Estimating Seqwater's firm-specific WACC parameters for the 2018-21 bulk water price investigation

Queensland Competition Authority

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1. Executive Summary

Terms of Reference and key recommendations

Seqwater provides bulk water services to 11 council areas in south east Queensland. The Treasurer and Minister for Trade and Investment ("the Minister"), have instructed the Queensland Competition Authority (QCA or 'the Authority') to make recommendations regarding Seqwater's bulk water prices for the period 1 July 2018 to 30 June 2021. As part of its investigation, the QCA has engaged Incenta Economic Consulting (Incenta) to advise on certain firm-specific weighted average cost of capital (WACC) parameters for Seqwater's Weighted Average Cost of Capital (WACC). In particular, we were engaged to assess Seqwater's submission, and provide recommendations relating to Seqwater's benchmark:

- Asset beta for the regulatory period on the basis of a first principles and empirical analysis of its systematic risk;
- Capital structure, considering Seqwater's total risk (systematic and non-systematic) in comparison to the risks of other relevant businesses in Australia and other jurisdictions;
- Equity beta to for the regulatory period, on the basis of the recommended estimates for the benchmark asset beta and capital structure, taking account of the QCA's standard approach to levering betas and estimates of gamma and the debt beta; and
- We were also asked to advise on a range for the estimated beta for Seqwater. We have advised on the upper bound by looking at another sector, tollroads, that is quite similar to the water sector on a number of indicators, but is expected to face higher systematic risk than Seqwater. We could not identify another sector that, based on first principles, might be expected to have lower systematic risk than Seqwater for the lower bound.[1]

Having undertaken our review of these issues, our recommendations for Seqwater's parameters are:

- A best estimate asset beta of **0.41,** with an upper bound estimate of **0.47**;
- Capital structure of **60 per cent** debt (relative to the sum of debt plus equity); and
- A best estimate of the equity beta of **0.77** based on a comparator group of 12 water supply businesses and the QCA's standard approach to levering betas (using the Conine approach) and estimates of gamma (0.46) and the debt beta (0.12), and an upper bound estimate of **0.91** based on our first principles assessment that the tollroads industry is expected to have greater systematic risk than Seqwater.

[1] In previous work for the QCA we have found that regulated energy networks and regulated water networks have a similar degree of systematic risk based on first principles analysis and empirical investigation. Other potential sectors, including airports and container ports, were expected to be subject to greater systematic risk than both Seqwater and tollroads.

First principles analysis

Seqwater's submission proposed an asset beta of 0.40, which was applied by the QCA in the case of the Gladstone Area Water Board (GAWB), and an equity beta of 0.77 with a benchmark gearing of 60 per cent. While Seqwater did not undertake a formal first principles analysis to support its proposed asset beta, our Terms of Reference requires this. In doing so we had regard to a standard set of factors potentially affecting systematic risk drawn from the economic and finance literature (and summarised by the QCA's adviser, Dr Martin Lally (2004)).[2] As noted above, we also had regard to the tollroads industry, whose benchmark systematic risk we compared with those of Seqwater.

Our first principles analysis came to the following conclusions regarding Seqwater:

- Market power and regulation – Market power and regulation are linked, as regulation is typically only applied to businesses with a material degree of market power. Seqwater is likely to have significant market power (as evidenced, for example, by price-inelastic demand).[3] Unlike other water businesses, Seqwater is subject to less formal regulation, but the practical effect is an expectation of a periodic reset on cost-based principles. A QCA review of Seqwater's prices requires a referral from the Minister. Based on the Minister's last referral, the QCA's 2015 review recommended prices for the period 2015-16, 2016-17 and 2017-18. This year the Minister has again asked the QCA to undertake a review of pricing for the period 2018-19, 2019-20, and 2020-21, which is based on efficient cost-of-service principles. While the QCA, at this time, does not have a regulatory role beyond the current review, and its further involvement is contingent upon Ministerial direction, we believe that such direction is likely to be forthcoming given the Queensland Government's desire to promote efficient, reliable, and affordable water supply in south east Queensland.

  In the current review, if actual volumes are found to be less than forecast for the 2015-16 to 2017-18 period, the shortfall would be added to the "price path debt", and recovered in an NPV-neutral manner over the period of the price path.[4] Seqwater's cash flows are therefore buffered by the regulatory approach that is being applied to it. Peltzman (1976) hypothesised that such firms tend to exhibit relatively low systematic risk.[5] While Seqwater's unique regulatory arrangements may suggest that it has greater long term regulatory risk than urban water networks (including bulk

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2 Lally, M. (26 February, 2004), *The cost of capital for regulated entities*, Report prepared for the Queensland Competition Authority, pp.80-84.

3 Residential demand for water has been found to be inelastic (-0.667) in the Brisbane Council region.

4 The "price path debt" refers to a $2.1 billion component of Seqwater's total debt of $9.4 billion (at 30 June 2016) that is earmarked for repayment over the period to 2028. The "price path" refers to a plan to gradually introduce uniform pricing of water among the council-based water distributor-retail businesses that purchase water from Seqwater. The "price path debt" that is being paid down represents under-recovery of revenues in previous periods, and this amount is added to required revenue based on the standard building blocks approach. If a "true-up" is required because actual revenues in the previous period fell short of expectations, this amount will be added to the separate "price path debt" component, and recovered over the period to 2028 in an NPV neutral manner.

5 Sam Peltzman, (1976), 'Toward a More General Theory of Regulation,' *Journal of Law and Economics*, Vol. 19, pp. 211-240. For empirical evidence supporting the "buffering hypothesis" see Rosenberg, B. and J. Guy (1976), 'Beta and Investment Fundamentals – II,' *Financial Analysts Journal*, Vol. 32, No. 4, pp.62-76; and Christoph Rothballer (2012), *Infrastructure Investment Characteristics: Risk, Regulation, and Inflation Hedging, Doctoral Thesis*, Technical University of Munich. We note that the term "buffering" relates to systematic risk. If under-recovered revenues are recovered in a later period this could actually increase the absolute volatility of an earnings stream.

water suppliers) in other states, we do not believe this would result in a materially higher asset beta. First, because all water businesses already have low income elasticity of demand (as discussed below), and secondly, because it is unlikely that such regulatory differences will result in asset betas differentials that can be observed empirically.

Tollroads are subject to competitive pressure from different routes and alternative transport modes. As a result, tollroads are typically not subject to periodic price review, and to the extent that they are price regulated, it is not by periodic resets based on efficient cost. Since their cash flows are not buffered by regulation like Seqwater's, other things being equal we would expect tollroads to be subject to greater systematic risk than Seqwater.

- Income elasticity of demand and the nature of the customer – The vast majority of Seqwater's demand is residential rather than industrial / commercial. Empirical evidence shows income inelastic (0.269) residential demand for water in Queensland, which implies low sensitivity to GDP shocks. This suggests relatively low systematic cash flow risk.

  Tollroad traffic is known for its greater sensitivity to the level of economic activity, which indicates a higher degree of systematic risk relative to Seqwater.

- Contract duration – While Seqwater has bulk water supply agreements with local councils under the Water Supply Code, these are not take-or-pay arrangements. Hence, these arrangements do not provide revenue protection from systematic or non-systematic demand shocks.

  Since tollroads do not have contracting arrangements with customers, contract duration is irrelevant to a consideration of the relative systematic risks of tollroads and Seqwater's bulk water supply.

- Pricing structure – Seqwater's pricing structure is fully volumetric, and therefore does not provide cushioning in the event of demand or supply shocks. However, as noted above, demand is generally resilient to GDP shocks.

  Tollroad prices are also volumetric, but as noted above, road traffic is relatively more sensitive to income shocks.

- Real options – As a regulated business, Seqwater cannot take advantage of real options to earn supernormal profits via expansion of its scope of operations or geographic reach. Organic expansion is covered by the same regulatory approach.

  Real options are likely to have relatively greater impact on tollroad operators, who can expand operations and not be constrained in the way that Seqwater's prices are constrained by periodic regulatory reviews.

- Operating leverage –We don't have the historical information to benchmark our preferred measure of operating leverage (the sensitivity of EBIT to revenue changes). However, an alternative (and complementary) measure is the ratio of operating expenditure to total assets. On this measure, Seqwater's 2016 Annual Report data indicate that Seqwater has low operating leverage; however, we believe that operating leverage is relatively unimportant to beta for regulated utilities.

There is relatively greater scope for the EBIT of tollroad operators to respond to income levels; however, tollroads have low operating costs relative to asset value, which would reduce the systematic risk impact of operating leverage for tollroads.

- Market weight – The market weight of the comparator businesses is potentially important, since a firm that comprises a material share of the total market against which beta is estimated would influence the benchmark itself, making that estimate misleading. None of the 12 water comparators we have relied upon is a material proportion of their respective markets (US S&P500 and UK FTSE), which eliminates market weight as a potential factor.

  None of the 5 comparator businesses in the mature tollroads comparator group has market values that are a material proportion of their respective market benchmarks.

