope is mixed. Some literature suggests economies of scope might be available in the case of vertical integration of bulk water, drinking water, and wastewater, whereas others point to diseconomies.[48] The literature on the private English water companies suggests that diseconomies of scope exist if quality of service is ignored, but could exist if quality is taken into account, suggesting that effective regulation may allow economies of scope to be realised.[49]

On the other hand, the regional private sector company may actually achieve diseconomies of scope compared to other models. For example, economies of scope can be lost when water services are separated from local governments where services and costs are shared with other local government functions.

Accountability to customers

The accountability of regional private sector companies to customers is improved by the profit motive and an effective regulatory regime. The companies are incentivised to improve services where the costs, plus a return on capital, can be recovered in tariffs. Effective regulation is needed to ensure the investments for service improvement and tariff changes are justified.

The regional private company model has indirect accountability to customers, even if the regulatory institutions are well-designed. In case of actual or perceived underperformance by Ofwat, customers can complain to Ofwat, and if dissatisfied with the response, usually need to influence national-level representatives. As noted above, however, water performance issues compete for the attention of elected members of parliament with many other broader socio-political matters.

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[47] Saal et al (2013), Scale and scope economies and the efficiency vertical and horizontal configuration of the water industry: a survey of the literature

[48] Saal et al (2013), Scale and scope economies and the efficiency vertical and horizontal configuration of the water industry: a survey of the literature

[49] Saal et al (2013), Scale and scope economies and the efficiency vertical and horizontal configuration of the water industry: a survey of the literature

Customer accountability at the English private water companies has generally been positive, when looking at the entire period since privatisation. This is attributed to effective economic regulation by Ofwat.[50] Customer outcomes have generally been positive.[51] Although Ofwat's performance has been criticised too.[52]

Competence of management and operations

The regional private companies in England have autonomy and usually a healthy financial position to justify the salaries of high-performing management and operational staff. Management and operational staff can identify ways to reduce costs, which directly impacts the regulated entities' profits. The nine English water companies are rivals for the best talent.

The privatisation of English water companies led to an average productivity growth rate of 2.1 percent since 1989.[53] The private company profit motive, and access to finance to hire skilled managers and operational staff, while also the incentives to reduce costs, were probably factors in this productivity improvement.

Reliable access to finance

Reliable access to finance for regional private companies depend on a stable regulatory system, grounded in sound economics and legal precedent as this gives investors confidence. The English water companies benefit from this stable regulatory system, and are therefore able to readily access finance on global capital markets. All had BBB (one grade above the minimum investment grade) or higher credit ratings in 2016-2018.[54]

Alignment of incentives

The management of the private regional water companies are incentivised to maximise profits. In a competitive market, firms are constrained from raising prices and compete to lower prices and raise quality to attract customers. The regional private water companies are monopolies, so effective regulation is needed to ensure prices are reasonable, quality is improved, and water quality or environmental outcomes are not sacrificed to increase profits.

However, incentive alignment with the public interest is dependent on the effectiveness of the regulatory regime. A notable example of the importance of an effective regulatory regime was recently highlighted in England. Between 2010 and 2017, Southern Water fraudulently reported its water testing results covering up serious wastewater pollution incidents.[55]

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[50] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 38

[51] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 42.

[52] For example, Financial Times, 15 February 2020, Ofwat faces biggest battle with water companies since privatisation, available at: https://www.ft.com/content/5da761e6-4f04-11ea-95a0-43d18ec715f5

[53] Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector, p. 26.

[54] Ofwat (2019), Monitoring Financial Resilience, available at: https://www.ofwat.gov.uk/wp-content/uploads/2019/01/Monitoring-financial-resilience-2018-Report.pdf

[55] An internal investigation of Southern Water found that employees (including those at the senior management level) deliberately prevented the sampling of wastewater to check compliance with environmental permit

Adaptability to change and new information

The English private water companies can be flexible and adapt to change within the regulatory framework set by Ofwat and the drinking water quality and environmental regulators. In some cases, private companies have merged with the historically private statutory water companies. Ofwat has a dedicated merger approvals regime.

4.4 Local Government Delegation of Service Provision to Third-Party Provider

The local government delegation of service provision to a third-party model scores well against the indicators.

Economies of scale

Economies of scale are possible in management and specialist services (but not water network or production except in very limited circumstances) where a concessionaire is able to operate over a number of water service contracts. Procurement of equipment and network assets may also be improved from scale (volume discounts and standardisation of plant and equipment). In the case of Papakura, Veolia has the only concession contract in New Zealand, but also provides outsourced water services to a number of other councils in New Zealand. Accordingly, there may be economies of scale available to Veolia from providing services across a number of council areas.

Economies of scope

There may be economies of scope available where service providers also provide other utility services. For example, Veolia provides waste, energy, and transport services in New Zealand.

Accountability to customers

Customer accountability is usually provided for in the concession contract. Key price and quality metrics (or mechanisms to set these over the life of the contract) are set out in the contract. Therefore, the degree of customer accountability depends on the negotiation of the contract at the outset. Ongoing customer accountability then also depends on contractual monitoring by the local government counterparty. Customers can lobby the local government in case of complaints or performance issues. Concession contracts also provide the local government with remedies in case of major breaches. However, concession contracts are usually around 30 years. Disagreements over contract interpretation can be a barrier to realising accountability to customers.

Competence of management and operations

Concessionaires are normally appointed following competitive tenders. A number of specialised water service companies usually compete for these contracts. Tenders are won on the basis of the demonstrated competence in management and operations of the concessionaire. Concessionaires tend to be global water service companies with

conditions. This resulted in unpermitted and premature spills of wastewater from Southern Water's treatment works. Ofwat also found that Southern Water had dumped untreated effluent into beaches, rivers and streams. Following Ofwat's investigation in 2019, it ordered Southern Water to pay £126m in penalties for breaching its sewage treatment statutory duties. See Financial Times (2019) *Southern Water hit by £126m penalty for 'serious failures'*. Retrieved from https://www.ft.com/content/518b21fa-9711-11e9-9573-ee5cbb98ed36

wide ranging experience and expertise. They will usually bring their international expertise to bear and improve competence of management and operations.

During the life of the concession contract (normally 30 years), the contractual conditions will set performance standards that incentivise competence in management and operations. However, this again depends on the terms of the contract.

Reliable access to finance

Concession contracts normally include provision for the concessionaire to charge tariffs for water directly to customers, or (less common) remuneration from the local government entity. Concessionaires can usually raise finance from the wider corporate group or directly from investors, secured against the revenues of the concession contract. For example, Veolia and Suez Environment raise billions of Euros a year on global capital markets to finance their operations across a range of industries, including water services.

Alignment of incentives

The incentives of concessionaires will depend on the terms of the contract. However, under most concessions, the operators are incentivised to provide a high-quality service for least-cost. Concessionaires are also 'repeat players' in concession contract tenders around the world. A track record of poor performance will reduce the chances of appointment in concession contract tenders. Once the tender is won, there are also various ways of designing concession contracts to incentivise performance improvements, and penalise poor performance.

Adaptability to change and new information

The model can be flexible and adaptable with good contract design. If well designed, Concessionaires can be incentivised to implement new and innovative ways to deliver services that lower cost. If the contract gets the balance between local government and concessionaire wrong and does not follow global PPP contract standards, then there can even be disincentives to adapt and change.

Concessionaires can also be incentivised to add new customers, since this increases profits. For high-growth places, such as many of New Zealand's cities, these incentives to adapt to change could be positive.

5 Conclusion

The Government is considering major reforms for the New Zealand water sector. It has identified a range of problems that exist, on the basis of some research and analysis. The reform process is focussed on amalgamations of local government water services into regional entities. However, other models used internationally are also relevant to New Zealand.

This paper contributes to the New Zealand policy debate. It reviews the four major options for water services. We review case studies of reform episodes where jurisdictions changed to one of the major models. These case studies have shown how important jurisdictions have tackled problems in the water sector with institutional reform, and how the reforms fared. We also reviewed all four models using the institutional indicators previously submitted by LGNZ to the water reform policy process to evaluate water services.

The analysis shows that there are strengths and weaknesses to each model. It is important to take care in this policy process in attributing benefits to just one aspect of reform. For example, when amalgamation and regulation occur together, it is not possible to be sure that improvements were primarily due to amalgamation.

Indeed, reports and analysis used to inform the policy reform process in New Zealand from Frontier Economics and Martin Jenkins focus on regional water company models. These reports attributed various positive outcomes to the combined amalgamated, privatised, and regulated entities. However, as our case study of the RWAs in England and Wales shows there were a range of policy, economic, and structural changes that contributed to this, so it is important to disentangle the various aspects of reform to determine how these contributed to the outcomes.

Careful consideration of the evidence on which type of reform are most likely to achieve desired outcomes in New Zealand is needed before choosing any particular model, for example regional publicly owned company. This paper shows that consolidation of governance and funding and financing may risk achieving the desired outcomes.

Given the wide range of needs and operating environments in New Zealand, it may make sense to allow flexibility so different regions can craft locally appropriate solutions with a broadly agreed regulatory framework and set of institutional principles. Institutional models exist where the central government sets regulatory bottom lines for funding, costs, drinking water, and environmental outcomes, but also retails the flexibility for local authorities to adapt models to local needs.

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Confidential

Analysing Economies of Scale in New Zealand Water Services

Report to Local Government New Zealand

October 2020

Acronyms and Abbreviations

DIA	Department for Internal Affairs
FE Report	Frontier Economics, Review of Experience with Aggregation in the Water Sector, 26 June 2019
Government	New Zealand Government
LGNZ	Local Government New Zealand
MEA	Modern equivalent asset
OECD	Organisation for Economic Co-operation and Development
Ofwat	The Water Services Regulation Authority, United Kingdom
UK	United Kingdom
Watercare	Watercare Services Limited (an Auckland Council company)
WICS	Water Industry Commission for Scotland

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Executive Summary

The New Zealand Government (Government) is reforming the water sector. It has already established a new water quality regulator—Taumata Arowai—and is considering other regulatory, funding, and administrative changes. The Government is considering the benefits of amalgamations of water services of the 67 territorial authorities into a smaller number of entities. It strongly prefers four or five providers.

