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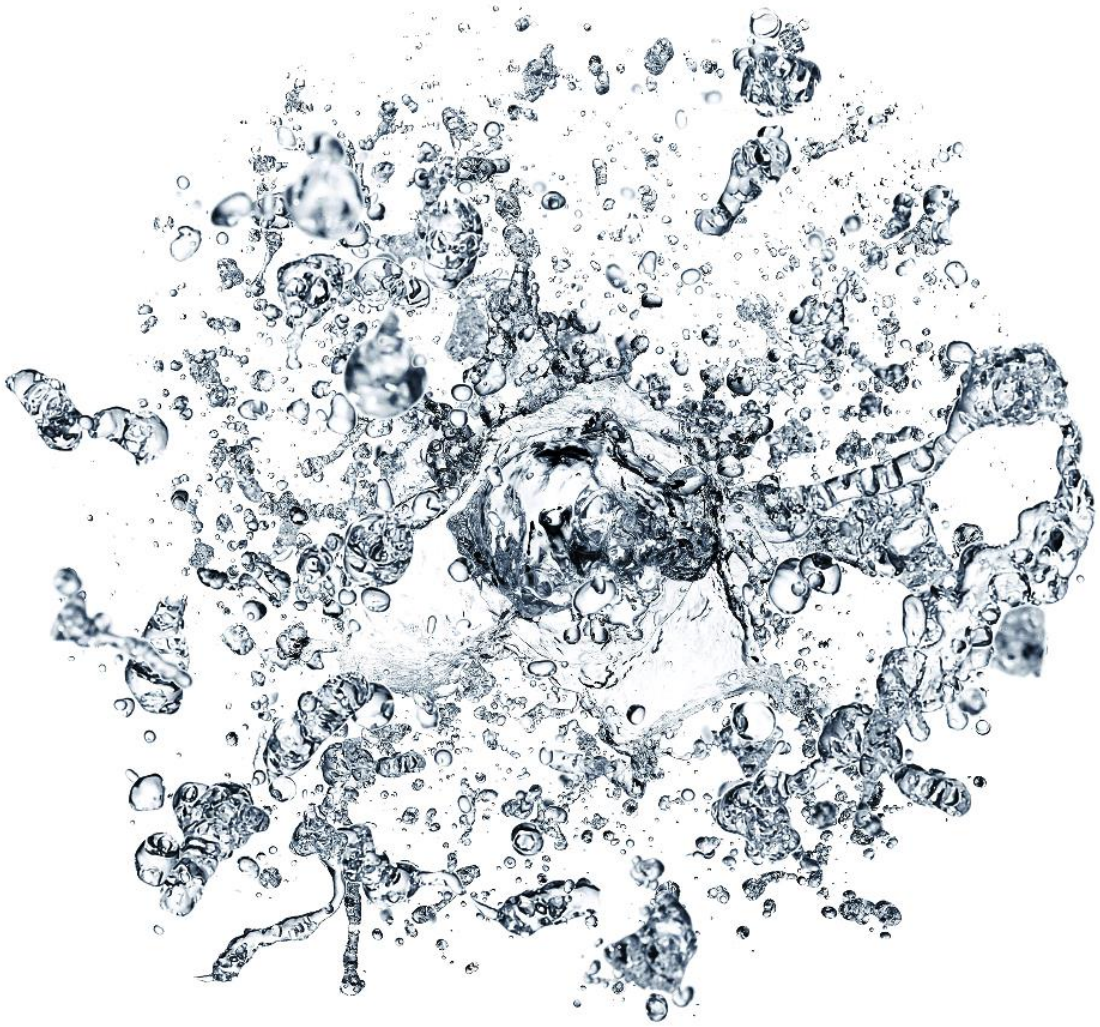


Expenditure review - Melbourne Water 2021 Price Submission

FINAL REPORT for the Essential Services Commission - Public

23 February 2021

Deloitte Access Economics

Contents

Glossary

Acronym	*Full name*
AAD	Average Annual Damages
AEP	Annual Exceedance Probability
BOD	Biological oxygen demand
BNI	Business Needs Identifier
CAGR	Compound annual growth rate
Capex	Capital expenditure
EPA	Environmental Protection Authority
ESC	Essential Services Commission
ETP	Eastern Treatment Plant
FBC	Functional Business Case
HBT	Health-based target
MW	Melbourne Water
Opex	Operating expenditure
PREMO	Performance, Risk, Engagement, Management and Outcomes
PS16	Pricing Submission 2016
PS21	Pricing Submission 2021
RP4	Regulatory Period 4
RP5	Regulatory Period 5
SDR	Standardised Death Rate
TKN	Total Kjeldahl nitrogen (TKN)
TSS	Total suspended solids
WDCC	Waterways and Drainage Customer Council
WHO	World Health Organisation
WIRO	Water Industry Regulatory Order
WSCC	Water and Sewerage Customer Council
WTP	Western Treatment Plant

Executive summary

About this report

The Essential Services Commission (ESC) is currently reviewing Melbourne Water's (MW) proposed services and prices for the regulatory period 1 July 2021 to 30 June 2026. This period is referred to in this document as 'the next regulatory period' or the 'fifth regulatory period' (RP5).

The ESC has engaged Deloitte Access Economic and Arup to review MW's operating and capex forecasts and to provide advice on whether it is consistent with the requirements of the regulatory framework.

In undertaking this review, our key responsibilities are to:

- assess the appropriateness of the expenditure forecasts in relation to the key objectives of the review
- provide advice to the ESC regarding the appropriateness of the forecasts, and
- where our advice indicates that proposed expenditure is not appropriate, propose a revised expenditure level.