- Stranding risk – Seqwater supplies an essential, renewable resource with inelastic demand. Furthermore, the Queensland Government's policy over the last 10 years has ruled out the possibility of optimisation of any of Seqwater's assets. Therefore, we do not consider there is any material risk of asset stranding.

  Stranding risk is likely to be higher for tollroads, which are subject to the development of parallel tollroads. This could potentially increase systematic risk.

In summary, Seqwater is a regulated monopoly supplying an essential renewable resource to mainly residential customers with inelastic demand, and is subject to periodic regulatory review. All these factors indicate a relatively low asset beta, and a lower asset beta than tollroads, which do not have income inelastic demand, and are not subject to periodic cost-based regulation.

Asset beta estimation

Sample selection

Our first principles analysis indicates that for Seqwater, a regulated monopoly water business (albeit with some unique characteristics) the best available comparators are other regulated water businesses:

- Monopoly water supply – Water businesses supply the same or similar monopoly water supply service as Seqwater;

- Low income elasticity of demand – Other water businesses have a similarly low income elasticity of demand for the service, which implies a low asset beta, other things being equal;

- Cost-based regulation - Like Seqwater, stock market listed water businesses are subject to similar, albeit not identical, periodic cost-based regulation, and while Seqwater may have marginally greater regulatory risk than most regulated urban water supply businesses, we do not believe this would result in a materially higher degree of systematic risk relative to other regulated water businesses;[6] and

[6] All the water businesses in the comparator group are subject to cost-based regulation. The UK businesses are subject to a revenue-cap, while most of the US businesses are subject to rate-of-return regulation (only a few having "de-coupling", which is a form of revenue-cap).

- Similar operating characteristics and stranding risk – Water business comparators have similarly low operating leverage and stranding risk as Seqwater.

Using Bloomberg's BICS feature, we selected a comparator group of listed businesses with water transmission / distribution activities by searching among businesses in Australia, the UK, New Zealand, Canada and the US, which had a market capitalisation in excess of USD200 million. We confined the search to English speaking countries that are likely to have closer market and institutional features. Businesses above a threshold USD200 million in capitalisation were selected since smaller businesses are more likely to be affected by infrequent trading of stock, which may distort beta estimates. This resulted in the selection of a comparator group of 9 US and 3 UK share market listed businesses, which is a reasonable sized sample for beta estimation.[7]

In the same way, we searched the Bloomberg BICS database for listed businesses with mature tollroad operations, and found 5 businesses that met our search criteria.

Methodology

We downloaded raw Bloomberg betas for the period July 2007 to June 2017, as we consider that a 10-year beta estimate is most likely to provide stable estimates of the forward looking beta. However, rolling 5-year beta estimates were also downloaded for comparison. Consistent with the QCA's preferred approach, we de-levered the raw betas using the Conine formula. While in the past we have only relied on monthly return interval estimates of beta, a number of regulators now rely on both monthly and weekly return interval estimates.[8] There is a debate among financial economists about the relative merits of less frequent data (e.g. monthly or quarterly) and more frequent data (e.g. weekly or daily). Higher frequency data provides more observations and narrower confidence intervals, but may have less "opacity" (i.e. information relevant to systematic risk is not incorporated).[9] This suggests that there is a trade-off between greater precision and more bias (weekly return interval estimates), and lower precision but less bias (monthly return interval estimates). Without data that could inform an alternative weighting approach, we have calculated the average of monthly and weekly interval return data.

Asset beta estimates

Our findings are summarised in Figure ES.1 below. The average 10-year beta using monthly frequency data was 0.33, while the weekly frequency data derived an estimate of 0.50. The average of monthly and weekly data for the 10-year period was **0.41.** In Figure ES.1 the paths of the rolling 5 year monthly and weekly asset beta estimates vary considerably over time; however, the average of

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7 We note that the Australian Energy Regulator (AER) has previously relied on a sample of 9 comparator businesses, where a maximum of only 5 or 6 were listed at the same time.

8 Regulators that currently have regard to both monthly and weekly return interval data include the Australian Energy Regulator (AER), the Economic Regulation Authority of Western Australia (ERAWA) and the New Zealand Commerce Commission (NZCC).

9 For example, Olan T. Henry (April, 2014), *Estimating β: An update*, University of Liverpool Management School, advocates higher frequency data. A study by Gilbert, T., Hrdlicka, C., Kalodimos, J. and Siegel, S. (2014), 'Daily Data is Bad for Beta: Opacity and Frequency-Dependent Betas,' *Review of Asset Pricing Studies*, Vol. 4 (1), pp.78-117, suggests that higher frequency asset beta estimates (daily and weekly) are biased, and advocated the use of monthly and quarterly data for beta estimation.

the rolling 5 year monthly and weekly estimates is also close to 0.41. Based on these findings we consider 0.41 to be our best estimate of Seqwater's asset beta.

Figure ES.1: Median 10-year, and rolling 5-year asset betas to June 2017 using weekly and monthly data

Source: Bloomberg and Incenta analysis

We have adopted the asset beta estimate for mature tollroads as the upper bound estimate of Seqwater's asset beta, since our first principles analysis indicates that tollroads should have relatively greater systematic risk. Applying the same method as for regulated water businesses, our estimate of the asset beta of mature tollroads is **0.47**.[10]

Benchmark capital structure

Seqwater proposed a benchmark gearing level of 60 per cent based on regulatory precedents in other Australian states. The only exception is the 50 per cent gearing adopted by the QCA in relation to the Gladstone Area Water Board (GAWB), which was due to its concentrated industrial demand component distinguishing it from other urban water networks. We reviewed the empirical evidence on regulated Australian energy businesses that lies behind the adoption of a benchmark gearing level of 60 per cent. We also reviewed more recent evidence for the gearing of the remaining listed Australian energy utilities and found it to indicate gearing of approximately 60 per cent over the last 10 years. We found that the US water businesses in our comparator group sample have a lower level of gearing compared with Australian energy businesses, although the UK comparators (50 per cent gearing) were

[10] That is, we have taken the average of the weekly interval asset beta estimate of 0.44, and the monthly interval estimate of 0.50.

closer to the predominant Australian regulatory gearing benchmark. On balance, we agree that a 60 per cent gearing level is appropriate for Seqwater.

Equity beta

Applying the Conine formula with a debt beta assumption of 0.12 and gamma assumption of 0.46 to re-lever our asset beta estimate of 0.41 to our recommended benchmark level of 60 per cent gearing, results in a best estimate of **0.77** for the equity beta. This is the same as the benchmark equity beta proposed by Seqwater based on a debt beta of 0.11 and gamma of 0.47. The upper bound of our estimate of the equity beta is determined by our estimate of the tollroads asset beta of 0.47. At a gearing level of 60 per cent, this implies an upper bound equity beta of **0.91**.

2. Terms of Reference and outline of report

2.1 Background

On 31 May 2017, the QCA received from the Treasurer and Minister for Trade and Investment, a referral notice under section 23 of the Queensland Competition Authority Act 1997 (QCA Act), to conduct an investigation into the bulk water prices for Seqwater. The objective of the investigation is to recommend bulk water prices for the period 1 July 2018 to 30 June 2021 (the regulatory period) for the following local council areas: Brisbane, Gold Coast, Ipswich, Lockyer Valley, Logan, Moreton Bay, Noosa, Redland, Scenic Rim, Somerset and Sunshine Coast. The QCA's investigation includes consideration of whether the WACC and the associated parameters proposed by Seqwater are reasonable for the period covered by the regulatory period. The referral notice asks the QCA to recommend prices that are, among other matters, consistent with a benchmark rate of return (WACC) where the cost of equity is determined by the QCA for the equity component, and the cost of debt will be provided by the Queensland Treasury Corporation (QTC) for the debt component.

2.2 Terms of Reference

The QCA's Terms of Reference require Incenta to provide advice that will inform and assist its determination of appropriate values for a number of firm-specific WACC parameters. The Draft Terms of Reference provided to us set out the following key elements of the consultancy:

1. Asset beta – assess Seqwater's submission and supporting documentation and provide an estimate of Seqwater's benchmark asset beta for the regulatory period on the basis of a first principles and empirical analysis of its systematic risk.

2. Benchmark capital structure – assess an appropriate benchmark capital structure for Seqwater, considering Seqwater's total risk (systematic and non-systematic) in comparison to the risks of other relevant businesses in Australia and other jurisdictions (as appropriate), and the extent to which the regulatory arrangements (treatment of the regulatory asset base) affect Seqwater's total risk.

3. Equity beta – recommend an appropriate value for the benchmark equity beta to apply to Seqwater for the regulatory period, on the basis of the recommended estimates for the benchmark asset beta and capital structure, and any other factors considered relevant (i.e. including the QCA's standard approach to levering betas and estimates of gamma and the debt beta).