LGNZ is participating in the reform process. It is a member of the Joint Three Waters Steering Committee with the Department of Internal Affairs (DIA) and other stakeholders. The committee provides oversight and guidance to support progress towards reform and assists with stakeholder engagement on options and reform proposals. LGNZ is providing constructive support to the committee and has offered to make its analysis and research available to all committee members.

The Government is considering amalgamation options as part of a full package of change proposals for water services delivery. One particular aspect of this package is aggregation of water services delivery into large scale entities with the intention to realise various benefits from scale. While the Government's reform agenda is not solely focused on benefits arising from economies of scale, these are an important consideration, amongst others, when determining the most suitable scale of water services delivery entities for New Zealand. To investigate the extent to which amalgamation may deliver economic (and other) benefits, the Government has recently commissioned:

- Literature survey and policy recommendations by the Government's consultants, Martin Jenkins
- Frontier Economics (2019), Review of Experience with Aggregation in the Water Sector
- Water Industry Commission for Scotland (WICS), Economic Analysis of Water Services Aggregation.

Does the evidence support the existing of economies of scale for the amalgamations proposed in New Zealand?

The Government is proposing major reforms that will be very costly and result in major changes for the local government sector. The party proposing changes to structure and delivery of key public services would typically provide analysis to support that the intended benefits will in fact materialise, and that these exceed the costs of reform. LGNZ is providing a contribution to test and understand the evidence for the benefits of scale.

The key question for this report is whether the evidence available at this stage in the reform process supports the existence of economies of scale for the type of amalgamations proposed and applicable to the geography and organisational form prevalent in New Zealand.

This report finds that economies of scale are generally not available from amalgamations of municipal water services, except in very limited scenarios. The

evidence prepared by the Government to date does not establish that the intended benefits from economies of scale will materialise.

Economies of scale are not necessarily available in water networks and water production

We reach this conclusion by first clarifying that the simple model of economies of scale is not appropriate for water services. There is a common misconception that all natural monopolies benefit from economies of scale. This is not necessarily true for water services. Water services have high sunk costs for new connections. There tend to be constant returns to scale as water networks grow. This is because additional network (pipes) and water production (water and wastewater treatment) investment is needed as networks get larger.

The only exception to returns to scale in water networks and water production is where an existing urban area increases in density.

Some returns to scale may be available in management and specialist services for water services. More coordination in procurement by larger entities may reduce costs. However, these benefits are minor in comparison to the significant costs of network and production services in water provision.

There are limited opportunities for economies of scale in New Zealand water services

There are only very limited theoretical opportunities for economies of scale in networks and water production in New Zealand. The Government is considering amalgamations at an administrative level of existing water services. Opportunities to combine proximate urban areas by joining physical networks have been exhausted and are not proposed anywhere to our knowledge. The administrative amalgamations proposed for New Zealand are unlikely to deliver scale benefits except for some minor efficiencies from operating and procurement functions.

The Government's evidence base confirms that economies of scale are only available in highly specific cases (not present in New Zealand)

The Government has proactively collected a list of literature for the purpose of an initial review. The initial review has drawn a number of conclusions on the benefits from administrative amalgamations, particularly in respect to efficiency benefits. Our analysis of the literature supports a different conclusion. Scale advantages do exist for larger water companies, compared to smaller ones. However, this literature generally only applies to already operational companies and networks and not physically distant or merged entities.

Where the literature examines proposed administrative amalgamations of the type proposed in New Zealand, the evidence is clear. Administrative amalgamations of water services that are not physically proximate generally do not generate efficiency benefits. In a small minority of cases benefits emerged, for example where towns that have grown to be one contiguous urban area, and which are physically close.

Frontier Economics Report draws incorrect conclusions from case studies

Frontier Economics has prepared a report ("FE Report") for the Government that reviews several case studies from jurisdictions selected by DIA. We have examined this

work with a focus on economies of scale and any efficiency benefits that may arise. Unfortunately, the case studies do not support a conclusion that administrative amalgamations lead to productivity and efficiency improvements for water services.

To support this conclusion, the analysis could be improved in two ways. Firstly, the analysis could better distinguish the role that amalgamation plays from other drivers in the improved performance of reformed water service entities. Secondly, the analysis could expand on cases where performance improved following the separation of water services, and the adoption of alternative models of delivery.

WICS modelling is based on assumptions that need review

The WICS analysis and modelling produces scenarios that should be treated with caution in drawing conclusions about the relative benefits of administrative amalgamations. The WICS analysis is based on assumptions about the level of investment needed for New Zealand water services that need to be investigated and, where appropriate, revised. These assumptions drive the modelled benefits from amalgamation and result in multi-million-dollar differences between the scenarios. In one example, a merged entity comprising the Wellington region, South Island and Chatham Islands has total costs that are 48 percent lower than if three entities served the Wellington region, upper and lower South Island separately. These efficiency benefits appear implausible.

Any administrative amalgamation benefits must be balanced against costs

This report identifies that amalgamation can result in efficiencies in a limited set of circumstances. These are most likely in management and specialist services and procurement. These costs comprise a minor share of total costs of water services. The gains from efficiency are smaller still. These potential benefits, including the full range of benefits sought, need to be weighed against the costs of administrative amalgamations, loss of economies of scope and loss of local influence and control of water assets. There are other options available that do not involve administrative amalgamation that may provide similar benefits, such as outsourcing, shared services or concessions.

Castalia's Comparative Analysis of Institutional Forms report complements this report

The Government's three waters reform process involves a package of considerations and economies of scale are part of this package. Other considerations include drinking water outcomes, environmental outcomes, access to finance, customer outcomes and impact on local government. The administrative amalgamation under consideration by the Government could influence those other outcomes.

Castalia has prepared a second report entitled *Comparative Analysis of Institutional Forms in Water Services for Proposed New Zealand Reforms* dated September 2020. This report evaluates four major models of water service delivery in use around the world, including the regional public corporation model under consideration.

The desired outcomes of reform are addressed in Castalia's *Comparative Analysis* paper. That paper also addresses improved access to finance. Access to finance and lower financing costs are likely to be improved by amalgamating water services into larger providers, all else equal. However, larger entities that are poorly funded and

badly run will face higher financing costs than well-funded and better run smaller entities. Access to finance and the cost of finance depend on the credit risk profile of the borrower in question. This also follows from improved governance, economic or contractual regulation and funding.

1 Introduction

This report analyses whether the evidence supports the existence of economies of scale for the type of amalgamations proposed and applicable to the geography and organisational form prevalent in New Zealand.[1] The report is structured as follows:

- We define the typology of economies of scale that are theoretically possible in water services (section 2)
- We review the evidence of economies of scale to identify where those economies are present (section 3)
- We identify that economies of scale are generally not available from New Zealand administrative amalgamations, except for in management and specialist services (section 4)
- We examine the evidence for economies of scale presented by the Government and find that:
  - Literature reviewed does not support economies of scale for the largest cost components of water services
  - The Frontier Economics report would benefit from considering key historical information and counterexamples
- We review the Water Industry Commission for Scotland (WICS) analysis and modelling of hypothetical water service amalgamations and find the application of apparent efficiencies of United Kingdom (UK) water services to New Zealand uses assumptions that need to be reviewed
- Finally, we conclude that there are only limited economies of scale available to New Zealand water services from administrative amalgamations and these need to be weighed up against costs (section 6).

[1] This report focusses on economies of scale. There may be some benefits that follow from other aspects of the Government's policy proposals, including improved quality and economic regulation and changes in how water services access finance. However, amalgamations are not the only way to achieve those outcomes.

2 Typology of Economies of Scale in Water Services

We describe the typology of economies of scale. At a basic level, economies of scale exist where increases in production lead to lower total average costs. However, economies of scale are more complex in water services than a standard first-year university micro-economics model would suggest and are different for the components of the water value chain.

2.1 Definition of Economies of Scale

Economies of scale exist where the average cost falls as output increases. Economies of scale can often exist for natural monopolies. However, economies of scale do not necessarily always exist for water services natural monopolies.

Basic economies of scale can exist where firms have fixed costs and average costs fall as output increases

Economies of scale are beneficial because they represent a cost saving. Textbooks state that economies of scale exist if long-run average total costs decline as output increases.[2] That is, by adding production, the average cost is reduced. On the other hand, diseconomies of scale arise where long-run average cost increases as output increases.[3] That is, by adding production, the average cost is increased.

Economies and diseconomies of scale can arise for different reasons:

- Economies of scale can arise where firms have high fixed costs and can add production inputs such as labour. For example, a coffee shop has high fixed rent and a costly espresso machine. The shop can add baristas and waiters to produce more coffees and reduce the average cost of the coffees. At some point, diseconomies of scale arise. The coffee shop will become too crowded with workers and a bigger shop and additional coffee machine is needed to utilise the workers
- Economies of scale can arise where firms find opportunities to break down production processes into specialised tasks.[4] Diseconomies can arise where the firm becomes so big that coordinating between all of the specialists and their tasks becomes costly and additional production increases average cost.

Figure 2.1 illustrates economies of scale for a firm over time. In the short run, it faces fixed costs (such as the coffee shop mentioned above). When average costs rise from increases in production, the firm can expand over the medium term and incur higher fixed costs (for example a bigger coffee shop and additional coffee machine) until returns to scale are exhausted. Then the firm can invest again in a bigger shop and additional machines until returns to scale are exhausted.