Deloitte Access Economics and Arup have been asked to review the three major service areas provided by MW – bulk water, bulk sewerage and waterways and drainage.

As part of our review, the ESC also requested that Deloitte Access Economics undertake a detailed review of the assumptions and methodology applied by MW in developing its growth forecasts for the three areas, and comment on the implications of any findings for the proposed expenditure. This analysis is provided in Appendix A.

Operating expenditure

The key features of MW's operating expenditure (opex) forecast ($2020-21m) include:

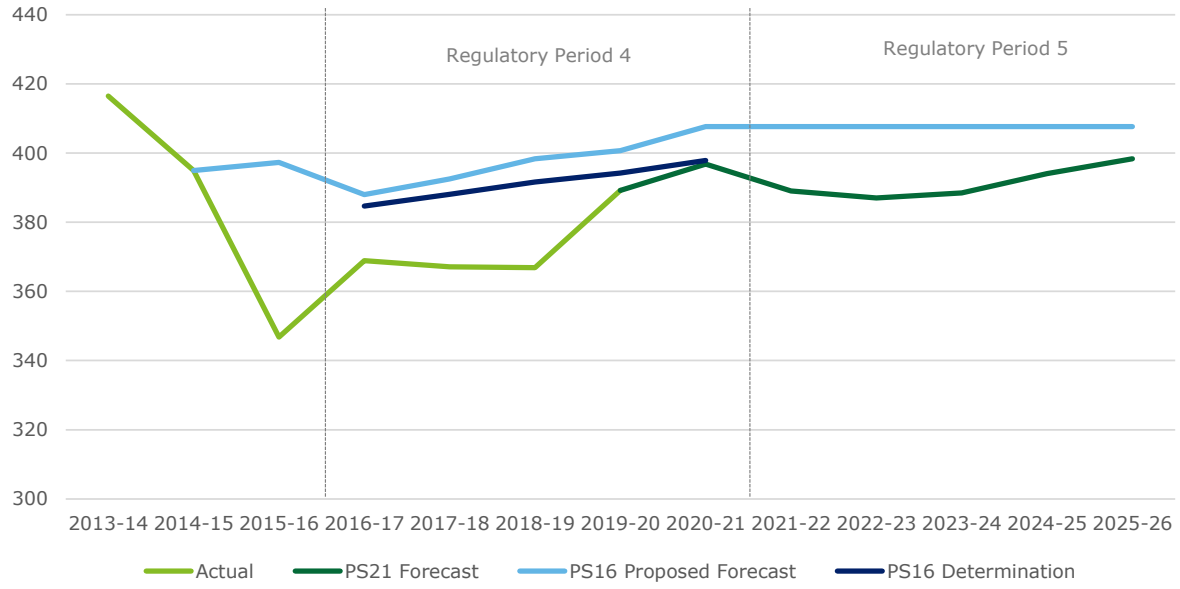
- baseline controllable opex in 2019-20 of $389.2m[1] (before adjustments), which is lower than that forecast in the 2016 price submission ($400.7m) and the 2016 price determination ($394.2m)
- a net growth-cost efficiency improvement rate of 0.05% per annum
- $230.1m of forecast additional expenditure in total over RP5 above the baseline, primarily reflecting energy costs (which MW removed from its baseline) and new waterways and drainage projects supported by customer willingness to pay studies[2]
- a total cumulative controllable opex of $1,956.9m over RP5.

Figure i shows MW's total controllable opex from 2013-14 to 2025-26, comparing actual and forecast expenditure to the PS16 proposal and final determination.

[1] Total baseline controllable opex is $1.93m higher than the figures presented in MW's original price submission, this is due to revisions provided during the review process to reflect the final statutory accounts for 2019-20. Revisions to base year expenditure were removed from the baseline forecast as adjustments, therefore there is no change in proposed forecast expenditure.

[2] Total adjustments are higher than proposed in MW's price submission due to revised energy forecast provided by MW during the review process. During the review process, MW revised their energy forecast by $7.54 million. The new value of the total controllable opex with revisions for energy is $154.8 million.

Figure i: Historical and forecast total controllable opex ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020). Notes:

1. Base year (2019-20) actual expenditure is slightly higher than the original price submission due to revisions provided by MW during the review process.
2. Includes revised energy forecast provided by MW during the review process.

We have recommended adjustments to forecast expenditure where we consider that insufficient information had been provided to support the proposed expenditure or where the expenditure was imprudent or inefficient. In total, we have **recommended a reduction of $41.8m** to MW's RP5 forecast controllable opex, representing 2.1% of proposed controllable expenditure. The reasons for these recommendations are outlined in Chapter 3.

Table i: MW forecast controllable opex and recommended adjustments ($2020-21m)

Opex item	Actual	Forecast RP5					
	Base year 2019-20	2021-22	2022-23	2023-24	2024-25	2025-26	Total
Proposed controllable opex[1]		**389.04**	**387.01**	**388.46**	**394.09**	**398.34**	**1956.95**
Recommended adjustments							
W&S base year adjustment	-1.95	-1.95	-1.94	-1.94	-1.94	-1.94	**-9.72**
Waterways base year adjustment	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	**-2.39**
Growth rate adjustment to baseline		-0.52	-1.03	-1.54	-2.05	-2.56	**-7.70**
Waterways and drainage service increase		-4.40	-4.40	-4.40	-4.40	-4.40	**-22.00**
Total recommended adjustments	**-2.43**	**-7.34**	**-7.85**	**-8.36**	**-8.87**	**-9.38**	**-41.81**
Recommended controllable opex		**381.70**	**379.16**	**380.10**	**385.22**	**388.96**	**1915.14**

Source: Deloitte Access Economics

Note: 1. Forecast proposed controllable opex includes a revised energy cost adjustment provided by MW during the review process. MW should clarify in its response to the ESC's Draft Decision whether it intends to recover this higher amount.