In addition, we were asked to advise on a range for the estimated beta for Seqwater. We have advised on the upper bound by looking at another sector, tollroads, that has similar characteristics to the water sector on a number of indicators, but is expected to face higher systematic risk than Seqwater. With reference to first principles characteristics, we could not identify another sector that we would expect to have lower systematic risk than Seqwater for the lower bound.[11]

[11] In previous reports the QCA we found the regulated energy networks and regulated water networks industries to have similar levels of systematic risk based on first principles analysis and empirical investigation. Other sectors that we considered included airports and container ports, but these were not pursued as we expected them to be subject to greater systematic risk than both Seqwater and tollroads.

2.3 Outline of report

The following chapters of our report are structured to respond to the QCA's Terms of Reference:

- Chapter 3 reviews Seqwater's submission and undertakes a first principles analysis of the systematic risk of a benchmark firm with Seqwater's characteristics.
- Chapter 4 reviews evidence and undertakes empirical analysis to provide estimates of the three key firm-specific WACC parameters: asset beta, benchmark capital structure, and equity beta.

3. First Principles analysis

3.1 Introduction

In this chapter we provide a first principles analysis of Seqwater's systematic risk by reviewing a standard set of factors potentially affecting systematic risk drawn from the economics and finance literature (and summarised by the QCA's adviser Dr Martin Lally (2004)).[12]

3.2 Seqwater's submission

Seqwater's submission was relatively succinct in relation to the benchmark weighted average cost of capital (WACC). It made the following comments on the question of beta:[13]

> *In its 2015 final report on pricing by the Gladstone Area Water Board, the QCA concluded that an asset beta of 0.4 for a generic water business was not controversial. This was the same figure that had been adopted for the previous regulatory period, it was submitted by GAWB itself, and it was consistent with expert advice on water businesses generally that was commissioned by the QCA. Indeed, the QCA's advisor, Incenta, also recommend an asset beta of 0.40 based on the most recently available evidence. We consider that an asset beta of 0.4 and gearing of 60% are both uncontroversial.*
>
> *The QCA's approach for converting these estimates into an equity beta is then formulaic, and produces an equity beta of 0.77. Seqwater submits that an equity beta of 0.77 be adopted.*

While Seqwater adopted the 0.4 asset beta that the QCA used in relation to the Gladstone Area Water Board (GAWB), it did not provide its own supporting first principles analysis to justify this proposed estimate. Our Terms of Reference require that we undertake a first principles analysis to inform our empirical analysis.

3.3 First Principles analysis

In our first principles analysis we have used the factors identified by Lally (2004), but have combined our consideration of them where we believe that separate treatment is inefficient or not as illuminating.

3.3.1 Market power and regulation

The link between market power, regulation and systematic risk

We consider the factors of market power and regulation to be logically linked, because only businesses with a material degree of market power should be subject to regulation. Given the fact that market power and regulation go hand in hand also means it is difficult to separate out their individual effects. The degree of market power is associated with the price elasticity of demand for its product or service, with inelastic demand for a firm's output indicating a degree of market power. By contrast, under perfect competition, the price elasticity of demand is infinite at the firm level.

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12 Lally, M. (26 February, 2004), *The cost of capital for regulated entities*, Report prepared for the Queensland Competition Authority, pp.80-84.

13 Seqwater (31 July, 2017), *2018 Bulk Water Price Review, Seqwater Submission, PART B*, p.58.

Lally's review of theory and empirical evidence concluded that there is an ambiguous relationship between market power and systematic risk. However, Lally considered the relationship between regulation and systematic risk to be settled. By constraining the market power of a monopoly service provider, regulation results in economic efficiency, and buffers the firm's cash flows. Consistent with Peltzman's (1976)[14] hypothesis that regulatory buffering of a firm's cash flows will reduce its asset beta, both Rosenberg and Guy (1976) and Rothballer (2012) have found that regulated industries have amongst the lowest betas after taking account of other firm-specific variables.[15]

As a monopoly provider of essential services in a defined geographical area, Seqwater has strong market power over its customer base. Within its geographic area, consumers have no choice but to rely on the water services of Seqwater. The price elasticity of demand for residential water consumption in the Brisbane Council's region in south east Queensland has been estimated by Hoffman, Higgs and Worthington (2005). Their study covered the period from 1998 to 2004 for 53 Brisbane postcode areas, and concluded:[16]

> *The price elasticity of demand is -0.667 (inelastic) indicating that a ten percent increase in the price of water is associated with a 6.67 percent decrease in the quantity demanded.*

Seqwater's regulatory framework

Seqwater's regulatory framework is not standard. Seqwater's prices are subject to Ministerial oversight, which involves price recommendations by the QCA when asked by the Minister.

- In accordance with the last referral notice, in 2015 the QCA recommended prices for Seqwater for the period 2015-16, 2016-17 and 2017-18; and
- Most recently the Minister has asked the QCA to recommend prices for Seqwater for the period 2018-19, 2019-20 and 2020-21.

Under the terms of the referral, the QCA has been asked to recommend prices which allow Seqwater sufficient revenue to recover prudent and efficient costs incurred in the provision of bulk water and to repay "price path debt". The "price path debt" is a progam outside of the building blocks approach, which has been established to reduce Seqwater's current relatively large debt burden by $2.1 billion (as at 30 June 2016) over the period to 2028.[17] We expect that repayment of the price path debt will move Seqwater's gearing level closer to a gearing level of 60 per cent over the period to 2028.[18,19,20]

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14 Sam Peltzman, (1976), 'Toward a More General Theory of Regulation,' *Journal of Law and Economics*, Vol. 19, pp. 211-240.

15 See Rosenberg, B. and J. Guy (1976), 'Beta and Investment Fundamentals – II,' *Financial Analysts Journal*, Vol. 32, No. 4, pp.62-76; and Christoph Rothballer (2012), *Infrastructure Investment Characteristics: Risk, Regulation, and Inflation Hedging, Doctoral Thesis*, Technical University of Munich.

16 Hoffman, M., H. Higgs, and A.C. Worthington, (2005), "Modelling residential water demand with fixed volumetric charging in a large urban municipality: The case of Brisbane, Australia," *Faculty of Commerce – Papers (Archive), University of Brisbane*, p. 8.

17 Queensland Audit Office 2016, *Water: 2015–16 results of financial audits, Report 7: 2016–17*, December, p. 20.

18 As at 30 June, 2016, Seqwater's total debt was $9.4 billion, and the RAB was $8.6 billion.

19 Queensland Audit Office 2016, *Water: 2015–16 results of financial audits, Report 7: 2016–17*, December, p. 20.

20 QCA (March, 2015), *SEQ Bulk Water Price Path 2015-18*, p. 40.

That is, when determining the efficient revenue / price path, the QCA is required to apply the building blocks approach, and to provide additional revenue that will be used to repay the "price path debt". Other features of the regulatory arrangement include:

- The Minister's referral requires that "Forecast demand is to be provided by Seqwater … [with] … QCA oversight … to ensure forecasts are within the range (low-high) published in the SEQ water security program";

- For the current review the Minister has asked the QCA to apply a true-up of revenue through the price path debt, from 1 July 2014 to 30 June 2018, that allows Seqwater to recover costs in the event of volumes falling short of forecasts, or repay costs if volumes exceed forecasts. This implies an ad-hoc form of revenue-cap regulation (because there is no guarantee that this arrangement will continue);

- The Minister's current referral allows Seqwater to retain the benefit of lower operational costs if volumes fall short of forecasts; and

- The referral allows Seqwater to recover review event costs. These review events include emergency events, changes in law or government policy events, feedwater quality events, cost of debt events, and drought response measures taken in accordance with the Water Security Program, where the drought response costs are material and efficient.

The regulatory approach that is applied to Seqwater therefore buffers its cash flows in a way that reduces systematic risk. As noted by Binder and Norton (1999):[21]

> *However, in response to a shock today, the firm's profits may not be buffered until some future period because of frictions in the regulatory process, i.e., 'regulatory lag.' Regulatory lag should not pose a problem for tests with security price data, because if the regulator makes the change in security holder wealth smaller, in an efficient capital market investors will rationally use the information about the future action of the regulator in adjusting the security price today.*

These remarks are relevant to the current review, as the QCA has been asked to apply a true-up mechanism that will hold market value relatively constant even if the current revenue is higher / lower than forecast, because the effect of the future buffering of cash flows will be factored into the market's estimates.

Tollroads

Tollroads do not have Seqwater's market power, as there generally are alternative routes and transport modes that provide competition. As a result of the lack of market power, tollroads are not subject to periodic cost-based regulation like Seqwater. Instead, they are often provided with a CPI-based tariff that is not regularly tested against efficient costs.

[21] See John J. Binder and Seth W. Norton (1999), 'Regulation, Profit Variability and Beta", *Journal of Regulatory Economics*, Vol. 15, Issue 3, p. 250.