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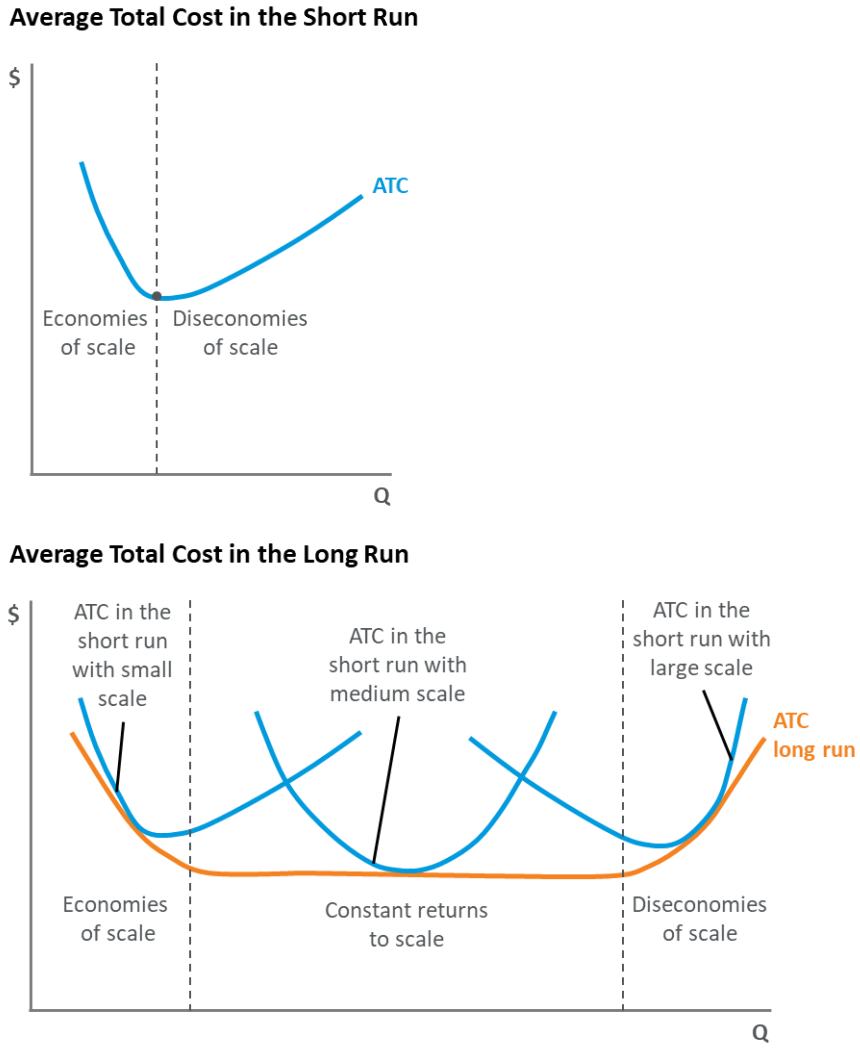
[2] Mankiw, N. Gregory (2018). *Principles of Economics*. Boston: Cengage Learning, p 261.

[3] Mankiw (2018), p 261.

[4] Mankiw (2018) highlights the example from Adam Smith's Wealth of Nations where Smith observed the specialisation of tasks for workers in a pin factory resulted in production of thousands of pins per worker per day.

Figure 2.1: Illustration of Economies of Scale



Source: Mankiw (2018), Principles of Economics

Many natural monopolies benefit from economies of scale

Natural monopolies are often assumed to experience economies of scale. Natural monopolies exist in industries "*in which multiform production is more costly than production by a monopoly*".[5] In other words, a natural monopoly exists where the efficient number of producers is one.

However, the fact that a firm is a natural monopoly does not of itself indicate that it has economies of scale. Natural monopolies generally incur significant fixed costs. There is a simple assumption that due to these fixed costs, a natural monopoly faces a downward sloping average cost curve. The result of this is that increases in production lowers average costs.

To demonstrate this model, consider the example of a toll bridge. Building the bridge incurs significant costs. However, once it is built, there is hardly any cost associated

[5] William J Baumol (1977) "On the Proper Cost Tests for Natural Monopoly in a Multiproduct Industry," American Economic Review, American Economic Association, 67 no. 5.

with allowing users to cross the bridge. Accordingly, as each new user crosses the bridge, the cost of providing that service (that is, the significant fixed cost of building the bridge) is being spread over more users. Therefore, we can say that as production—in this case users of the bridge—increases, the average cost of production falls. The toll bridge eventually exhausts the economies of scale when the traffic begins to congest the bridge.

Water services do not necessarily experience economies of scale

However, the same economies of scale for typical natural monopolies are not available for water services. Unlike other textbook natural monopolies (but similar to some other network industries), an increase in the scale of service of a water provider does not necessarily result in falling long-run average total costs.

Water services in fact comprise two distinct outputs:

- Provision of connections to the network—this provides an option to access the network for clean water or discharge into a wastewater system
- Provision of volumes of (clean) water and conveying and treating wastewater.

Table 2.1 below shows the distinction and how for each of the three waters, there are separate network-related and volume-related outputs.

Table 2.1: Water Services in Networks and Production and Treatment

	Network	Production (Treatment/Storage/ Interface with Environment)
Water	Connections	Potable water
Wastewater	Connections for removal	Removal and treatment of pollutants from wastewater
Drainage	Gathering from the street	Treatment and storage of stormwater prior to discharge*

Note: *This service is currently not provided but should be provided in some areas in future.

The option to access the network is generally a fixed cost. New connections can be added to an existing network, or as is more common, added in bulk when the network is expanded to new developments. Adding new connections is costly because it requires extension of the network, except in some limited circumstances (such as infill housing).

Provision of volumes of water or transmission of wastewater are variable. Volumes can change at the margin. Once the network is in place, the variable cost of adding additional volume (provided capacity is available) is low.

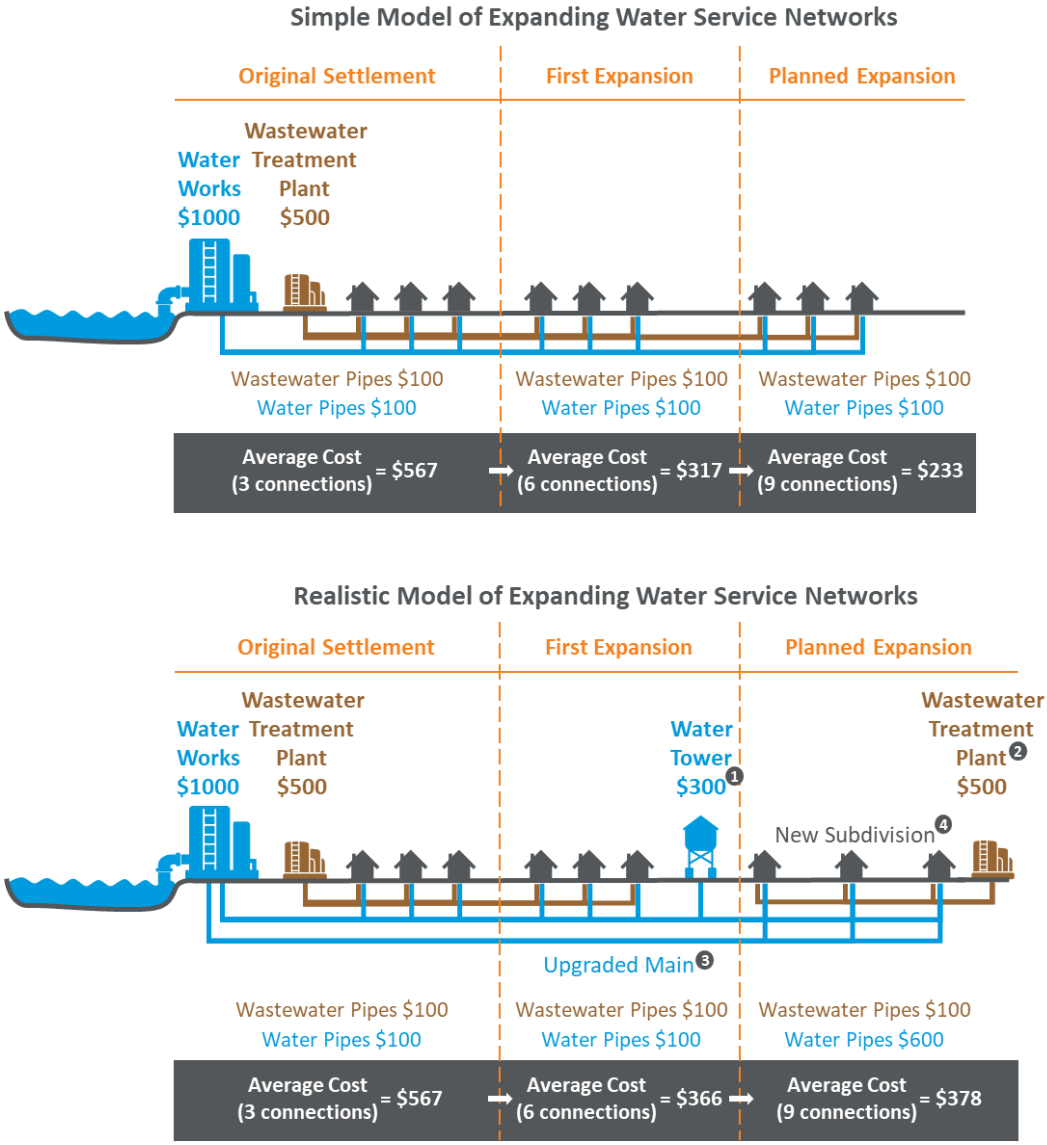
Often when additional capacity is added to the network, there are constant returns to scale, or even diseconomies, as significant additional investment is needed. Figure 2.2 below sets out two models for economies of scale in water services:

- A simple, but incorrect, model for how increases in connections and volumes affect scale
- A more realistic model of constant returns or even diseconomies of scale as a water network expands.

Costs increase as additional connections are added. Additional connections require new water sources, upgrades to existing pipe infrastructure, and investment in larger scale wastewater treatment plants. Due to the unique characteristics of water services, an increase in the scale of service delivery may not necessarily result in economies of scale (reduced long-run average total costs).