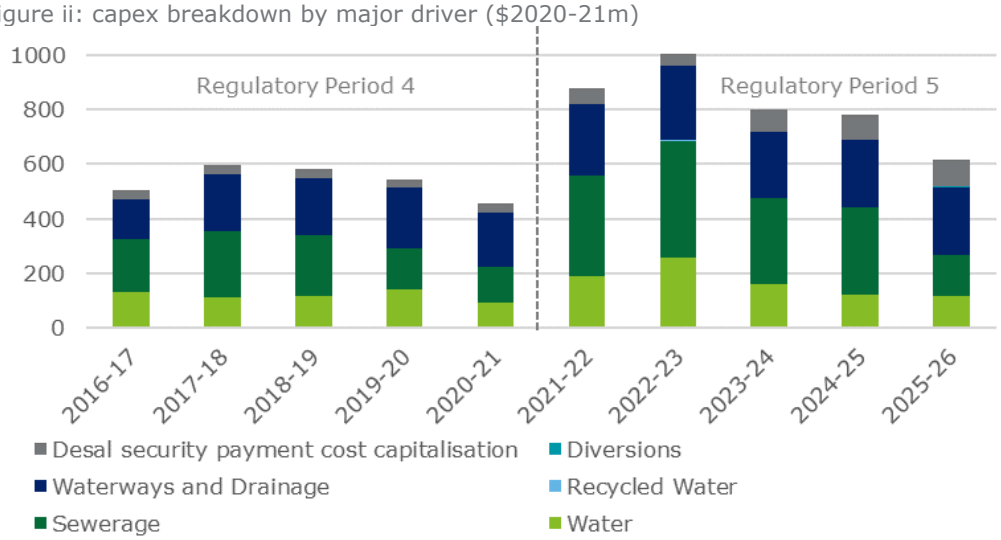
Capital expenditure

The key features of MW's capital expenditure (capex) forecast include:

- total capex forecast of $3,702.2m[3] over RP5
- expenditure forecast to peak in 2022-23, particularly due to the proposed Western Treatment Plant (WTP) 55E ASP Upgrade and Hobsons Bay Main (HBM) Yarra Crossing Duplication projects which will reach peak construction in that year.
- a 39% increase in capex compared to the previous regulatory period[4] (2016-17 to 2021-22, 'RP4') capex (using actuals for 2015-16 to 2019-20 and forecasts for 2020-21). This is primarily driven by increases in:
    - 'growth' capex in response to strong population growth over the past five years
    - 'renewals' capex to keep current assets fit-for-purpose as they age and deal with the challenges presented by climate change. The key 'renewals' project is a large atypical sewer main renewal project (Hobsons Bay Main Yarra Crossing Duplication).
    - 'improvement' capex to deliver higher levels of service in response to customer willingness to pay analysis.
- an additional desalination security payment capitalisation cost of $398.6m over RP5.

Figure ii below presents forecast capex from 2021-22 to 2025-26, split by major drivers. Sewerage projects comprise the most significant proportion of spend for all years except 2025-26 in which Waterways and Drainage is the major capex driver.

Figure ii: capex breakdown by major driver ($2020-21m)



Source: Actual and forecast is based on MW 2021 Price Review Model – ESC Reviewed (provided 24 December 2020)
*values for 2020-21 represent 'pre- populated' values using forecasts from the PS16 submission, MW forecast (at the time of the submission) capex of $663.0 (including desal security payment cost capitalisation) in 2020-21. The updated forecast (February 2021) for capex in 2020-21 is $670.2million (including desal security payment cost capitalisation).

Overall, we recommend a 8% reduction ($296.8m) on total capex over RP5 compared to MW's forecast. This reflects:

- a $46.8 million reduction across the 15 major projects assessed in detail, which reflects a 4.4% reduction on MW's 2021 price submission proposal for these projects
- an overall reduction of an average $50m per annum across the broader capital program, resulting in a reduction of $250m over RP5. This reflects our views on the prudency and efficiency of some of the individual projects we examined, our concerns in relation to deliverability of a significantly increased capital program, our view that growth in customer

[3] Excluding desalination security payment cost capitalisation and corporate capex. Total RP5 capex is $4,100m including desalination security payment cost capitalisation and corporate capex.
[4] Excluding corporate capex

numbers is likely to be much lower than MW has forecast, and concerns about the prudency of stormwater harvesting projects.

The recommended reductions are summarised in Table ii below.

Table ii: MW forecast controllable capex and recommended adjustments ($2020-21m)