Conclusion

The QCA's role beyond the current review is uncertain, as it depends on whether a subsequent referral is received from the Minister. While Seqwater's price reviews are subject to the Minister's discretion, we believe it is likely that these reviews will be applied relatively regularly in order to ensure future water price stability, and repayment of the "price path debt" by 2028. As a consequence, we expect cash flows will be buffered in a way that will reduce systematic risk / beta. We do not expect Seqwater's non-standard regulatory arrangements to imply a materially higher asset beta than that of suitable comparator water businesses that have cost-based regulation applied (i.e. whether revenue-cap, price-cap or rate of return regulated). By contrast, tollroads have neither the market power nor the regulatory controls that are applied to Seqwater. On the basis of these characteristics we would expect that other things being equal, tollroads would be subject to higher systematic risk than Seqwater.

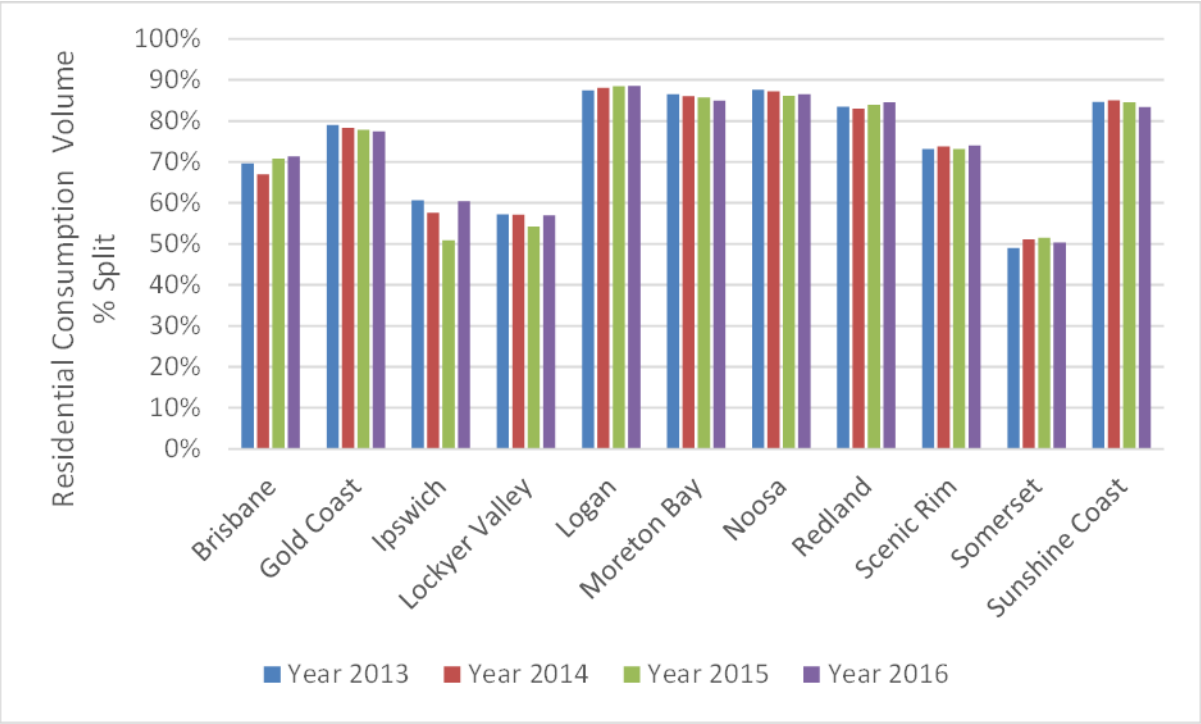
3.3.2 Income elasticity of demand and the nature of the customer

The income elasticity of demand, which indicates the sensitivity of the businesses' cash flows to GDP shocks, is influenced by the nature of the customer. As a customer, the government's demand for water services is likely to be relatively invariant to the state of the economic cycle, because the government activity is often insensitive to economic cycles.[22] This contributes to cash flows that do not systematically vary with the market, and therefore contributes to a lower asset beta. Low income elasticity of demand implies low sensitivity to GDP shocks, and therefore a lower asset beta. By their nature, water services are essential services with limited substitutes, and they can be expected to have a lower income elasticity of demand than luxury goods. For example, the income elasticity of demand for water services can be expected to be lower than for air travel. However, the industrial component of demand for water services will generally have greater sensitivity to GDP shocks, and this could potentially result in a higher asset beta for water services for the industrial demand component, all else being equal.

Seqwater has a mixture of industrial and commercial (together termed "non-residential") customers, and residential customers. Figure 3.1 below shows that the share of residential customer demand relative to total water demand is relatively high, averaging 70 to 85 per cent in the major urban council areas of Brisbane, Gold Coast, Moreton Bay and Sunshine Coast. In the 2016/17 financial year these four council areas accounted for 80 per cent of Seqwater's total water demand.

[22] For example, the water demand at government schools or hospitals is unlikely to be affected by the state of the economic cycle.

Figure 3.1: Seqwater: historical demand split by residential and non-residential



Source: Seqwater

From first principles, we would expect the variability of domestic water consumption to be materially influenced by weather patterns rather than economic factors. The income elasticity of demand for residential water consumption in the Brisbane Council region in south east Queensland has been estimated in the Hoffman, Higgs and Worthington (2005) study mentioned above. During their study period (1998 to 2004) they found that for residential water consumption in the Brisbane region:[23]

> *The income elasticity of 0.269 (inelastic) suggests that a ten percent increase in income is associated with a 2.69 percent increase in the quantity of water demanded.*

This is a relatively low level of responsiveness in water usage to changes in income. In the literature, Hoffman, Higgs and Worthington (2005) found similar income inelastic estimates for water demand (in the range of 0.00 to 0.46).[24]

From first principles, we should also expect residential electricity demand to be inelastic with respect to income. A recent study by Rai, Reedman and Graham (2014) estimated price and income elasticities for every state in Australia for two periods, the latter being for 2003/04 to 2010/11, and found strong evidence for a structural break in the data post 2003/04 period, with each state's price

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23 Hoffman, M., H. Higgs, and A.C. Worthington, (2005), p. 8.

24 Garcia, S. and A. Renaud (2003), "Estimating the benefits of efficient water pricing in France", Journal of Resource and Energy Economics, Vol. 26, pp. 1-25, found an income elasticity of demand of zero. Agthe, D. & Billings, R. (1987) "Equity, Price Elasticity, and Household Income Under Increasing Block Rates for Water" *American Journal of Economics & Sociology*, vol. 46, issue 3, pp. 273-286, calculated an income elasticity of 0.46.

and income elasticity of demand being lower during the later period. In the more recent period they found the income elasticity of demand for retail electricity in Queensland to be 0.457, which is slightly less income inelastic than what Hoffman, Higgs and Worthington (2005) found for Brisbane's retail water consumption.[25] This implies that other things being equal, we should expect the cash flow beta component of Seqwater's systematic risk to be similar to that of electricity distribution businesses with predominantly domestic consumption.

Tollroads

Much of the traffic on tollroads cannot be considered to be of an essential nature, particularly the component relating to leisure activities. We would therefore expect tollroad traffic to be sensitive to the state of the economy and levels of income. This has been widely recognised in the economics literature. For example, a World Bank Institute study concluded that:[26]

> *Even with the effects of toll levels held constant, traffic volumes are sensitive to income and economic growth. The failure to recognize this may be one of the main reasons that so many toll road projects have failed or ended in bitter renegotiations. Motorization and vehicle- kilometers travelled tend to increase faster than income levels. This high income elasticity, especially for leisure trips, makes toll roads especially sensitive to macroeconomic conditions.*

Conclusion on income elasticity of demand

In summary, with respect to income inelastic demand, we would expect the revenues (and returns) of a regulated water business like Seqwater (which has a dominant domestic water consumption component) to exhibit relatively little pro-cyclical demand fluctuation, which implies a relatively low asset beta. By contrast, with higher income elasticity of demand for its traffic we expect the revenues (and returns) of a tollroad operator to exhibit greater sensitivity to the state of the economy.

3.3.3 Contract duration

When a business has long term take-or-pay contracts with suppliers and customers, this will provide a degree of cash flow security as long as the counterparties remain solvent. This is because it would be unlikely for a large proportion of the contracts to fall due during the term of a cyclical downturn that could last one or two years. As a result, the cash flows of such a firm will be less pro-cyclical, and the asset beta could be expected to be lower, other things being equal.

Seqwater has bulk water supply agreements with its council water retailers through the Bulk Water Supply Code. However, while these are supply contracts rather than take-or-pay contracts,[27] we do not consider that this characteristic results in a material systematic risk to Seqwater since its customers are captured, and its services are essential. That is, in the event of an economic downturn, Seqwater's customers would have no option but to continue to require bulk water supplies, which can only be

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25 Alan Rai, Luke Reedman, and Paul Graham (February, 2014), *Price and income elasticities of residential electricity demand: the Australian evidence*, CSIRO Energy Flagship.

26 Estache, Antonio, and Gines de Rus (2000), *Privatization and Regulation of Transport Infrastructure – Guidelines for Policymakers and Regulators*, WBI Development Series, p. 239.