In the realistic model of an expanding water service network in Figure 2.2, costs actually increase as the city and its water network expands. In the first expansion phase, the fixed costs are averaged among the six connections because the existing network investments have capacity to accommodate additional volumes and new connections. In the planned expansion phase, significant additional trunk infrastructure investment is needed, and housing is less dense so longer pipework is necessary. The average costs actually rise (diseconomies of scale) for the planned expansion phase.

Figure 2.2: Water Network Costs: Simple Model (Economies of Scale) and Realistic Model (Constant Returns or Diseconomies of Scale)



Notes: 1. New water tower required to serve larger network. 2. New wastewater treatment plant needed that is closer to new subdivision. 3. Mains upgrade needed to get water to new subdivision. 4. New subdivision has lower density housing at fringe of city with higher water pipe costs.

2.2 Economies of Scale in Water Distribution, Production, and Treatment Networks

Economies of scale may exist depending on whether one analyses the distribution network of connections, or the production and treatment of volumes component. This section discusses the impact of scale, which Figure 2.2 above illustrates.

2.2.1 Impact of scale on the water distribution network of connections

Water distribution systems are natural monopolies and have high costs of building capacity. Pipes need to be buried across large distances. Pumps and intermediate storage systems are also required.

New water connections are always long-term investments. When networks are expanded and costs are incurred, there are usually constant returns to scale. In a flat urban area that is expanding at the fringe (like many New Zealand towns), the investment in the water network will usually generate constant returns to scale. This is because fixed costs are incurred as networks expand.

In some cases, diseconomies of scale arise. This can occur where the network expands into less dense areas (such as lifestyle blocks at the fringe of a typical New Zealand town). Economies can be quickly exhausted when demand continues to increase, or networks must expand to cover larger geography (for example new urban areas).

For central areas around an existing network, when capacity is exhausted, costly remedial or replacement work is needed to facilitate additional connections. In urban Auckland or Wellington, old systems must be fully replaced to meet new demand from land use intensification.

Sewer networks face the same general economies of scale constraints as drinking water networks. However, sewer networks can exhaust scale economies at a smaller size. Sewer systems generally rely on gravity. It is expensive to build sewer systems that cannot rely on gravity and require pumping. Costs increase as systems become longer, which can quickly lead to diseconomies of scale as sewer networks expand beyond a particular area.

There may be some economies of scale provided that capacity has not been exhausted and connections can be easily added, for example in areas that are increasing in density (infill housing or intensification through apartment buildings). Density of population is key: if new customers are proximate to existing networks and existing networks have unused capacity, then economies of scale may be realised by adding connections.

2.2.2 Impact of scale on production and treatment facilities for water volumes

The provision of volumes to a connected customer—in the short run—has increasing returns to scale until the capacity is reached. In reality, this usually occurs in the immediate period after construction of production and treatment facilities. Water production and wastewater treatment investments are large and lumpy. There is usually excess capacity for some period following construction, and to ensure security or resilience.

In the long run, as demand for water grows, additional facilities are needed. Returns to scale are constant in cases where water sources, or locations to treat and discharge wastewater, are uniformly distributed. For example, in Christchurch, water bores (and co-located treatment plants) are dispersed around the city.

Most urban locations, however, were built close to a centralised water source. As the urban area grows, new water sources need to be accessed which are usually not uniformly distributed. Therefore, diseconomies of scale can arise as the city grows. For

example, as Auckland has grown, it has needed to expand dams in the Waitakere and Hunua Ranges and is now proposing to take more water from the Waikato river.

This is very different from electricity networks. Electricity is a high value, essentially weightless product with very low transport costs (as a share of total value to consumers). Transmission from one end of New Zealand to the other can be economic. Water, in contrast, is very low value and very high weight and is costly to transport (around $1.00 - $3.00 per cubic metre[6]). Therefore, production and treatment facilities are localised, and economies of scale match to the scale of the proximate area.

Wastewater treatment exhibits economies of scale up to where volumes increase within the capacity of the existing plants. However, diseconomies of scale arise in reality. Wastewater treatment plant size is determined by physical, social, and geographic limits, rather than economies of scale. In bigger towns, wastewater treatment plant location is limited to suitable sites that (a) lie lower than most of the town to maximise gravity flow of sewerage (compared to expensive pumping), (b) have a place where it is acceptable to discharge the treated effluent, and (c) are far enough away from residents to make the site suitable.

2.3 Economies of Scale in Management and Specialist Services

Scale economies in water management and specialist services are available in many cases. Management and specialist services, however, usually comprise a small fraction of total costs so costs savings that can be realised will often not be substantial.

An increase in the scale of a water service provider may decrease the average cost of management and specialist services, while other operating costs such as energy tend to change in proportion to scale.

Water services involve a range of specialist jobs. Management services include managerial and other skilled labour, plus management systems such as billing and accounting software and hardware. Specialist services include water quality testing laboratories, engineering, and design.

Management functions and specialist services can have returns to scale. The water service can become more efficient when the tasks are shared among specialists. However, diseconomies of scale can arise if the management becomes bureaucratised and unwieldy[7]

The fixed cost of corporate management systems and head office functions can be spread effectively across larger services. Corporate head office functions have significant potential for economies of scale. Billing, network oversight, and other corporate services such as human resources and payroll can reap returns to scale. Specialist fixed assets, such as water testing laboratories and network monitoring computer systems can also see returns to scale. Scale may also enable the attraction of talent to the larger entity (however, smaller entities may be able to contract for that expertise).

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[6] Water New Zealand (2017), "National Performance Review Volume 1 National Overview 2016-2017".

[7] Gustavo Ferro (2017) "Literature review: global study on the aggregation of water supply and sanitation utilities," World Bank Group, p. 9.

2.4 Economies of Scale in Procurement

An increase in the scale of a water service provider may decrease procurement costs. Larger entities can standardise procurement of capital items thereby reducing the average cost of capital investment. While the goods and services procured for capital and operational needs might not reduce in cost, the entity's scale can lower overall costs somewhat in the procurement activity. Ongoing average maintenance operational costs can be lowered if standardised plant and equipment is used by the amalgamated entity, due to technical similarities and common parts and processes.

Scale may also result in average costs of goods and services themselves reducing. Larger entities tend to have greater market power to obtain volume discounts from service providers. For example, a larger scale water service might procure lower average cost engineering services by bundling work on the entire network – something a small-scale provider would be unable to do.

3 Extent of Opportunities for Economies of Scale in New Zealand's Water Services

There are only limited economies of scale available in New Zealand from amalgamating water distribution, production, and treatment services. Amalgamations of existing water service providers are likely to only result in efficiencies from economies of scale related to operating and procurement functions.

There is a high risk that amalgamations made on the basis of perceived economies of scale benefits could result in only minor benefits. These benefits must be weighed against other considerations such as the costs of reform, loss of economies of scope and loss of local influence and control of water assets.

New Zealand water services are already mostly vertically integrated between water production and distribution, as well as the wastewater system and treatment. Similarly, stormwater (drainage) is already managed by local government.

3.1 Opportunities for Economies of Scale in Water Distribution, Production, and Treatment in New Zealand

Most urban areas in New Zealand already have a single water service provider. There are limited situations where city expansion into neighbouring areas is possible, and where administrative amalgamations could unlock material economies at the network and production level. Most towns are distant from one another and therefore do not offer opportunities for significant physical amalgamation of drinking or wastewater networks.

There are no significant opportunities to merge physical networks in metropolitan areas

All large metropolitan areas in New Zealand already have a merged or single water service provider. Opportunities to connect physical networks are limited. New Zealand's large metropolitan agglomerations already have single water service providers operating the network(s) under the local council. Wellington is a special case with five territorial authorities and the local bulk water provider (the regional council) owning Wellington Water. Wellington Water manages the three waters of the five territorial authorities over multiple networks owned, with some physical interconnectedness of networks.

In principle, some economies might exist where large urban agglomerations are expanding and encroaching on existing networks. Such opportunities may exist in future at the Auckland/Waikato boundary, or other regional boundaries where urban areas are growing together. We are unaware of any current opportunities of this type.

Most New Zealand water services are geographically dispersed networks

Outside of Auckland, Hamilton, Tauranga, Wellington, and Christchurch, New Zealand's urban areas are widely dispersed. Overall, New Zealand is highly urbanised

with 86 percent of the population living in towns.[8] It also has very low population density: less than half of the OECD average.[9] Most people live in urban areas, but these urban areas have large distances between them. Physical connection of those networks is highly unlikely (and is not being proposed by the Government).

Given no interaction in physical network or in the production and treatment of water, administrative amalgamations cannot create economies of scale at the network and production level.

3.2 Management and Specialist Services and Procurement Functions May Provide Economies of Scale

Amalgamation could produce economies of scale through the reduction of corporate overheads and better coordination and bulk discounts in procurement.

Amalgamation may provide economies of scale in management and specialist services, but risks a loss of economies of scope

New Zealand water services differ in their degree of asset management sophistication.[10] Larger metros with larger-scale networks have high levels of management competence compared to smaller water services. Amalgamation may result in average asset management levels being improved by merging metropolitan water management with smaller scale poorer performers.

However, it is not clear that scale on its own is the driver of such improvements. International jurisdictions that experienced improved asset management levels also went through regulatory and governance reforms.[11]

Scale may provide lower average costs for the management services such as finance, human resources, research and development, regulation, planning, procurement, accountancy, legal, corporate buildings, call centres, and best management practices. However, almost all water services are already run as sub-units of local government entities and benefit from economies of scope. Any savings in average management services costs for water will be offset by increases in average management services costs for the remaining local authority activities. These benefits are not going to be large, as international literature suggests management services comprise a very small part of total costs for water services.[12]

Other options exist to achieve some cost savings through preserving economies of scope (for example many New Zealand water services benefit from management services also provided to other parts of council). Outsourcing or shared services can

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[8] Statistics New Zealand "Urban and rural migration" accessed August 31, 2020, http://archive.stats.govt.nz/browse_for_stats/population/Migration/internal-migration/urban-rural-migration.aspx#gsc.tab=0

[9] Statistics New Zealand "New Zealand in the OECD" accessed September 1, 2020 http://archive.stats.govt.nz/browse_for_stats/government_finance/central_government/nz-in-the-oecd/population.aspx#gsc.tab=0

[10] Castalia (2017), Three Waters Asset Management Maturity in New Zealand: Report to DIA.