Project		2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Water Top 5	Proposed capex	45.12	115.32	47.49	21.36	32.94	**262.22**
	Recommended adjustments	-0.63	-7.08	-28.09	1.70	25.57	**-8.53**
	Recommended capex	44.49	108.24	19.40	23.06	58.51	**253.69**
Sewerage Top 5	Proposed capex	131.15	257.13	157.97	181.42	27.23	**754.90**
	Recommended adjustments	-5.34	-21.77	-2.85	-8.62	0.32	**-38.26**
	Recommended capex	125.81	235.36	155.12	172.80	27.55	**716.64**
Waterways and Drainage Top 5	Proposed capex	22.26	16.14	0.00	0.00	0.00	**38.40**
	Recommended adjustments	-7.09	6.99	0.10	0.00	0.00	**0.00**
	Recommended capex	15.17	23.13	0.10	0.00	0.00	**38.40**
Total top 15	**Proposed capex**	**198.53**	**388.58**	**205.46**	**202.78**	**60.17**	**1055.52**
	Recommended adjustments	**-13.06**	**-21.86**	**-30.84**	**-6.92**	**25.89**	**-46.79**
	Recommended capex	**185.47**	**366.72**	**174.62**	**195.86**	**86.06**	**1008.73**
Remainder of program	Proposed capex	620.88	571.41	513.07	484.59	456.74	**2646.70**
	Recommended adjustments	-58.65	-53.97	-48.46	-45.77	-43.14	**-250.00**
	Recommended capex	562.24	517.44	464.61	438.82	413.60	**2396.70**
Total adjustments (including individual projects)	**Proposed capex**	**819.41**	**959.99**	**718.54**	**687.37**	**516.91**	**3702.22**
	Recommended adjustments	**-71.71**	**-75.83**	**-79.30**	**-52.69**	**-17.25**	**-296.79**
	Recommended capex	**747.70**	**884.16**	**639.23**	**634.67**	**499.65**	**3405.43**

Source: Arup and Deloitte Access Economics.

1 Introduction

1.1 Background

The Essential Services Commission (ESC) is currently reviewing Melbourne Water's (MW) proposed services and prices for the regulatory period 1 July 2021 to 30 June 2026. This period is referred to in this document as 'the next regulatory period' or the 'fifth regulatory period' (RP5).

MW submitted its 2021 Price Submission to the ESC in November 2020. The Price Submission includes forecasts of operating expenditure (opex), capital expenditure (capex), demand, proposed service standards and prices. The 2021 Price Submission is MW's first under the PREMO framework which links the return on equity to the ambition of a business in delivering better customer value in its pricing proposal. This framework focuses on five elements: performance, risk, engagement, management and outcomes.

The ESC intends to release a Draft Decision on MW's Price Submission in March 2021, with a final decision expected in June 2021 that specifies the maximum prices that MW may charge.

1.2 Scope of review

The ESC has engaged Deloitte Access Economics and Arup to review MW's opex and capex forecasts and to provide advice on whether it is consistent with the requirements of the regulatory framework.

In undertaking this review, our key responsibilities are to:

- assess the appropriateness of the expenditure forecasts in relation to the key objectives of the review
- provide advice to the ESC regarding the appropriateness of the forecasts, and
- where our advice indicates that proposed expenditure is not appropriate, propose a revised expenditure level.

Deloitte Access Economics and Arup have been asked to review the three major service areas provided by MW:

1. Bulk water
2. Sewerage
3. Waterways and drainage

Our review considers expenditure forecasts across the whole business as well as proposed expenditure in each service area.

As part of our review, the ESC also requested that Deloitte Access Economics undertake a detailed review of the assumptions and methodology applied by MW in developing its growth forecasts for the three areas, and comment on the implications of any findings for the proposed expenditure.

1.3 Approach to review

Our approach for undertaking the review has involved the following key steps.[5]

1. an initial review of the price submission, financial model template and associated documentation, including benchmarking MW's pricing submission to past determinations
2. initial planning and a workshop with ESC staff including identifying and discussing key issues for the focus of the review
3. preparation of key discussion points, which was subsequently provided to MW prior to the online workshops

[5] Throughout the review process, Melbourne Water has been provided with opportunities to provide further information to support its expenditure proposal.

4. MW conducted three online workshops to explain and take questions on key aspects of the pricing submission. Further information requests were sent to MW following the workshops.
5. detailed review and analysis of supporting information provided
6. draft Report prepared and provided to MW for comment
7. subsequent discussion with MW regarding its response
8. final report.

We would like to record our thanks to MW's regulatory team for the assistance they provided to our review.

The methodology applied in assessing MW's operating and capex is set out in sections 3.1 and 4.1 respectively.

1.4 Structure of this report

This report is structured as follows.

- **Chapter 2** briefly summarises MW's price submission with respect to expenditure forecasts and outlines key expenditure drivers
- **Chapter 3** provides our analysis, conclusions and recommendations on key issues with respect to MW's operating expenditure
- **Chapter 4** provides our analysis, conclusions and recommendations on key issues with respect to MW's capital expenditure.
- **Appendix A: Demand forecast review** provides out analysis and key findings of the underlying forecast demand assumptions adopted by MW in its submission.

Unless stated otherwise, all values presented in this report are in $2020-21.

2 Summary of forecast expenditure

This chapter provides a summary of Melbourne Water's (MW) forecast expenditure including key underpinning assumptions.

2.1 Key expenditure drivers

MW is the bulk water supplier for Greater Melbourne, including the three major retailers, Western Water, and some other regional retailers. Other services provided by MW include supplying recycled water to wholesale customers, treating and disposing most of Melbourne's sewerage as well as managing waterways and major drainage systems.

2.1.1 Demand for services

Demand for MW's bulk water and wastewater services is driven primarily by population size. A growing population leads to more residential and non-residential properties, adding to the collective volume of water demanded and effluent disposed.

For waterways and drainage, demand for services is driven by a wide range of factors such as size of assets (e.g. length of waterways and hectares of catchment area) to be managed, or the number of emergency response events. To simplify, MW has adopted growth in connections (i.e. new properties) as a proxy for demand for waterways and drainage services.

MW assumed a 1.95% annualised growth rate (2021 to 2031) for household growth and a 2.23% annualised growth rate (2021-2026) for customer connections across greater Melbourne. This forecast is based on Victorian in Future (VIF) 2019 population forecasts, which were prepared prior to the COVID-19 pandemic and therefore do not account for more recent trends in migration and economic slowdown.