27 Bulk water customers are under no obligation to take any bulk water under the agreements.

obtained from Seqwater.[28] Moreover, there is a greater risk that the supply of water may not be available due to weather events, such as drought or floods; however, this risk is not likely to be systematic in nature.

Conclusion on contract duration

In summary, Seqwater's bulk water supply contracts are not expected to result in a material impact on its systematic risk. Since tollroads do not have contracts with customers at all, contracting is not a differentiating systematic factor between them and Seqwater.

3.3.4 Pricing structure

A bulk water pricing formula with a fixed and variable component could reduce the short term revenue impact of a fall in demand, regardless of whether it is caused by climate or the state of the economy. Since the fixed component would need to be paid irrespective of usage, to the extent that the bulk water demand was systematic in nature, application of such a formula would reduce the level of systematic risk. In accordance with the last referral notice, the QCA's SEQ bulk water price path review (2015) recommended a purely volumetric price path over the 2015-18 period, which was part of a 10-year price path. The current referral notice also asked the QCA to recommend prices for the 2018-21 period that are volumetric only. Since bulk water prices are volumetric, with no fixed rate component, this exposes Seqwater to fluctuations in demand.[29][30] As noted above, however, we would not in any event expect the volumes of water consumed by Seqwater's customers to co-vary materially with the state of the economy or market.

Conclusion on pricing structure

In summary, while Seqwater's pricing structure is volumetric, we would not expect this to have a material influence on its level of systematic risk. Tollroads also price on a volumetric basis, which implies that pricing structure is not a differentiating systematic factor between them and Seqwater.

3.3.5 Real options

Most businesses have the option to introduce new products and expand the geographic scope of their operations. These options will increase sensitivity of cash flows to real GNP shocks.[31]

Seqwater

As a business subject to periodic regulatory review by the QCA, Seqwater does not possess the option to expand operations and increase its geographic scope as, by definition, it is the owner and operator of bulk water services in a defined region of south east Queensland. In these circumstances, Seqwater's growth is constrained to the volume of water consumed in its geographic region, and since

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28 In addition, we note that bulk water supply agreements between Seqwater and its bulk water customers (local government owned retailers) are determined by the Queensland Government under section 360G of the Water Act 2000.

29 QCA (March, 2015), *SEQ Bulk Water Price Path 2015-18.*

30 A major focus of the price review was to commence a process of alignment of bulk water charges in the 11 council areas that Seqwater serves.

31 See Chung, K. and C. Chareonwong (1991), 'Investment Options, Assets in Place and the Risk of Stocks,' *Financial Management*, Vol. 20, pp. 21-33.

operations are likely to continue to be subject to periodic review by the QCA, its ability to abuse its monopoly position is constrained. If the scale of Seqwater's operations increases through demand growth and concomitant capital expenditure, the larger operation would be likely to be subject to the same cost-based regulatory review as the current activities, which would constrain any impact on beta. To summarise, the growth options referred to in the literature are unlikely to materially impact Seqwater's asset beta.

Tollroads

Tollroads are not constrained in the same way as Seqwater. If a tollroad expands its current operation (e.g. by adding more lanes) the cash flows from the expanded operation will not be subject to periodic reviews that apply cost-based regulation. In contrast to Seqwater, real options are more likely to impact the systematic risk of tollroads.

Conclusion on tollroads

Real options are likely to impact on the systematic risk of tollroads, but are unlikely to affect the systematic risk of Seqwater due to its regulatory framework. Hence, the existence of real options suggest higher systematic risk for tollroads relative to Seqwater, other things being equal.

3.3.6 Operating leverage

Lally (2004) considered that "firms with greater operating leverage (higher fixed operating costs to total operating costs) should have greater sensitivity to real GNP shocks because their cash flows will be more sensitive to own demand, and hence to real GNP shocks."[32] As noted above, we believe that businesses with largely residential demand for essential services subject to cost-based regulation will not demonstrate much systematic cash flow volatility.

The most common formula used to reflect operating leverage is:

$$Degree\ of\ Operating\ Leverage = \frac{\%\Delta EBIT}{\%\Delta Q}$$

Where, $\Delta EBIT$ is the change in Operating Income Before Tax, and ΔQ is the change in quantity sold. We could empirically estimate the relationship shown above by estimating the γ_1 coefficient in the following regression:[33]

$$Ln\ EBIT\ =\ \gamma_0\ +\ \gamma_1\ Ln\ Sales\ +\ \mu$$

Where *LnEBIT* is the natural logarithm of Earnings Before Interest and Taxes, and *LnSales* is the natural logarithm of sales revenue. However, Seqwater does not have enough operational history to undertake such an estimate. Instead, we have measured the ratio of operating costs to assets (opex/assets), which is an alternative indicator of operating leverage.[34]

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32 Lally, M (26 February, 2004), p. 83.

33 See, for example, Xue Zhang, (15 August, 2012), *The Role of Operating Leverage in Asset Pricing*, Master Thesis in Finance, Tilburg University.

34 Bloomberg codes applied to obtain these data were: Total Assets (BS_TOT_ASSET), Operating expenditure (IS_OPERATING_EXPN). Years with missing data were removed.

Operating leverage: Seqwater vs tollroads and other water businesses

The results in Table 3.3 below show that Seqwater's operating leverage measured by opex/assets is well below the median of the water sample, and is lower than observed for any firm in the water or tollroads samples. The opex/assets ratio for the regulated water business comparator group had a median value of 0.13, while the median value for tollroads was 0.12. The opex/assets ratio observed for Seqwater in 2016 (based on the Annual Report) was only 0.05, indicating that the scope for operating leverage to have an impact on the valuation of Seqwater (hence beta) is limited relative to the water comparator group.[35]

Table 3.3: Operating leverage (opex/assets) – median values, 2000-2016

	Number of firms	Opex / Assets
Seqwater (2016)	1	0.05
Regulated water comparators (2000-2016)	12	0.13
Tollroads (2000-2016)	6	0.12

Source: Bloomberg, Seqwater Annual Report (2015-16), and Incenta analysis

Conclusion on operating leverage

Whilst on this measure Seqwater's operating leverage is shown to be lower than that of the water and tollroads comparator groups, we do not consider this will have a material effect on the relative systematic risk of Seqwater, or on the relative systematic risk of Seqwater and the comparator group. Both Seqwater and the water industry comparator group have cash flows that are not highly systematically volatile (i.e. are more likely to be affected by weather patterns that are non-systematic in nature). In order to exert an influence on beta, operating leverage must translate into disproportionate *systematic* volatility in earnings.

3.3.7 Market weight

Lally (2004) considered that when the market weight of an industry is a large proportion of the market that beta is estimated against, the resulting beta estimate will be materially drawn to a value of unity, "even for a market weight as low as 5%."[36] We do not consider this to be an issue for the beta estimates we have undertaken, as the sample firms are not a material proportion of the relevant market indices.[37]

3.3.8 Stranding risk

Most sources of stranding risk relate to political, competitive, or technological changes, and are therefore non-systematic in nature.[38] However, stranding risk could potentially influence asset beta if a fall in real GDP results in reduced demand for the product or service that would increase the chance of future operations becoming unprofitable, which would result in business closure. However, bulk water services supplied by Seqwater are essential services that are renewable in nature, and we have

35 Selection criteria for the water and tollroads comparator groups are discussed in chapter 4 below.
36 Lally, M (26 February, 2004), p. 84.
37 These are the S&P500 Index (US), FTSE Index (UK), IBEX Index (Spain), FTSEMIB (Italy), and AS51 Index (Australia).
38 Lally (2004) did not consider stranding risk as a factor influencing beta.

seen that this demand is income inelastic. Furthermore, the Queensland government's policy position over the past 10 years has been that Seqwater's RAB cannot be optimised. Based on these observations, we consider there to be no material stranding risk facing Seqwater.

3.3.9 Conclusion based on First Principles analysis

Our first principles analysis of Seqwater's characteristics leads us to conclude that it is likely to have relatively low systematic risk, since it:

- Is a monopoly service provider with a 'captured' customer base;
- Experiences resilient demand for its services that is also income inelastic and, while fluctuating with weather induced events, will result in low sensitivity of demand / revenue to GDP shocks; and
- Is subject to a cost-based regulatory framework that, subject to referrals from the Minister, periodically reviews Seqwater's performance against efficient benchmarks, and constrains its ability to abuse its market power.

Our first principles analysis has also shown that the tollroads industry has characteristics likely to result in higher systematic risk relative to Seqwater, as it:

- Faces competition from alternative routes and/or transport modes;
- Has a higher income elasticity of demand, which makes cash flows sensitive to the economic cycle; and
- Lacks periodic cost-based regulation that buffers cash flows from any systematic movements relative to the economic cycle.