[11] The amalgamation which created Scottish Water in 2002 was accompanied by regulator and governance reforms.

[12] See section 4.1 below for specific literature.

also lower costs. The benefits in management costs savings must also be weighed against the cost of reform and loss of local control over water services.

Procurement efficiencies may exist in New Zealand

Improved coordination in procurement may lower costs in water services in New Zealand. There may be bulk discounts available where capital expenditure is incurred. Larger scale water services have more market power in negotiations with service providers or vendors, which can be significant for small rural services where few providers trade.

4 Evidence for Economies of Scale and Implications

Government officials have collected evidence including literature and commissioned economic analysis to support the policy development process on amalgamating water services. The relevant evidence for possible scale economies consists of:

- Survey of econometric and case study literature. We examine this in section 4.1 below
- Report by Frontier Economics entitled Review of Experience with Aggregation in the Water Sector (Frontier Economics report). We examine this in section 4.2 below.

Castalia reviewed this evidence.[13] We find that it supports the conclusion that economies of scale do not arise from water service amalgamation except in limited circumstances, and confined to certain functions. The evidence does not establish a basis for significant economies of scale resulting from water service amalgamation.

We find that the econometric literature suggests that urban agglomerations result in the greatest economies of scale. However, where there are no urban dimensions to agglomeration (which would be true for most of New Zealand), the literature suggests that economies of scale are either non-existent, or worse, that diseconomies of scale occur.

We also find that the Frontier Economics report appears to have drawn factually incorrect conclusions from the case studies reviewed.

4.1 Literature Suggests Benefits from Economies of Scale in Limited Cases

Government officials and the Government's consultants collected relevant econometric and case study literature. This was provided to us. We reviewed this literature and we found that it is consistent with the findings of our analysis in section 2 above. There are some efficiencies in management and specialist services, and procurement from amalgamation of water utilities into larger entities. These benefits are relatively minor in comparison to the significant costs of network and production services in water provision.

The literature also provides evidence that economies of scale exist for existing larger water utilities in contiguous urban areas with higher population densities relative to smaller water utilities in smaller urban areas. Studies that focus on amalgamations find that benefits from economies of scale are likely to occur when already close urban areas carry out an amalgamation (in some cases some physical joining of water networks occurs). Conversely, the literature indicated that amalgamation of disparate water networks is most likely to result in diseconomies of scale.

Accordingly, it is important to distinguish how this finding from the literature applies in the New Zealand context. Given reform proposals at this stage focus on

[13] We note that four of the papers in the literature collection did not draw any conclusions about economies of scale: Deloitte (2015) *State of the Water Sector Report 2015*; OTTER (2019) *Tasmanian Water and Sewerage State of the Industry Report 2017-18*; WICS (2014) *Water Industry Commission for Scotland Presentation for the 1st WAREG meeting*; and National Water Grid Authority (2020) *Water Infrastructure Projects*.

administrative amalgamation and not physical amalgamation of networks, the literature does not support a conclusion that economies of scale are available for the types of amalgamations proposed in New Zealand for water networks and production.

Larger urban areas benefit from economies of scale relative to smaller urban areas

The literature suggests that economies of scale exist for larger urban water services relative to smaller ones. The benefits are likely to only be significant in situations of larger urban agglomerations, relative to smaller urban agglomerations.

However, large water services suffer diseconomies of scale beyond a certain level of connections; the literature varies on the number of connections. There is no definite number of connections that reflects maximum efficiency.[14] The literature consistently states that each country's experience of economies of scale in water services will depend on institutional settings such as regulation, public or private ownership. Therefore, results from econometric studies need to be treated with caution, and viewed in context. Economies of scale may exist, but where these do, there is no consistent optimal scale because this varies between countries.[15] Optimal scale is highly particular to the provider's conditions.[16]

Table 4.1 below summarises our findings from the literature.

[14] We were told by WICS that 800,000 connections marks an efficient minimum. However, this particular figure is not reflected in the Government's literature list.

[15] IPART (2007) Literature Review Underlying Costs and Industry Structures of Metropolitan Water Industries.

[16] Gustavo Ferro (2017) Literature review: global study on the aggregation of water supply and sanitation utilities, World Bank Group.

Table 4.1: Government's Literature Survey of Meta-Studies

Title	Significant network scale economies exist	Significant Production scale economies exist	Significant Management and specialist service economies exist	Summary of findings
Abbot and Cohen (2009) *Productivity and efficiency measurement in the water industry*	✓	✓	✓	Tentative conclusion that economies of scale exist in the water industry but notes that at some point these economies are exhausted. The paper adds that there is little consensus regarding how geographic and demographic conditions impact diseconomies of scale.
ACIL Tasman (2007) *Size and Scope Economies in Water and Wastewater Service*	✓	✓	✓	Scale economies are modest and only apply when moving from small to medium size utilities. Customer density is the greatest driver of efficiency. The availability of scale economies depends on the extent to which the volume of water supplied can be increased without incurring expansion costs in the number of connections serviced and size of the area served.
Ferro (2017) *Literature Review Global Study on the Aggregation of Water Supply and Sanitation Utilities*	✓	✓	✓	Economies of scale may exist for smaller entities. Medium to larger entities are more likely to encounter constant or diseconomies of scale. International literature on the existence of economies of scale is mixed.
Ferro et al (2011) *Economies of scale in the Water Sector: a survey of the Empirical Literature*	✓	✓	✓	Economies of scale have been found in several countries when population serviced ranged between 100,000 and 1 million. Note that population density is a key driver of these economies.
IPART (2007) *Literature Review Underlying Costs*	✓	✓	✓	Review suggests that economies of scale exist below an optimal scale of approximately 200,000 users. Evidence from Italy suggests economies

and Industry Structures of Metropolitan Water Industries				of scale exist until a utility produces 90 million cubic meters (around 1 million users). Highlights two caveats: studies should not be generalised given differences in operational characteristics of different jurisdictions, and engineering scale economies can be offset by organisational management diseconomies.
OECD (2018) *Financing Water Investing in Sustainable Growth*	✘	✘	✘	Paper makes no conclusions on the existence of economies of scale in water services.

Studies that review amalgamations mostly show very limited economies of scale benefits

In contrast, literature that examines historical amalgamations finds very few cases of benefits of economies of scale from amalgamations. This is the more relevant literature for New Zealand's current policy decisions. In New Zealand, the question is whether the amalgamations of the type and size proposed will deliver any benefits of scale. Table 4.2 below summarises these studies.

A subset of the literature reviews amalgamations, or potential amalgamations in Germany, Japan, Central and Eastern Europe and the Netherlands: DIW Berlin (2016), Urakami and Parker (2011), Klien (2015) and Blank et al (2019). This literature generally finds that benefits of economies of scale are more likely where water output and customers served increases within an existing service area. Where density increases within an existing serviced area, economies of scale can emerge.

In a minority of case studies, economies of scale are identified for amalgamations between water services. US Water Alliance (2019) finds three case studies where benefits arose. One involved amalgamating 14 drinking water suppliers under the same company already providing wastewater and stormwater services in an existing metropolitan agglomeration (Hampton Roads: Virginia Beach, Norfolk and Newport News in Virginia and North Carolina). Another case found economies of scale where individual local government jurisdictions with separate water services had grown into one contiguous urban area (around the city of Raleigh, North Carolina). Finally, one case study of a rural amalgamation of 18 services in Iowa serving 55,000 people identified benefits from consolidating some water assets and sharing services.

Table 4.2: Government's Survey of Econometric and Country Wide Studies

Title	Significant network scale economies exist	Significant Production scale economies exist	Significant Management and specialist service economies exist	Summary of findings
Econometric Country-Specific Studies				
Worthington and Higgs (2011) *Economies of Scale and Scope in Australian Urban Water Utilities*	✓	✓	✓	Strong economies of scale exist at relatively low levels of water output if amalgamation occurs in a close geographic proximity and no significant system investments are necessary.
DIW Berlin (2016) *Cost Structure and Economies of Scale in German Water Supply*	✘	✘	✘	In a survey of 665 possible mergers, 407 resulted in diseconomies of scale. Economies of scale are most likely to occur by increasing the size of very small-scale firms, and through "an increase in water output and population in existing service areas".
Urakami and Parker (2011) *The Effects of Consolidation amongst Japanese Water Utilities: A Hedonic Cost Function Analysis*	✘	✓	✘	Consolidation of Japanese water utilities since the 1990s has achieved minor economies of scale. Savings are often made in the production of water, but these are offset by increasing costs related to low population density.
Klien (2015) *Consolidation of Water Utilities: Lessons from Central and Eastern Europe*	✘	✘	✘	Consolidations in Eastern Europe have resulted in increased unit costs, i.e. diseconomies of scale. Author finds that any potential benefits from economies of scale are offset by the cost of adding incremental, more distant users.

Munisamy (2009) *Efficiency and Ownership in Water Supply: Evidence from Malaysia*	✘	✘	✘	Article made no definitive conclusions on the existence of economies of scale. Observed that private firms operate more efficiently than publicly owned water utilities.
Blank et al (2019) *Productivity change in Dutch Water 1980-2015*	✘	✘	✘	Assessment of water utility mergers in the Netherlands since the 1980s has revealed no efficiency gains.
Country Wide Survey				
US Water Alliance (2019) *Strengthening Utilities Through Consolidation: The Financial Impact*	✓	✓	✓	Consolidations produced scale benefits in the Iowa Regional Utilities Association, the City of Raleigh, and the Hampton Roads Sanitation District. Benefits resulted from attracting better management, improved water quality, and reduced operation and maintenance costs. These benefits confined to urban agglomeration situations (that is, small towns becoming one unit) or shared services.