Water demand (megalitres of water sold) is forecast to grow on average by 0.8% per annum from the 2018-19 base year to the end of the PS21 regulatory period. This assumption reflects the underlying trends of more water connections, with a declining consumption per connection (due to a combination of retail water company end use model assumptions around new properties being (on average) smaller, with less outdoor water usage, and the overall stock of water-using appliances becoming more efficient over time).

Demand forecasting for sewage is inherently more uncertain than demand forecasting for water. This is due to limited metering of effluent at the property level as well as the variety of sewage attributes (e.g. total suspended solids or biological oxygen demand) that impact operations.

From 2018-19 to the end of RP5, MW has forecast sewage growth in megalitres of sewage treated of, on average:

- 0.5% per annum at the Eastern Treatment Plant (ETP)
- 1.0% per annum at the Western Treatment Plant (WTP).

Treatable load parameters (which are a more material driver of treatment plant costs) are also forecast to grow:

- total suspended solids (TSS) growth is forecast to be 1.3% per annum at ETP and 1.9% per annum at WTP
- biological oxygen demand (BOD) growth is forecast to be 1.0% per annum at ETP and 1.5% per annum at WTP
- total Kjeldahl nitrogen (TKN) growth is forecast to be 1.1% per annum at ETP and 1.9% per annum at WTP.

2.1.2 Growth as a driver of forecast expenditure

The ESC's pricing framework requires MW to provide a forecast growth rate factor to apply as an increase in baseline (business as usual) operating expenditure. An 'efficiency factor' is then subtracted from this growth rate to reflect such things as economies of scale and ongoing improvements in business operations. In determining the baseline growth rate, the ESC's guidance paper allows MW to consider:

- what is the appropriate underlying growth driver for each service area (eg. population growth or customer connections)
- what is the factor that should be applied to baseline opex as a result of the selected growth driver (that is, the baseline growth factor may be a proportion of the underlying growth driver)

In its submission MW adopted a growth rate linked to population growth, at 1.95% per annum, and implicitly adopt a 1:1 relationship between the baseline growth factor and underlying population growth forecast.

MW has clarified that, in practice, population and customer growth forecasts are not used to set the overarching expenditure budgets across MW, but are rather used:

- to inform a bottom-up forecast of variable operating expenses, such as chemicals and energy, noting that MW is a predominantly fixed cost business
- to determine the appropriate efficiency factor to be applied to baseline opex to achieve a specific net growth efficiency improvement target, where population growth is used as a proxy for baseline expenditure growth
- as a consideration for 'just-in-time' capital investment, particularly those driven by growth, noting other drivers (such as current asset conditions, asset loads and licence conditions) are considered more significant drivers of investment
- to set prices for variable tariffs
- to allocate sewerage revenue requirement across retailers and the appropriate sewerage revenue fixed charge.

We understand that the ESC's framework is a regulatory construct developed to simplify the regulatory assessment process by applying a top-down approach to business as usual expenditure forecasts. This includes avoiding the need for detailed bottom-up assessment of expenditure items and enabling greater benchmarking across businesses. As such, we recognise this approach may not reflect how forecasts are prepared in practice by water businesses.

We have taken MW's points above into consideration in our review, but note that the foundations of our assessment approach continues to be in line with the ESC's PREMO framework. This is the approach taken to assessing Victorian water businesses and previously used to assess MW's 2016 price proposal.

2.1.3 COVID-19

COVID-19 has resulted in the largest global recession since the Great Depression and is severely affecting the Australian and Victorian economies. The pandemic is forecast to cause Victorian economic output to fall by 4.0% in 2020-21 following an estimated fall of 0.3% in 2019-20.[6]

As noted above, MW has prepared its expenditure forecasts based on pre-COVID-19 growth assumptions. While it commissioned some updated growth forecasts in late 2020, and carried out a high level scenario assessment of the implications of changing its growth assumptions (which would impact both prices and cost forecasts) it did not update its price submission to account for the impacts of COVID-19 on growth.

MW considers this is reasonable because under a COVID-19 scenario the reduction in customer numbers is larger than the reduction in costs, such that under a price cap framework, prices would be higher for customers.

[6] Department of Treasury and Finance Victoria (2020), *Budget Paper No.2 Strategy and Outlook* < https://s3-ap-southeast-2.amazonaws.com/budgetfiles202021.budget.vic.gov.au/2020-21+State+Budget+-+Strategy+and+Outlook.pdf>

MW engaged Macroplan to undertake population forecasts under a COVID-19 scenario. The modelling suggested that there would be a muted drop in population growth, from 1.95% under VIF2019 to 1.93% under a COVID-19 scenario.

Based on this view of population under a COVID-19 scenario, MW suggests there would be a negligible impact on forecast expenditure. MW identified that COVID-19 adjusted estimates would have:

- no impact on the proposed capex as all capital projects with a growth driver have been proposed on a 'just-in-time' basis to deal with recent growth that has occurred during RP4
- a minor decrease in opex of $1.3m over the whole PS21 period, driven by a small reduction in chemicals ($0.3m) and energy costs ($1.0m).

Based on this, MW decided to use 'original best estimates' of forecast demand and expenditures instead of 'COVID-19 adjusted estimates'. We note that COVID-19 impacts on the demand outlook have been considered in some parts of the demand forecast. In particularly, developer contribution forecasts in the waterways and drainage demand outlook have taken into account COVID-19 impacts on the near-term outlook. However, this has not been applied consistently across the demand outlook.

2.1.3.1 Review of demand assumptions

As expected, the VIF (2019) population outlook is substantially stronger than more recent population forecasts from the Victorian Treasury, Centre for Population Projections and Deloitte Access Economics. This is due to the fact that the VIF (2019) outlook predated COVID-19 and its impacts on underlying drivers of population, including migration, fertility and mortality.