4. Asset beta, benchmark capital structure and equity beta

4.1 Introduction

In this chapter we derive estimates of the asset beta, benchmark capital structure and equity beta appropriate to Seqwater, and provide our best estimates of these linked parameters. We first derive a best estimate of the Conine asset beta of Seqwater based on a sample of internationally listed regulated water businesses, which we consider to be 0.41. Next, we assess Seqwater's characteristics and regulatory precedents to derive an estimated benchmark capital structure of 60 per cent debt relative to the Regulated Asset Base (RAB).

4.2 Asset beta

4.2.1 Selection of comparator sample

Conclusions based on first principles analysis

Our first principles analysis has shown that regulated water businesses are appropriate systematic risk comparators for Seqwater, and that tollroads can be expected to have a relatively higher systematic risk than Seqwater:

- Monopoly water supply – Water businesses supply water services to a captured customer base, as does Seqwater. By contrast, tollroads are subject to competition.

- Cost-based regulation - Like Seqwater, stock market listed water businesses are subject to similar, albeit not identical, periodic cost-based regulation, and while Seqwater may have marginally greater regulatory risk than most regulated urban water supply businesses, we do not believe this would result in a materially higher degree of systematic risk relative to other regulated water businesses.[39] Tollroads are generally not subject to periodic cost-based resets.

- Low income elasticity of demand – Other water businesses have a similarly low income elasticity of demand for the service, which implies a low asset beta, other things being equal. On the other hand, the income elasticity of demand is higher for tollroad customers.

- Similar operating characteristics and stranding risk – Water business comparators have similarly low operating leverage and stranding risk as Seqwater. While tollroads have similar low operating leverage to Seqwater, they have higher stranding risk.

Seqwater is not a stock market listed business, but even if it were we would refer to a broader sample of comparator water businesses. While there are no water businesses listed on the Australian stock market, there is a small number of regulated Australian energy businesses, and a much larger number of international regulated energy businesses, which would be likely to exhibit similar systematic risk characteristics to Seqwater. However, we considered that if an adequate number of regulated water businesses could be found, this would provide a reasonable estimate of the asset beta of Seqwater.

[39] All the water businesses in the comparator group are subject to cost-based regulation. The UK businesses are subject to a revenue-cap, while most of the US businesses are subject to rate-of-return regulation (only a few having "de-coupling", which is a form of revenue-cap).

Based on first principles, we also conclude that tollroads are expected to have higher systematic risk than Seqwater. Therefore, we expect tollroads to exhibit a higher asset beta than Seqwater.

Refinement of water and tollroad comparator samples

While a larger sample of comparator water businesses is desirable, if they are drawn from countries where market, institutional, and regulatory approaches are markedly different from those of Seqwater, the resulting estimates are likely to be less reliable than when these characteristics are closer. Many international markets are relatively immature, particularly in developing countries, where beta estimates may be distorted or unstable due to relatively fast economic growth and market volatility.

In our view, the closest comparator businesses are to be found among regulated water businesses in English speaking countries owing to market, institutional, and regulatory similarities. In these countries businesses are subject to periodic cost-based regulation where the form of price control is via revenue caps or the rate-of-return approach, and may or may not apply incentives for cost reductions and / or quality of service enhancements. We therefore employed Bloomberg's BICS feature to search for listed water utilities in Australia, New Zealand, Canada, the United States and the United Kingdom.

Among the countries considered, listed water industry comparators were found only in the US and UK. In the US, most water businesses are regulated via rate of return regulation, with a few businesses being subject to "decoupling", which is equivalent to revenue cap regulation. UK water businesses, on the other hand, are all subject to revenue cap regulation. While these regulatory approaches may result in some minor differences in systematic risk, it unlikely that they are of sufficient materiality to be empirically measurable.

Selected comparator groups

We found the following 12 comparator businesses, of which 9 are located in the United States:

- American States Water Co.
- American Water Works Co Inc
- Aqua America Inc
- Artesian Resources Corp
- California Water Services Group
- Connecticut Water Service Group
- Middlesex Water Co
- SJW Corp
- York Water Co

Three comparators are located in the United Kingdom:

- Pennon Group PLC[40]
- Severn Trent PLC
- United Utilities Group PLC

We undertook a similar search using Bloomberg's BICS industry classification, and reviewed 117 businesses that are described as Highway/Bridge/Tunnel Concessions (BICS code 161J121111). Only one of these businesses operating mature tollroads was from an English-speaking country,[41] which caused us to relax the country selection criterion to include non-English speaking Western European countries. We expect tollroad operations in these countries to be relatively mature, and for the market characteristics to be closest to those of English-speaking countries. The resulting comparator group included the following 5 businesses:

- Abertis Infraestructuras SA (Spain)
- ASTM SPA (Italy)
- Atlantia SPA (Italy)
- Societa Iniziative Autostradali e Servizi SpA (Italy)
- Transurban Group (Australia)

4.2.2 Methodology

This section describes the key methods we used to estimate the asset betas of the comparator groups identified above.

Bloomberg data

We have relied on raw Bloomberg equity betas, which we downloaded for the period July 2007 to June 2017 (10-year beta estimate). We also downloaded raw Bloomberg equity betas for overlapping periods of 5 years, and have used these to show 5-year rolling asset betas for periods ending June 2011 through June 2017.[42] As explained further below, we consider 10-year asset betas to provide a better indicator of the long run beta, but have shown the rolling 5–year betas in order to show how the shorter period beta estimates have moved over time.

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40 We note that if revenue shares were used as the selective criterion, Pennon Group PLC would be excluded since 58 per cent of its 2017 revenue was obtained from waste management and only 42 per cent from water and sewerage operations. However, approximately 72 per cent of Pennon's 2017 EBITDA (and assets) was derived from water and sewerage, which is the dominant influence on its share price and systematic risk.

41 That English-speaking country business was Transurban Group (TCL AU Equity) domiciled in Australia. Another Australian business, Macquarie Atlas Roads Group (MQA AU Equity) was considered to be too immature to include in the sample, as its first available financial data are for 2010 and it has experienced significant M&A activity in the last three years.

42 The five-year period ending June 2011 is the first for which all firms in the sample have 5-year asset beta estimates.

We de-levered the raw Bloomberg equity betas using the average annual net debt gearing (i.e. net debt to net debt plus market capitalisation) during the 10 or 5-year beta estimation period using the QCA's assumptions, which include application of the Conine re-levering formula. For de-levering purposes, rather than apply statutory tax rates, we used an estimate of long-term average effective tax rates (based on Bloomberg data) calculated over the previous 15-year period.

Return window and estimation period

Return window

In the past our preference has been to rely on monthly return interval data. However, in recent years a number of regulators in Australia and New Zealand have adopted the practice of relying on both weekly and monthly data for beta estimation, when previously they had also favoured monthly data only.

The case for a shorter return window

An adviser to the Australian Energy Regulator (AER), Professor Olan Henry, [43] recommended the use of weekly data, considering that monthly returns should continue to be used, but only as a check on the robustness of estimates. In practice, the AER has stated it has regard to both monthly and weekly estimates, but has not opined on whether one approach is superior to the other.[44] Relying on Henry's advice to the AER, the Economic Regulation Authority of Western Australia (ERAWA) applies weekly return intervals.[45] In New Zealand the Commerce Commission has adopted an approach of equally weighting monthly and weekly beta estimates for the two most recent 5-yearly periods.[46]

The case for a longer return window

Recent empirical evidence questions whether the use of weekly return intervals provides a net advantage. For example, it is often claimed that daily or weekly return intervals (high frequencies) offer lower standard errors (i.e. narrower confidence intervals) than the use of monthly interval returns (low frequencies). US evidence (Gilbert *et al.* (2014)) shows that differentials between betas estimated using low and high frequencies can be explained by proxies for firms' opacity.[47] "Opacity" (i.e. less, or less timely, information flows to the market) creates uncertainty about the transfer of news about systematic risks into a firm's share price, which reduces the speed with which beta can be affected by it. With higher frequency (e.g. days or weeks) the share prices, and therefore the beta of an opaque firm will not fully incorporate news.

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43 Olan T Henry (April, 2014), *Estimating β: An update*, University of Liverpool Management School; and Olan T Henry (23 April, 2009), *Estimating β*, Report for the Australian Regulator; and Olan T Henry (November, 2008), *Econometric advice and beta estimation*.

44 AER (October, 2013), *Better Regulation: Equity Beta Issues Paper*.

45 Economic Regulation Authority (December, 2013), *Explanatory Statement for the Rate of Return Guideline*, p. 189.

46 Commerce Commission New Zealand (16 June, 2016), *Input Methodologies review draft decisions, Topic paper 4: Cost of capital issues*, p.63. The Commerce Commission's method gives equal weight to four estimates: the most recent 5 year monthly and weekly beta estimates, and the previous 5 year monthly and weekly estimates.

47 Gilbert, T., Hrdlicka, C., Kalodimos, J. and Siegel, S. (2014), 'Daily Data is Bad for Beta: Opacity and Frequency-Dependent Betas,' *Review of Asset Pricing Studies*, Vol. 4 (1), pp.78-117.