4.2 Frontier Economies Report Draws Incorrect Conclusions

The FE report was prepared for the Government in support of a policy development process on amalgamation. It finds "[t]here is strong and consistent evidence that the structural and related reforms implemented in the jurisdictions examined in this review have led to significant improvements in productivity and efficiency."[17] Furthermore, it attributes these benefits to amalgamation which achieved economies of scale.

We found that the FE report draws incorrect conclusions from the case studies. It attributes benefits to amalgamation, when in fact amalgamation predated the period that Frontier Economics review (in the case of England and Wales and Scotland). The FE report also fails to assess prior periods of failed amalgamation (Scotland and Tasmania). It also understates cases of de-amalgamation that led to efficiency gains (Melbourne) and overlooks alternatives to amalgamation that deliver efficiency benefits.

England and Wales amalgamation occurred 17 years before benefits arose

The FE report cites the performance improvements of the 10 England and Wales water companies as evidence that amalgamation of water providers results in benefits. The FE report, however, focuses only on the period **after** the 10 England and Wales regional water board were privatised and regulated.[18]

The England and Wales water companies did not amalgamate in 1989. The amalgamation preceded the period studied in the FE Report by 17 years. In 1973, the UK government amalgamated 1,000 bodies involved in the supply of water and around 1,400 bodies responsible for sewerage and sewage disposal into 10 regional water boards.[19] These same regional water boards were privatised in 1989 and subjected to price and quality regulation by the new water regulator Ofwat.

Therefore, if the question is whether amalgamation led to benefits, then the relevant period is the reform period before and after the 1973 reforms. To identify the impact of amalgamation alone, the period from before the 1973 reforms until 1989 needs to be studied which represents the period after amalgamation, but before privatisation. This analysis would identify the benefits of changing from a larger number of water services to a smaller number.

The FE report highlights a range of positive outcomes that occurred over the 1990s. However, these benefits relate only to the outcomes of privatisation and regulation of the water sector. Given the period of focus, it is not accurate to attribute "[a] number of the efficiencies achieved following aggregation… as realisation of economies of

[17] Frontier Economies (2019), Review of Experience with Aggregation in the Water Sector Report for the Department of Internal Affairs. p. vi.

[18] We note that Frontier Economics implies that the Welsh water company (Dŵr Cymru Welsh Water) was not privatised and was a not-for-profit from the outset. However, this is a mischaracterisation. Wales Water was privatised in 1989, but its owner faced financial difficulties in 1999/2000 and sold the company to a public benefit corporation.

[19] Parker (2018), The Official History of Privatisation, Volume II.

scale, where average costs fall as scale increases", or to link "structural changes" to the information and data reviewed.

For the more relevant period (between 1973 and 1989), however, the 10 regional water boards performed poorly and underinvested. Amalgamation appears to have failed to drive positive outcomes from 1973 to 1989:

- Insufficient investment occurred. Frontier Economics claim that there was a "significant uplift in investment in the years after aggregation."[20] However this is factually untrue. Capital investment reduced over the period: the industry in 1982 spent only half of the total capital expenditure spent in 1974. It was only after 1989 that capital investment would improve
- There were no improvements in environmental performance in England and Wales from amalgamation. In fact, there was no significant decrease in pollution incidents across the 1980s. European Community (EC) law on water quality was breached due to polluted rivers from sewerage, and the EC would begin prosecution proceedings against the UK government over this issue
- The regional water boards were inefficient. Frontier Economics claim that operating efficiencies followed amalgamation. However, it was only in the 1990s that England and Wales water providers outperformed Ofwat (the economic regulator) operating expenditure efficiencies. This implies that for the previous 17 years, the amalgamated publicly owned water boards operated inefficiently
- Local authorities lost governance rights after amalgamation. Initially, local authorities had board of director appointment rights, however these rights were centralised to the national government in 1983
- On the basis of this poor performance alone, the opposite conclusion could be drawn from the England and Wales case study: that amalgamation alone does not drive positive productivity and environmental benefits.

Scotland's amalgamations initially resulted in poor performance

The FE report focuses on the performance of Scottish Water (the single water service provider covering the whole of Scotland since 2002) to establish the benefits attributable to amalgamation. The creation of Scottish Water in 2002 coincided with improved governance and regulatory oversight.

However, there is a long history of amalgamation in Scotland before 2002. In 1945, there were 210 water authorities in Scotland. Through a series of reforms, Scotland increasingly amalgamated its authorities reaching a point in 1996 where Scotland was served by three water service providers.[21] The New Zealand Government's strong

[20] Frontier Economics (2019), p. 23.

[21] Emanuele Lobina and Philipp Terhorst (2005), D19: WaterTime case study - Edinburgh, UK. WaterTime EU Research Project.

preference is for four or five multi-regional water services providers.[22] Therefore, the reform periods in Scotland where a smaller number of regional entities were created should be the focus of study.

Scottish Water was established in 2002 in part to address poor performance of the three regional providers serving Scotland between 1996 and 2002. These providers had the following problems:

- Price differentials rapidly grew between the three entities. Prices in the North were twice that experienced in the South
- Backlogs in investment developed. The entities were not effective at financing their capital expenditure. Their debts were GB£500 million more than the assets.[23]
- Operating efficiency considerably lagged that experienced in England and Wales.

Tasmania's amalgamations initially resulted in poor performance

The FE report also focuses on the recent performance of Tasmania's single water company TasWater, but it does not consider the prior reform period where amalgamation failed to drive performance improvements.

In 2009, Tasmania's 29 local council-owned and operated water providers were merged into three regional water providers plus a fourth shared services entity. Between 2009 and 2013, amalgamation failed to drive positive outcomes. Tasmania's economic regulator noted that capital expenditure decreased across all three corporations in 2012-13 compared to 2011-12. Operating costs also increased.[24] TasWater resulted from a merger of the poorly performing four entities in 2013, with the State government becoming a 10 percent shareholder and injecting AUD200 million of equity.

Service levels did not improve as expected from the 2009 amalgamation, which prompted further investigation and reform, ultimately leading to the creation of TasWater. Given the similarity between Tasmania's water services in 2009 and 2013, and the multi-regional proposal for New Zealand amalgamations, this period should be further investigated.

Melbourne's disamalgamation improved performance

Overall, the FE report asserts that the evidence is "strong and consistent" in favour of amalgmation and that amalgmation is "key" to improve outcomes. However, the report briefly reviews Melbourne Water, the single water service provider to the city of Melbourne. Melbourne Water was amalgamated in 1992, however this amalgamation resulted in diseconomies of scale due to its size. In 1995 Melbourne

[22] New Zealand Government (2020) Cabinet paper: Investing in Water Infrastructure to Accelerate Reform and Support Economic Recovery Post-COVID-19, at [69]. Available here: https://www.dia.govt.nz/diawebsite.nsf/Files/Proactive-releases/$file/Investing-in-water-infrastructure-to-accelerate-reform-and-support-economic-recovery-post-Covid-19.pdf

[23] Frontier Economics (2019), p. 16.

[24] Office of the Tasmanian Economic Regulator (2013), Tasmanian Water and Sewerage State of the Industry Report 2012-13.

Water was separated into four entities: three retail water businesses, and a wholesale bulk water, sewer and waterways manager (which would retain the name Melbourne Water).

The separation of then Melbourne Water into smaller entities resulted in increased efficiency. Post separation, 23% of efficiency gains were produced by the three smaller water retailers.[25] The Essential Services Commission estimated that the entities' Total Factor Productivity improved by 1.5%-2.6% per year from 1998 to 2006.[26]

Examples such as Melbourne Water are important because they help define the limits of amalgamation as a driver of improved water service performance. If amalgamation (in isolation) drives benefits, this claim must be squared with the evidence of positive outcomes resulting from Melbourne Water's disamalgamation.

Management services efficiencies also possible without amalgamation

The FE report claims that amalgamation leads to improved strategic management in water companies.[27] This may be true, but it is not the only way that these benefits can be achieved.

Concession contracts, which lease public water assets to a private operator for a period, can result in improved management given the commercial incentives operating on the entity. Furthermore, these benefits can occur at a very small scale – for example, in France concession for water service provision can be at a municipal level.

Shared service models may also drive efficiencies. It is possible for retail water provision to remain local, while amalgamating corporate services. Wellington Water adopted this model. Tasmania also adopted this model in 2009.[28]

[25] Frontier Economics (2019), p. 25.

[26] Total Factor Productivity aims to capture all the outputs produced by an entity and all the inputs used to produce those outputs.

[27] Frontier Economics (2019), p. 28.

[28] As we note above, Tasmania's 2009-2013 adoption of three regional water providers and a single shared services provider did not result in improved performance, however, it is not clear that this poor performance was a result of the shared services model.

5 WICS Modelling of Amalgamation Scenarios

DIA appointed WICS[29] to analyse hypothetical New Zealand amalgamation scenarios and model potential efficiency gains. WICS' view is that various efficiency improvements will arise from additional investment, governance and regulatory reform and economies of scale from amalgamations.

Castalia has reviewed three separate sets of slide packs presenting the outputs of WICS' analysis. We have not reviewed the underlying data held by WICS. We participated in a presentation with local government managers and DIA. We also had a one-on-one discussion with WICS regarding its methodology and findings.

We have concerns about the assumptions used and approach to model efficiency. Our first concern relates to the assumptions about the level of investment needed in New Zealand. These potentially overstate the needed investment (and therefore also the size of benefits the analysis derives from amalgamations). Our second concern is that the analysis assumes that significant efficiencies from economies of scale are available in amalgamations. The scale benefits are a major driver of differences in future costs for the modelled amalgamated New Zealand water utilities. Therefore, the conclusions from WICS' analysis for New Zealand amalgamation scenarios should be treated with caution.