MacroPlan forecasts of population growth are also materially higher than those of Victorian Treasury, Federal Treasury and Deloitte Access Economics. This is partly due to a relatively modest assumption regarding the impact of COVID-19 on Victorian net overseas and net interstate migration, as well as a sharp fall in mortality which outweighs a decline in the fertility rate.

MacroPlan forecast a smaller Victorian population when compared to the forecasts published in the VIF (2019) report, and a larger population when compared to the latest forecasts published by the Victorian Treasury, Deloitte Access Economics and the Centre for Population. Table 2.1 demonstrates that the Victorian Treasury and Centre for Population Projections forecast a CAGR to 2023-24 0.9 percentage points below the VIF (2019) outlook and 0.5 percentage points below MacroPlan.

Table 2.1: Victorian population forecasts comparison

	CAGR	**Population**
	2018-19 to 2023-24	**Difference to VIF (2019) by 2023-24**
VIF (2019) (Jul 2019)	1.9%	-
MacroPlan (Sep 2020)	1.5%	132,000
Deloitte Access Economics (Sep 2020)	1.1%	286,000
Centre for Population Projections (Dec 2020)	1.0%	296,000
2020-21 Victorian Budget (Nov 2020)	1.0%	312,000

Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

MacroPlan forecasts of population growth are considered unreasonably high and in need of revision. Detailed demand analysis is provided in Appendix A.

MW has stated that its price submission further addresses COVID-19 related growth risk by:

- smoothing the profile of capex which defers some projects to the third year of RP5 onwards

- opting to smooth price increases for waterways and drainage services with a gradual increase over the regulatory period, rather than a one-off initial increase in 2021-22
- considering the impact of Macroplan's growth forecast on chemical and energy opex.[7]

In response, we note that:

- in smoothing the profile of proposed capex and the waterways and drainage price path MW has sought to accept some risk on behalf of customers and dampen year-on-year price impacts. However this offers a relatively modest acceptance of risk relative to the size of the impact of COVID-19 on customers, recognising there may be a need to postpone expenditure further out than anticipated by MW under a 1.93% growth rate
- MW has not included the reduced chemical and energy opex in its proposed price path on the basis that the revenue risk is greater than the opex reduction.

Moreover, we have also identified inconsistencies across key assumptions underpinning the demand outlook. In particular:

Waterways and drainage

- potential COVID-19 impacts have not been directly included in forecasts for waterways and drainage services demand. MW has determined that pre-COVID-19 forecasts for property growth and developer contributions are still applicable, however this is unlikely given the material change in key growth factors such as interest rates, house prices and stimulus measures.
- property contribution forecasts, produced by BIS Oxford Economics, are underpinned by an in-house macroeconomic and demographic model. MW has extended these forecasts from 2026-27 to 2030-31 using household growth projections from VIF (2019).
- the property market outlook used to forecast connections has not been used in the longer-term developer contributions analysis.

Sewage demand

- the population forecasts used were finalised prior to the outbreak of COVID-19 and are likely to overstate forecast sewage demand.
- employment growth is likely to be a more appropriate growth factor for non-residential sewage demand compared to population growth.
- demand from larger non-residential customers is derived using customer-level insights. While this approach is considered reasonable it is recommended that these are revised to incorporate potential changes in planned investments following the impact of COVID-19.
- sewage demand forecasts are broadly stronger than history. However, data is only available for 2010-11 and 2018-19 and may be affected by record rainfall in 2010-11.
- forecast growth in BOD for the WTP appears unreasonably high relative to historical trends. Forecast non-residential demand for South East Water at the ETP also appears high when compared to South East Water's residential demand forecasts and Yarra Valley Water's non-residential demand forecasts.

Water demand

- the population forecasts used were finalised prior to the outbreak of COVID-19 and are likely to overstate forecast water demand. Water retailers also use different sources for population forecasts creating internal inconsistencies.
- retailers use different approaches to forecast key growth factors such as the number of non-residential connections and total water use per connection (residential and non-residential). While this may be appropriate it is difficult to verify.
- the connection forecasts from retailers used in the water demand forecast have not been used in the waterways and drainage demand forecast.

[7] MW, December 2020, *Melbourne Water price submission and updated State Economic Outlook*, provided 4 January 2021.

During the review process, MW was asked to consider how adopting the latest Victorian Treasury population growth forecast would impact their pricing proposal. In their response provided in early January, MW identified there may be potential delivery risk for capex programs, suggesting MW could return the value of any capex over $100m that could not be delivered in the annual schedule by adjusting the price cap over the remaining regulatory period. MW did not indicate any need to reprioritise or reprofile capex as a result of lower growth in line with Victorian Treasury projections. MW also indicated adopting the lower growth forecast would result in only a $3.6m reduction in opex due to reduced chemical and energy needs.[8]

MW also provided updated growth projections from MW's metropolitan retailers, revised in December 2020 to reflect revised COVID-19 assumptions. MW indicated that population growth is 2% (CAGR) across retailers. Due to limited time these revised population forecasts were not reviewed in detailed. However, we note that the high population growth is primarily driven by WW, which makes up the smallest proportion of MW's demand. [9]

We acknowledge the uncertainty created by COVID-19 right at the time that MW was preparing its submission made it difficult for MW to reflect COVID-19 impacts in its submission. However, it is now clear that the pre-COVID-19 forecasts for connections and demand are too high. We consider it would now be appropriate for MW to review its growth forecasts and revisit forecast capital expenditure, as well as associated operating expenditure, in its response to the ESC's Draft Decision.