At lower frequencies, such as months or quarters, it is more likely that all information relevant to systematic risk will be impounded into the firm's returns, and therefore, also in the beta estimates based on these returns. Gregory *et al.* (2016) undertook a similar analysis for the UK and other countries, and including several additional explanatory variables.[48] Their findings indicate that high frequency beta estimates are systematically lower than low frequency beta estimates, and that the differential can be "explained by factors that are known to vary with risk: opacity (as measured by abnormal accruals); size; illiquidity; and BE/ME."[49] This research therefore questions the recommendations of Henry, which favoured higher frequency beta estimates.

Conclusion on return window

In summary, there appears to be a trade-off between greater precision and more bias (weekly return interval estimates), and lower precision but less bias (monthly return interval estimates), which implies that caution should be exercised. While in some industries there is little difference between weekly and monthly beta estimates, in others the difference can be material, and the reasons for these differences are not well understood. Taking account of these trade-offs, we consider that the most appropriate approach to minimise estimation error is to place weight on both the weekly and monthly return interval estimates. We consider that an equally weighted average is the most appropriate course since we have no grounds for favouring one approach over the other (i.e. we have no data relating to the implicit trade-offs mentioned above) and estimates from both approaches contain relevant information.

Estimation period

The objective is to estimate the forward-looking asset beta, and our consistent view has been that a 10-year period is likely to provide a superior estimate. Shorter estimation periods can be influenced by aberrations such as the global financial crisis, which falls within our preferred 10-year estimation period. The adoption of 5-year estimation periods for regulatory purposes would, in our view, introduce unnecessary volatility that is not reflective of the forward-looking asset beta. Our 10-year monthly estimates of beta are based on 120 months of data up to 30 June, 2017, and 520 weeks of data for the same period. Our 5-year beta estimates are based on 60 months and 260 weeks of data respectively.

4.2.3 Asset beta estimates

Water industry comparators

The results of our monthly asset beta estimates for the water industry comparators are shown in Table 4.1 below. The average and median estimated asset beta is 0.33 using 10 years of data, with individual firm asset beta estimates ranging from 0.24 to 0.45. Using 5 years of data annual average (median) beta estimates range from 0.30 (0.30) for the year ending 2013 (2012), up to 0.41 (0.43) in 2015 (2017).

[48] Gregory, A., Hua, S. and Tharyan, R. (March 2016), *In Search of Beta*, Xfi Centre, University of Exeter Business School.

[49] Gregory, A., Hua, S. and Tharyan, R. (March 2016), p.21. Note that BE/ME refers to Book Equity / Market Equity.

Table 4.1: Water - individual firm asset betas to June 2017 using monthly data – 10 years and rolling 5 years

			Rolling 5 year asset betas (year ending 30 June)							10 year
Company name	Ticker	Country	2011	2012	2013	2014	2015	2016	2017	asset beta
American States Water Co	AWR US Equity	US	0.31	0.30	0.31	0.58	0.54	0.33	0.41	0.34
American Water Works co Inc	AWK US Equity	US	0.26	0.23	0.25	0.25	0.19	0.14	0.22	0.24
Aqua America Inc	WTR US Equity	US	0.20	0.19	0.16	0.37	0.39	0.33	0.44	0.24
Artesian Resources Corp	ARTNA US Equity	US	0.30	0.33	0.35	0.37	0.36	0.15	0.09	0.30
California Water Service Group	CWT US Equity	US	0.26	0.27	0.22	0.43	0.51	0.45	0.55	0.33
Connecticut Water Service Group	CTWS US Equity	US	0.36	0.36	0.36	0.44	0.42	0.20	0.09	0.32
Middlesex Water co	MSEX US Equity	US	0.34	0.37	0.36	0.50	0.53	0.43	0.34	0.38
SJW Corp	SJW US Equity	US	0.54	0.51	0.42	0.58	0.50	0.32	0.15	0.45
York Water Co	YORW US Equity	US	0.40	0.38	0.40	0.43	0.46	0.44	0.52	0.42
Pennon Group PLC	PNN LN Equity	UK	0.33	0.29	0.33	0.27	0.36	0.37	0.47	0.33
Severn Trent PLC	SVT LN Equity	UK	0.23	0.17	0.17	0.19	0.35	0.37	0.69	0.30
United Utilities Group PLC	UU/ LN Equity	UK	0.36	0.26	0.26	0.17	0.32	0.29	0.57	0.34
Average			**0.32**	**0.31**	**0.30**	**0.38**	**0.41**	**0.32**	**0.38**	**0.33**
Median			**0.32**	**0.30**	**0.32**	**0.40**	**0.41**	**0.33**	**0.43**	**0.33**

Source: Bloomberg and Incenta analysis

Table 4.2: Water - individual firm asset betas to June 2017 using weekly data – 10 years and rolling 5 years

			Rolling 5 year asset betas (year ending 30 June)							10 year
Company name	Ticker	Country	2011	2012	2013	2014	2015	2016	2017	asset beta
American States Water Co	AWR US Equity	US	0.66	0.59	0.61	0.53	0.46	0.47	0.57	0.62
American Water Works co Inc	AWK US Equity	US	0.34	0.34	0.35	0.40	0.37	0.31	0.30	0.36
Aqua America Inc	WTR US Equity	US	0.55	0.51	0.50	0.48	0.49	0.41	0.44	0.51
Artesian Resources Corp	ARTNA US Equity	US	0.28	0.29	0.32	0.34	0.35	0.34	0.43	0.32
California Water Service Group	CWT US Equity	US	0.55	0.48	0.47	0.49	0.45	0.46	0.50	0.51
Connecticut Water Service Group	CTWS US Equity	US	0.56	0.51	0.56	0.42	0.39	0.32	0.43	0.50
Middlesex Water co	MSEX US Equity	US	0.51	0.51	0.58	0.55	0.51	0.50	0.60	0.53
SJW Corp	SJW US Equity	US	0.89	0.78	0.72	0.62	0.53	0.55	0.57	0.76
York Water Co	YORW US Equity	US	0.47	0.47	0.50	0.57	0.57	0.55	0.74	0.52
Pennon Group PLC	PNN LN Equity	UK	0.46	0.43	0.44	0.35	0.38	0.40	0.48	0.45
Severn Trent PLC	SVT LN Equity	UK	0.46	0.43	0.43	0.33	0.40	0.40	0.50	0.45
United Utilities Group PLC	UU/ LN Equity	UK	0.45	0.40	0.37	0.27	0.35	0.34	0.41	0.40
Average			**0.51**	**0.48**	**0.49**	**0.45**	**0.44**	**0.42**	**0.50**	**0.49**
Median			**0.49**	**0.48**	**0.48**	**0.45**	**0.42**	**0.40**	**0.49**	**0.51**

Source: Bloomberg and Incenta analysis

Table 4.2 displays the results using weekly data. The average asset beta, at 0.49, is materially higher than the average estimate of 0.33 using monthly data. The individual firm weekly beta estimates range from 0.32 to 0.76, with the latter estimate being for SJW Corporation. While SJW Corporation is involved in property development, as well as provision of water utility services, the non-water activity is relatively minor.[50]

For the water industry there is a material difference between asset beta estimates depending on the frequency of returns. While Gregory *et al.* (2016) concluded that higher frequencies result in estimates that are systematically lower than low frequency estimates, this is not the case for the water

[50] Bloomberg records that the 2016 revenues were $333 million for water utility services (96 per cent of which were regulated) and $6.7 million for real estate activity.

industry. As discussed above, our approach is to average the monthly and weekly return interval (mean) estimates, which results in a 10-year beta estimate of 0.41. If the 10-year median estimates for monthly and weekly return intervals are averaged, the result is 0.42. These relationships are displayed in Table 4.1 below.

Figure 4.1: Water - average 10 year and rolling 5-year asset betas to June 2017 using weekly and monthly data

Source: Bloomberg and Incenta analysis

Figure 4.1 shows that the rolling 5-year monthly asset beta oscillates near the 10-year monthly data estimate of 0.33, while the rolling 5-year weekly asset beta oscillates near the 10-year weekly data estimate of 0.49. This is not surprising given that the rolling and 10-year period data are largely overlapping. The 10-year average of 0.41 appears to be reflective of the average of the rolling 5 year weekly and monthly averages.

Tollroads industry

Our asset beta estimates for mature tollroads are displayed in Tables 4.3 below. The results are consistent with the findings of Gregory *et al.* (2016), that weekly frequency beta estimates are generally lower than monthly frequency beta estimates. The 10-year asset beta estimate using monthly data is 0.50, while the 10-year weekly data estimate is 0.44. The average 10-year asset beta estimate is 0.47 (and taking median values is 0.49).