WICS carried out a three-step analysis to determine investment needs for New Zealand water services, and then the efficiency gains possible from structural and regulatory reforms. The three-step methodology is:

- Step One: Establish a baseline of the charges required to maintain the current levels of service for New Zealand (assuming no improvement in service to meet growth, quality, environmental or customer service)
- Step Two: Determine the change in water services charges for each New Zealand local authority if each made the investments necessary to meet minimum water quality and environmental standards
- Step Three: Model how water services costs change under different amalgamation scenarios, assuming efficiency gains are achieved, and a well-defined regulatory governance framework is imposed.

5.1.1 Assumptions of investment needed in New Zealand water assets are questionable

The Step Two assumptions appear questionable. In Step Two, the analysis forecasts that New Zealand needs to make additional enhancement investment of $27 billion by 2050. Only by making these investments, can New Zealand water services match the quality, environmental and service gains seen in the UK.

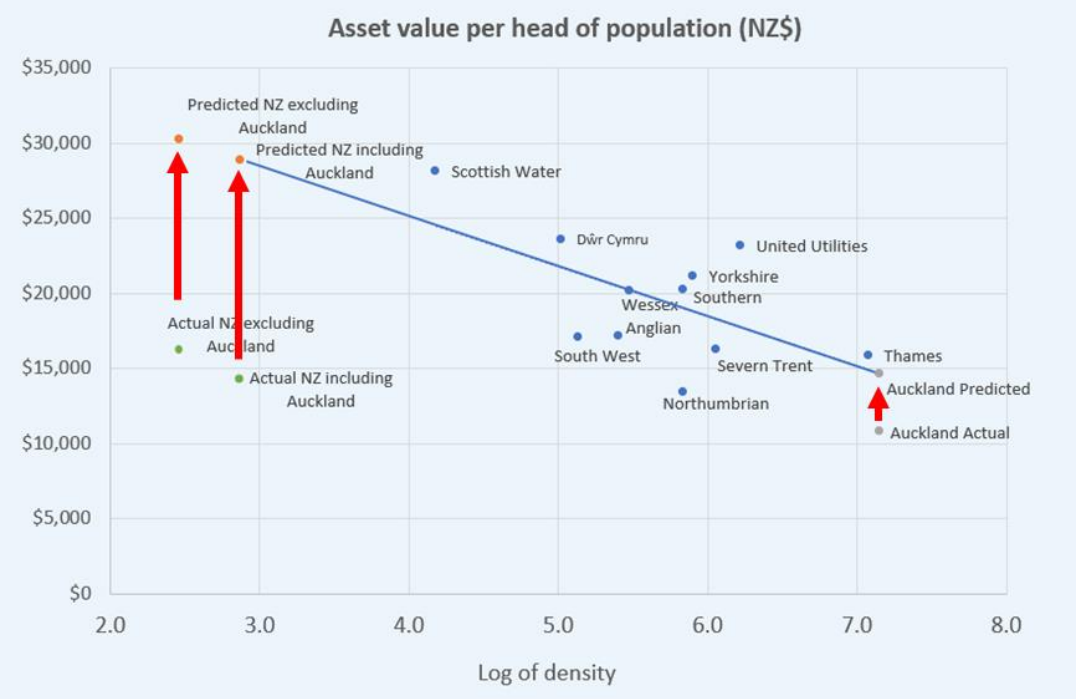
The required investment for New Zealand is derived by plotting all UK water service providers asset values according to population density. Figure 5.1 illustrates the

[29] WICS is the regulator of water services in Scotland. It manages the regulatory framework, sets prices, facilitates competition and monitors the performance of Scottish Water. WICS is unusual by world standards for regulators in that it provides consulting services in other countries under the Scottish Government's Hydro Nation initiative. Scottish Water has been held up by New Zealand sector leaders and Ministers as a reform model for New Zealand to learn from.

approach. The difference in actual asset value per capita and predicted asset value per capita is the amount of additional investment needed. This is represented by the red arrows for New Zealand, New Zealand (excluding Auckland) and Auckland (arrows added by Castalia).

The analysis does not appear to consider that the cost drivers between the UK and New Zealand are likely to be different than just density. The analysis assumes that New Zealand faces the same local cost drivers as the UK. This is concerning because New Zealand has a different urban typology[30] and a lower connection rate (that is unlikely to increase much).

Figure 5.1: WICS Assumptions of Necessary New Zealand Water Investment



Source: Water Industry Commission for Scotland (2020), arrows added by Castalia

For the required level of investment to be accurate, WICS has to establish that New Zealand's current value of water assets is in fact as far below UK levels as assumed. There are a number of reasons to question this assumption, which we address below:

Comparisons of New Zealand water asset values with asset values for England, Wales and Scotland water companies need to use equivalent measures

The analysis does not appear to compare asset values of the UK water companies and New Zealand water services using the same asset value measures. This is important for the accuracy of the comparisons, since water services involve very expensive sunk investments, often made many decades ago.

During the privatisation of water companies in England and Wales, significant revaluations of water assets occurred. The water boards that pre-dated privatisation

[30] For example, outside of major cities, New Zealand's urban typology is mostly single-unit dwellings on large sections which get larger the further from the urban centre one travels (such as lifestyle blocks).

reported asset values using historical cost accounting. This resulted in huge differences in asset values between for example, a water treatment plant built in 1926 for GB£10,000 and one built in 1989 for GB£10 million (which might functionally perform the exact same task). The solution was to revalue the capital stock of the 10 water companies on a modern equivalent asset (MEA) basis.[31] The revaluation process involved massive changes to the reported asset values of the water companies.[32]

In contrast, New Zealand water services are valued in accounts according to New Zealand accounting principles. Council asset management plans also detail approximate values for replacement. In order to partially account for this issue, WICS assume an asset floor it its base case[33] to approximate the minimum current asset values for New Zealand water services. However, WICS do not provide any information on how this assumption was reached.

The role that capital investment plays in New Zealand water quality and environmental performance needs to be tested

New Zealand has had well-documented and high-profile water quality problems. The Havelock North case is tragic and most prominent. Increased capital investment is likely to play a role in improving New Zealand's water services in some areas. Analysis done by Beca and GHD-Boffa Miskell for DIA has quantified some of the investment in three waters services necessary to meet future mandatory quality and environmental standards. Other issues have been identified in the quality of governance, deficient management and operational systems, and inadequate water quality and environmental regulation and enforcement. It is clear that a range of changes, alongside some capital investment, will be needed to address the underlying problems.

WICS assumes that capital investment in New Zealand's three water assets needs to match UK levels to address the range of problems in the New Zealand water sector. However, it is not yet clear in the New Zealand policy reform process what level of capital investment is needed and where. We know that some level of capital investment is necessary. However, it is not clear that WICS' assumptions are correct that New Zealand needs to invest at the same levels as areas of the UK that have comparable population densities.

Insufficient evidence that New Zealand's water quality and environmental outcomes are materially worse than UK

WICS compared water quality and environmental standards between New Zealand and Scotland (including EU regulations). However, WICS does not present any comparison in outcomes in its analysis. Therefore we do not know the role that increased capital investment plays in any difference in quality and environmental outcomes.

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[31] Hull (2013), Basic Network Utility Economics, pp. 303-304

[32] Saal, Parker & Weyman-Jones (2007), Determining the contribution of technical change, efficiency change and scale change to productivity growth in the privatized English and Welsh water and sewerage industry: 1985-2000.

[33] We refer to the "Base Case Mark II" developed by WICS in response to stakeholder feedback.

WICS finds that the regulations applying in both countries are similar. However, WICS concludes that because New Zealand appears to carry out fewer sampling tests of drinking water (10,000 for Watercare vs 50,000 in Scotland), performance is worse. This conclusion needs to be tested further.

New Zealand's lower sample size does not necessarily prove that New Zealand has more water quality issues, and that an equivalent level of capital investment is needed. The differences in sampling procedure merely mean that the Scottish quality regulator can be more confident that the sample it has collected reflects the actual state of water quality in Scotland, compared to the New Zealand equivalent. WICS did not appear to compare the actual water quality levels and environmental outcomes between the two countries.

While New Zealand has had many water quality issues, the UK has also experienced quality problems, including issues masked by fraudulent water testing between 2010 and 2017.[34] Differences in sampling size has consequently not protected the UK from bad water quality outcomes.

5.1.2 The WICS analysis assumes UK economies of scale will apply to New Zealand amalgamation

In step three, the analysis defines hypothetical merged water utilities and assumes the same efficiencies achieved at UK water companies will apply in New Zealand. There are three issues with this approach:

- The analysis does not establish a causal link between amalgamation and the benefits realised in the UK
- Even if there is a causal link in the UK examples, the analysis does not consider whether the same benefits will occur given differences between the UK and New Zealand
- The assumed amalgamation scenarios result in unrealistic conclusions.

The WICS analysis does not show that UK amalgamations caused economies of scale benefits

The analysis draws on two reform periods, similar to Frontier Economics, to support the potential efficiency gains available to future New Zealand water utilities:

- England: 1990s privatisation of Regional Water Associations into private firms
- Scotland: 2002 merger of the West, East and North of Scotland Water Authorities into Scottish Water.

[34] Southern Water, one of the UK's largest water and sewerage companies, deliberately misreported the true performance of its sewage treatment works from 2010 to 2017. An internal investigation of the company found that employees (including those at the senior management level) deliberately prevented the sampling of wastewater to check compliance with environmental permit conditions. This resulted in unpermitted and premature spills of wastewater from Southern Water's treatment works. Ofwat also found that Southern Water had dumped untreated effluent into beaches, rivers and streams. Following Ofwat's investigation in 2019, it ordered Southern Water to pay £126m in penalties for breaching its sewage treatment statutory duties. See Financial Times (2019) *Southern Water hit by £126m penalty for 'serious failures'*. Retrieved from https://www.ft.com/content/518b21fa-9711-11e9-9573-ee5cbb98ed36

The WICS analysis identifies a range of efficiency gains that the amalgamations, governance reforms, increased investment and regulation ought to deliver:

- Financing expenditure gains will come from larger scale entities able to access cheaper finance. This ignores that Scottish Water borrows from the Scottish Government, not through capital markets. A water entity does not need to be amalgamated or large to be able to borrow directly from the government at low rates.