2.1.4 Community expectations

In developing its 2021 Price Submission, MW undertook a lengthy consultation process with various stakeholders (including retail water companies, households and businesses, local government, industry associations and community groups).

MW's engagement for PS21 followed a three-stage approach:

- Stage 1: Values and focus areas - understand customer values and areas of interest to be addressed through the engagement program and to inform the initial drafting of customer outcomes
- Stage 2: Preferences and performance - identify customer preferences for investment and expectations of MW's performance
- Stage 3: Validation - validate the proposed customer outcomes, performance measures and investments in the draft Price Submission

MW used various mediums for consultation, including:

- the Waterways and Drainage Customer Council (WDCC) comprising 14 members from local government, community groups, statutory authorities and the development industry provided strategic advice on the nature and level of waterways and drainage services to be delivered by MW
- the Water and Sewerage Customer Council (WSCC) comprising 6 retail water companies provided a dedicated customer forum to test strategic ideas, seek preferences and provide advice on key issues, opportunities and focus areas to support PS21
- the Regulatory Managers Forum covered key regulatory topics such as the appropriate length of the PS21 regulatory period and form of price control, as well as the design of bulk water and sewerage tariffs, and appropriate risk-based treatment of the Victorian Desalination Plant water order
- the Engagement Advisory Panel provided a forum for review of engagement activities to identify opportunities for joint efforts and alignment of engagement activities across the sector
- roadshows and information sessions to explain the approach to risk, pricing, capital and opex
- 3,753 residents and 535 businesses responded to 2 surveys testing investment preferences and willingness to pay for services

[8] MW, December 2020, *Melbourne Water price submission and updated State Economic Outlook*, provided 4 January 2021.
[9] MW, December 2020, *Melbourne Water price submission and updated State Economic Outlook*, provided 4 January 2021.

- 6,351 visits and 228 subscribers to the Price Submission YourSay website
- a series of briefings were provided to state government, consumer advocates and Traditional Owners (Bunurong, Wadawurrung and Wurundjeri Woi wurrung)
- 145+ participants (households and businesses) in 20 focus groups and 1 online panel
- Community Deliberative Panel – a representative sample of 39 people from across Melbourne participated in a forum on Waterways and Drainage Services
- A Local Government submissions process, with 21 of 38 Councils making a submission.

MW suggested its price submission demonstrates a high level of customer influence. Examples provided by MW where the capex program has been influenced by consultation include:

- increases in flood mitigation and some major drainage renewals
- increases in the level of service for natural wetlands and new obligations around social and recreational programs, waterway restoration and providing greater access to the public
- stormwater harvesting program - design and construction of stormwater harvesting infrastructure including pump stations, storage and transfer pipelines to manage the impact of increasing volumes of stormwater arising from greater Melbourne's growth and densification.

2.1.4.1 Consultation with retailers

Deloitte Access Economics and Arup consulted at officer level with MW's three largest retail customers Yarra Valley Water, South East Water and City West Water) to seek their feedback on MW's price submission, consultation process and the proposed expenditure.

Appreciation was expressed for the increased number of times MW engaged with the retailers compared to previous price submissions and that MW did endeavour to align its submission with retailer views. However, officers noted the depth and quality of engagement was not materially different to previous submissions.

The retailers also suggested the consultation process would have benefitted from more direct discussion about the impacts of COVID-19 (not just with households and businesses).

Specific to capex, retailers noted the following:

- while no major concerns were identified in MW's submission, it was unclear if expenditure is prudent and efficient as there was a more limited exploration of alternative options during engagement process than might have been desirable
- they would have preferred more information on how capex projects have been prioritised and how they directly link to better outcomes
- in some cases documents provided to retailers were more 'investment need plans' rather than technical business cases
- there was limited consideration of whether some capex items could be deferred due to COVID-19
- there was limited information on how consumers would be compensated if capex projects are accepted but don't go ahead.

2.1.5 Service standards

MW has Bulk Water Supply Agreements with each of its customers (City West Water, South East Water, Yarra Valley Water, Western Water, Gippsland Water, Barwon Water, South Gippsland Water and Westernport Water). The agreements set out the responsibilities of MW and the retailers for bulk water, including requirements of MW's water quality monitoring program and minimum standards for: effective disinfection, pH levels, fluoride, iron, magnesium, aluminium, turbidity, coliforms, apparent colour and algae.

The Safe Drinking Water Act 2003 and associated Safe Drinking Water Regulations 2015 provide the legislative basis on which MW must manage the safety of the water it supplies to retail water companies.

MW has agreements with the retailers for bulk sewage transfer, treatment and disposal. In addition, MW is required to comply with Environmental Protection Authority (EPA) discharge licence requirements for both the WTP and ETP, as well as other obligations set out under the Statement of Obligations issued by the Department of Environment, Land, Water and Planning.

2.1.6 Addressing new obligations

Below is a brief summary of the some of the key new obligations MW must satisfy in PS21.

- Statement of Obligations – An Emissions Reduction clause introduced in March 2018 sets MW a target of 204,380 tonnes carbon dioxide-equivalent (tCO2e) greenhouse gas emissions by 2025 (approximately a 50% reduction against the baseline)
- a change in the baseline target for WTP scope 1 emissions under the Safeguard Mechanism of the National Greenhouse and Energy Reporting Act 2007 means MW's emissions at WTP will be subject to carbon emissions reduction obligations from 2021-22
- the Environment Protection Authority (EPA) has indicated its intent to require MW to achieve 100% re-use of annual production of biosolids from the WTP within a reasonable timeframe. Based on a consultation process with customers and regulators, MW proposed targets of at least 40% (approximately 17,000 tonnes per annum) re-use by 2025-26
- amendments to the *Water Act in 2019* require MW to consider opportunities to provide for Aboriginal cultural values and uses of waterways
- under the *Marine and Coastal Act 2018*, the Minister for Water has authority to request MW provide technical advice on coastal erosion in its waterway management district, including matters relating to or affecting the marine and coastal environment.
- New Government policy to explore public recreation opportunities on water storages.