Table 4.3: Tollroads - individual firm asset betas to June 2017 using monthly and weekly data – 10 years and rolling 5 years

Company name	Ticker	Country	2011	2012	2013	2014	2015	2016	2017	asset beta
Monthly interval returns:										
Abertis Infraestructuras SA	ABE SM Equity	Spain	0.49	0.46	0.43	0.48	0.47	0.44	0.44	0.48
ASTM SPA	AT IM Equity	Italy	0.60	0.55	0.47	0.42	0.44	0.50	0.45	0.56
Atlantia SPA	ATL IM Equity	Italy	0.59	0.57	0.49	0.47	0.52	0.51	0.48	0.59
Societa Iniziative Autostradali e Servizi SpA	SIS IM Equity	Italy	0.50	0.49	0.45	0.46	0.50	0.56	0.55	0.54
Transurban Group	TCL AU Equity	Australia	0.36	0.28	0.18	0.17	0.17	0.19	0.34	0.32
Average			**0.51**	**0.47**	**0.40**	**0.40**	**0.42**	**0.44**	**0.45**	**0.50**
Median			**0.50**	**0.49**	**0.45**	**0.46**	**0.47**	**0.50**	**0.45**	**0.54**
Weekly interval returns:										
Abertis Infraestructuras SA	ABE SM Equity	Spain	0.50	0.49	0.46	0.49	0.50	0.49	0.46	0.49
ASTM SPA	AT IM Equity	Italy	0.43	0.45	0.41	0.40	0.39	0.41	0.34	0.42
Atlantia SPA	ATL IM Equity	Italy	0.47	0.50	0.47	0.52	0.55	0.56	0.50	0.51
Societa Iniziative Autostradali e Servizi SpA	SIS IM Equity	Italy	0.41	0.44	0.44	0.48	0.50	0.52	0.43	0.44
Transurban Group	TCL AU Equity	Australia	0.43	0.42	0.38	0.31	0.31	0.28	0.31	0.38
Average			**0.45**	**0.46**	**0.43**	**0.44**	**0.45**	**0.45**	**0.41**	**0.44**
Median			**0.43**	**0.45**	**0.44**	**0.48**	**0.50**	**0.49**	**0.43**	**0.44**

Source: Bloomberg and Incenta analysis

4.2.4 Conclusion on asset beta

Based on our preferred measure of the average of monthly and weekly interval estimates over a 10-year period, our best estimate of the regulated water industry asset beta is **0.41**. This is the long-run estimate of beta that we consider to be the best estimate of the forward-looking asset beta, and is also reflective of the average of rolling 5-year average beta estimates. The 5-year asset beta estimates for both weekly and monthly data have oscillated near the respective 10-year beta estimates. Following our first principles analysis, we have also estimated an upper bound to Seqwater's beta based on the asset beta for mature tollroads, which we estimate to be **0.47**.

4.3 Benchmark capital structure

In assessing the benchmark capital structure of Seqwater we have had regard to Seqwater's submission, the capital structures of comparator water businesses, regulatory practices and the data relied upon to justify those practices.

4.3.1 Seqwater's submission on benchmark capital structure

Seqwater's submission proposed a benchmark gearing level of 60 per cent, which it considered to be "appropriate for a benchmark efficient business providing the services performed by Seqwater. In support, Seqwater noted that:[51]

> *… a 60% gearing estimate has almost uniform support from Australian regulators of water businesses, and that the QCA has adopted 60% gearing for Seqwater in past decisions.*

By implication, we agree with Seqwater's non-reliance on its own actual capital structure, which for the 2016 year was 82 per cent based on balance sheet values, and more than 100 per cent based on

[51] Seqwater (31 July, 2017), *2018 Bulk Water Price Review – Seqwater Submission, Part B*, p. 55.

RAB. This would appear to be a non-commercial level of gearing that is not reflective benchmark gearing levels, as shown below.

4.3.1 Regulatory practice

In support of its statement about regulatory decisions for benchmark gearing of water businesses, the Seqwater submission provided a table showing 7 regulatory decisions since 2013, including decisions by the QCA in relation to Seqwater in 2013, and the Gladstone Area Water Board (GAWB), in 2015. It noted that 6 out of 7 decisions included a benchmark gearing level of 60 per cent, with the sole exception being the 50 per cent gearing applied to the GAWB, which was explained by "concentrated demand and weather risks" that do not have application to Seqwater. The Australian regulatory decisions are displayed in Table 4.4 below, which is drawn from Seqwater's Table 28. We agree with Seqwater's view that Australian regulatory precedent for water utilities has generally been 60 per cent.

We also agree with Seqwater's view that the circumstances applying to the GAWB do not apply to it. A large proportion of the latter business' demand is dependent on a few businesses, and it is dependent on one relatively narrow catchment area. By contrast, a much smaller proportion of Seqwater's ultimate demand is dependent on businesses, which are many and varied. In addition, Seqwater has the security afforded by a large number of dams as well as a desalination plant.

Table 4.4: Regulatory precedents for gearing

Regulator	Business	Year of decision	Gearing
IPART	Sydney Desalination Plant	2017	60%
ESC	Melbourne Water	2016	60%
IPART	Sydney Water	2016	60%
ESCOSA	SA Water	2016	60%
OTTER	TasWater	2015	60%
QCA	GAWB	2015	50%
QCA	Seqwater	2013	60%

Source: Seqwater (31 July, 2017), p. 55.

We note, however, that the empirical underpinning of the 60 per cent benchmark regulatory gearing that has been widely applied in the Australian water industry is drawn from the regulated Australian energy industry. There are currently only three regulated Australian energy businesses that are listed on the stock market. While the current gearing of these firms is below 60 per cent, this is due to a recent spike in share prices,[52] and their 10-year average gearing levels are closer to 60 per cent.

4.3.2 Evidence from water industry comparator businesses

Table 4.5 below shows the 5-year and 10-year average capital structures of our water industry comparator group. For the whole group the average gearing levels (net debt to net debt plus market

[52] See J.P. Morgan (27 July, 2016) *Australian Utilities – Regulated Utilities: Yielding cash but not value.* DUET was delisted during 2017.

equity) average 38 per cent over the 10 years to 2016, and 31 per cent in the last 5 years to 2016. The median values were even lower, at 34 per cent and 27 per cent respectively.

Over the last 10 years the average gearing level for the three UK water businesses in our comparator sample has been close to 50 per cent, which is closer to the widely adopted 60 per cent Australian regulatory benchmark for water businesses.

Table 4.5: Capital structure of water industry comparators (Net Debt / Net Debt plus Market Capitalisation), 2007 to 2016

			Gearing (Net Debt)	
Company name	Ticker	Country	5 year ave	10 year ave
American States Water Co	AWR US Equity	US	20%	27%
American Water Works co Inc	AWK US Equity	US	35%	47%
Aqua America Inc	WTR US Equity	US	26%	30%
Artesian Resources Corp	ARTNA US Equity	US	28%	40%
California Water Service Group	CWT US Equity	US	28%	32%
Connecticut Water Service Group	CTWS US Equity	US	27%	32%
Middlesex Water co	MSEX US Equity	US	18%	32%
SJW Corp	SJW US Equity	US	27%	36%
York Water Co	YORW US Equity	US	14%	26%
Pennon Group PLC	PNN LN Equity	UK	44%	45%
Severn Trent PLC	SVT LN Equity	UK	50%	52%
United Utilities Group PLC	UU/ LN Equity	UK	54%	53%
Average			**31%**	**38%**
Median			**27%**	**34%**
Average for UK water			**49%**	**50%**

Source: Bloomberg

4.3.3 Conclusion on benchmark capital structure

Seqwater's actual gearing level is not relevant when assessing the benchmark level of gearing. Seqwater's submission proposed a 60 per cent benchmark gearing level, which is consistent with Australian regulatory practice. We consider this benchmark to be appropriate for a benchmark regulated water business that has Seqwater's characteristics. While 60 per cent benchmark gearing is materially higher than the observed gearing of US water industry comparators, and 10 percentage points higher than observed among UK water industry comparators, it is consistent with observations for Australian regulated energy businesses. Our observations for the three remaining listed Australian regulated energy businesses indicates that while market gearing levels have recently dipped below 60 per cent due to spiking share prices, the 10 year average gearing level has continued to be close to 60 per cent.[53] We consider the gearing levels of UK water businesses to more instructive owing to more similarity between UK and Australian tax regimes and regulatory approaches. Taking account of the UK water evidence, and Australian energy industry evidence, our view is that a 60 per cent benchmark gearing assumption is appropriate for Seqwater, and is consistent with the majority of Australian regulatory precedent.

[53] The three surviving listed regulated energy businesses are: APA, AusNet Services and Spark Infrastructure Group.

4.4 Equity beta

Our best estimate of Seqwater's benchmark asset beta is 0.41. We use the Conine formula with a debt beta assumption of 0.12 and a gamma value of 0.46 to re-lever our asset beta estimate of 0.41 to our recommended benchmark level of 60 per cent gearing, which results in a best estimate of **0.77** for the equity beta. This is the same as the benchmark equity beta of 0.77 proposed by Seqwater. We estimate an upper bound equity beta of **0.91** for Seqwater (based on an estimated asset beta of 0.47 for mature tollroads).