  The analysis assumes that amalgamation, and therefore greater scale, is a key driver of the potential gains. However, this does not take into account that efficiency gains post-1989 in England and Wales had less to do with scale (amalgamations occurred in 1973), and more to do with privatisation and regulatory changes. The WICS analysis appears to assume operating expenditure gains will emerge from economies of scale and scope. WICS' analysis reviewed water providers across the UK and created three bands of operating efficiency achievable at a certain scale:

  - Larger company with the potential for scale and scope economies. Example used is Yorkshire Water which reduced its operating costs by 40%.
  - Successful smaller company with consequently lower scope for scale and scope economies. Example used is Bristol Water which reduced its operating costs by 25%.
  - Smallest companies with least scope for economies of scale and scope. Example used is Folkstone Water which reduced its operating costs by 15%.

- Capital expenditure gains will emerge from improved asset management processes, better procurement, and further innovation. Our analysis and literature review above suggest this is a valid assumption.

Efficiency gains unlikely to apply to the New Zealand context and geography

The WICS analysis assumed efficiency gains from amalgamations drive lower modelled charges to consumers (that is, cost of overall services) than might be the case if amalgamations did not occur. The efficiencies arise in the modelling because it is assumed that New Zealand water services face the same inherent costs as Scotland and the UK. There are many reasons to question this.

New Zealand has a very different geography and urban typology to Scotland and the UK. New Zealand's land mass is over three times the size of Scotland. The population density is approximately a third of Scotland's.

We are also concerned with how the WICS analysis draws on English water companies to make comparisons. For example, the analysis suggests that New Zealand amalgamated entities may realise the same 40 percent improvement in operating efficiency as Yorkshire Water. This does not account for the fact that Yorkshire Water serves 5.4 million users across an area approximately the size of New Zealand's Marlborough Region. To achieve that number of connections we would have to

amalgamate the whole of New Zealand (and to achieve the densities that Yorkshire Water has we would then need to shrink the New Zealand landmass by 90 percent).

Amalgamation scenarios appear implausible

The assumed major efficiency gains in WICS' analysis produce some unusual modelled scenarios for future amalgamated water entities. These results appear implausible.

We have only reviewed the model results set out in the slide decks. We were not permitted access to the data and underlying model which limits the extent of our analysis. For example, we do not know the exact efficiency factors WICS applied to the different amalgamation scenarios and for which particular costs.

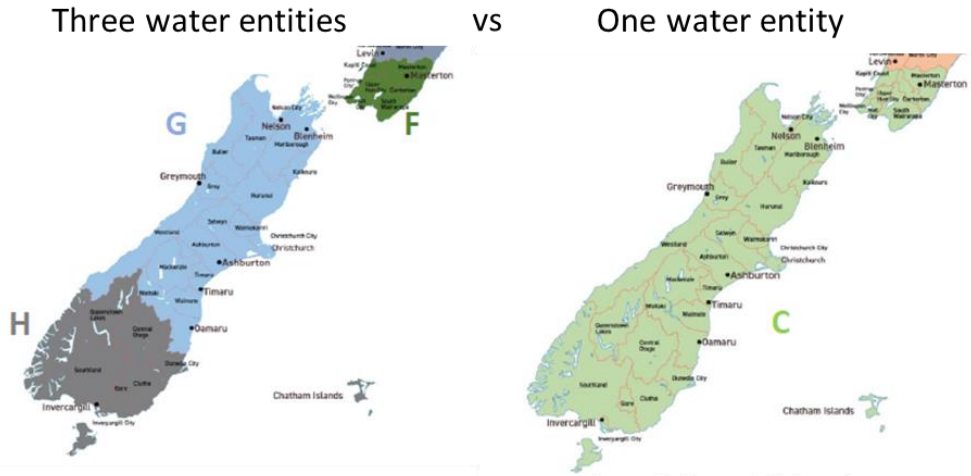
Applying efficiencies observed in the UK, the WICS slide decks claim that most amalgamation scenarios result in much reduced household bills by 2050 for the assumed improvement in service levels, relative to the projected cost if local authorities were to remain stand-alone (that is, the status quo). In some scenarios, a rural council may reduce its bill to households by over 75%. On the basis of how the material is presented, we interpret that these savings are being driven by the scale of the amalgamated entity.

In order to illustrate the ambitious efficiency assumptions for amalgamated entities we carried out a pairwise analysis.[35] This was difficult because each of the scenarios involve different configurations of territorial authorities (and we did not have access to the data). We can, however, compare "Scenario 3" and "Scenario 6" where the Wellington region and South Island are configured into three and one water entities respectively.

Figure 5.2 below shows that by opting to amalgamate the Wellington entity with the two South Island entities, a remarkable 48 percent reduction in costs ($708 million vs $1,049 million) is possible by 2050 compared to having three separate entities. For this to be true, the returns to scale and benefits from centralising all management and operational oversight functions to either the North or South Islands would have to outweigh the additional costs of overcoming regular Cook Strait travel, and other practical and logistical issues.

[35] Without access to WICS data, we had to conduct our analysis based on the limited information contained in WICS slide decks which were provided to us by DIA. We took the average household bill from each scenario and we multiplied that bill by the number of households WICS assume to be within the areas of the modelled entities. We understand that the modelled (publicly owned) entities fully recover costs from household bills. Therefore, the total costs of the entities should equal the total revenues.

Figure 5.2: WICS Modelling of South Island and Wellington Water Entities



Scenario 3: modelled costs

Entity	2019	2030	2050
F	$166m	$247m	$265m
G	$234m	$460m	$537m
H	$92m	$205m	$247m
Total	**$493m**	**$911m**	**$1,049m**

Scenario 6: modelled costs

Entity	2019	2030	2050
C	**$496m**	**$741m**	**$708m**

Source: WICS, Economic Analysis of Water Services Aggregation, slide deck 3, pages 18 and 22[36]

Note: We use WICS' "Base Case Mark II" which is a more conservative model approach and was prepared by WICS in response to stakeholder feedback. Exact costs were not provided so we determined costs from WICS' graphs.

A further example that illustrates seemingly implausible results produced by the WICS model is "Scenario 9". Entity A is Auckland's Watercare and Northland plus the entire South Island and Chatham Islands. Entity B is the rest of the North Island. This scenario produces the lowest South Island costs of any modelled scenario. The modelled result is depicted in Figure 5.3 below.

This model result again apparently shows that the scale efficiencies will overcome the inefficiencies and practicalities of managing the entire South Island water services as well as New Zealand's largest city from a centralised location. We are unaware of any New Zealand logistics or utility business that divides the geography in this way.

[36] WICS suggest that the following numbers (representing nominal revenue) should be used:

Entity	**2019**	**2030**	**2050**
F	252m	407m	589m
G	365m	725m	1035m
H	154m	328m	495m
Total (F+G+H)	771m	1460m	2119m
C	814m	1258m	1632m

Figure 5.3: WICS Scenario 9—Two Amalgamated Water Services

Entity	2019	2030	2050
A	$851m	$1,113m	$1,022m
B	$561m	$770m	$712m

Source: WICS, Economic Analysis of Water Services Aggregation, slide deck 3, page 25[37]

Note: We use WICS' "Base Case Mark II" which is a more conservative model approach and was prepared by WICS in response to stakeholder feedback. Exact costs were not provided so we determined costs from WICS' graphs.

[37] WICS suggest that the following numbers (representing nominal revenue) should be used:

Entity	**2019**	**2030**	**2050**
A	1309m	1899m	2386m
B	869m	1303m	1630m

6 Conclusion

The evidence does not support the existence of significant economies of scale resulting from administrative amalgamations of water services of the type proposed for New Zealand.

Water services do not experience the economies of scale which are generally assumed for natural monopolies. Water services face constant returns to scale, except in limited situations—such as an increase in density in an existing urban area with water network capacity.

There are three potential economies of scale operating in the provision of water services. These economies of scale are highly sensitive to local circumstances. These are economies of scale in network infrastructure, water production, and management and specialist services. Economies of scale are most likely in management and specialist services.

Economies of scale are not generally available from the types of amalgamations proposed for New Zealand. Apart from limited instances of existing urban areas merging, administrative amalgamations are unlikely to deliver any returns to scale in network services and water production services.

The Government's evidence to date does not establish the existence of significant economies of scale. The literature surveyed in fact supports a conclusion that economies of scale from administrative amalgamations are unlikely. The Frontier Economics report draws the wrong conclusions from the literature. The WICS model results we reviewed appear to be based on assumptions that are not reasonable, and the modelled scenarios produce implausible results.

There may be some economies of scale available for New Zealand water services in procurement and operations, but the scale of savings is likely to be small, relative to the total cost of the fixed network assets. There are alternatives to amalgamations that could deliver improved procurement and operations such as outsourcing or concessions.

Castalia has prepared a second report entitled *Comparative Analysis of Institutional Forms in Water Services for Proposed New Zealand Reforms*. This report evaluates four major models of water service delivery in use around the world, including the regional public corporation model under consideration. It demonstrates alternatives to improving water services which do not involve amalgamation. This report also addresses how these models achieve various reform outcomes including improved access and reduced cost of finance.[38]

Finally, the proposed amalgamations must be weighed against the costs and risks. These include the loss of local influence over water assets and loss of economies of scope with other activities of local government. The Government's proposed reforms

[38] Scale can improve cost of finance, all else equal. However. access to finance and the cost of finance ultimately depend on the credit risk profile of the borrower in question. Improved governance, economic or contractual regulation and funding (tariff-setting or some other form of funding such as government transfers) also contribute to access and cost of financing.

will be very costly. The Government needs to show that the reform will deliver benefits and that these outweigh the costs, including any costs imposed by transition.

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