MW also undertook a willingness to pay study to understand customers' preferences for waterways and drainage services and pricing. This study was used to determine the level of service MW has proposed to provide in relation to its waterways and drainage obligations and is a significant driver for increased expenditure proposed in RP5.

2.2 Operating expenditure

The key features of MW's opex forecast include:[10]

- baseline controllable opex in 2019-20 of $389.2m[11] (before adjustments), which is lower than that forecast in the 2016 price submission ($400.7m) and the 2016 price determination ($394.2m)
- a forecast average customer growth rate of 1.95% per annum
- a cost efficiency improvement rate of 2.0% per annum, resulting in a net change of -0.05%
- net growth-efficiency rate is not applied to energy which is removed from the baseline and added back as an adjustment.
- $230.2m of forecast additional expenditure in total over RP5 above the baseline[12]
- a total cumulative controllable opex of $1,956.9m over RP5
- a slight decline in controllable opex per connection[13] over RP5, after factoring in the additional expenditure.

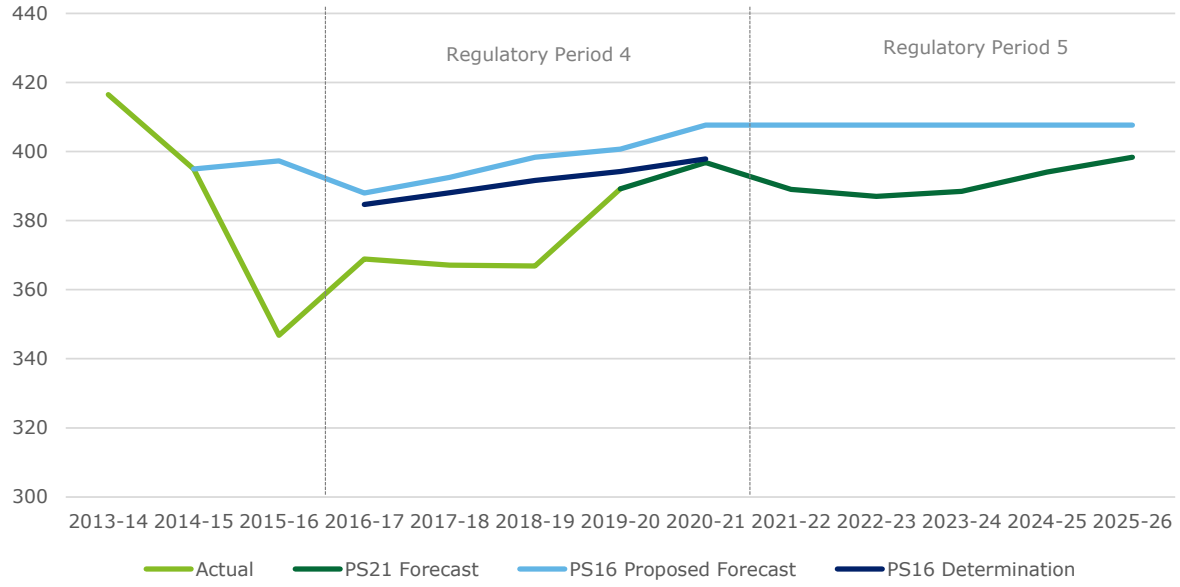
Figure 2.1 shows MW's total controllable opex from 2013-14 to 2025-26, comparing actual and forecast expenditure to the PS16 proposal and final determination.

In 2019-20, MW's actual controllable opex was below the expenditure approved in the 2016 price determination, however, shows a 6.1% increase from the previous year (2018-19) to 2019-20. Higher sewerage service costs and operating and maintenance costs are key drivers for this increase.

[10] MW *2021 Price Review Model – ESC Reviewed* (revised version provided 24 December 2020)
[11] Total baseline controllable opex is $1.93m higher than the figures presented in MW's original price submission, this is due to revisions provided during the review process to reflect the final statutory accounts for 2019-20. Revisions to base year expenditure were removed from the baseline forecast as adjustments, therefore there is no change in proposed forecast expenditure.
[12] Total adjustments are higher than proposed in MW's price submission due to revised energy forecast provided by MW during the review process. During the review process, MW revised their energy forecast by $7.54 million. The new value of the total controllable opex with revisions for energy is $154.8 million. Further analysis of energy costs is provided in Section 3.5.1. Source: MW *Additional queries – Energy costs and Carbon pledges* 11 December 2020.
[13] Based on Melbourne Water's pre-COVID connection forecast.

Overall, opex by 2025-26 is 2.4% higher than opex in the start of the period (2021-22). The compound annual growth rate over RP5 is 0.59%.

Figure 2.1: Historical and forecast total controllable opex ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020). Notes:

1. Base year (2019-20) actual expenditure is slightly higher than the original price submission due to revisions provided by MW during the review process.
2. Includes revised energy forecast provided by MW during the review process.

Major opex drivers are not split by service area. At a whole of business level:

- energy costs decrease at the start of RP5 with an increase towards the end of the period
- labour forecast assumes no change in FTEs with wages increased by 2% nominally.
- IT costs increase 4% annually (CAGR) over RP5 from 2019-20.
- chemical costs increase 2% annually (CAGR) over RP5 from 2019-20.

2.2.1 Water and sewerage

Water and sewerage services make up approximately 63% of MW's total controllable opex.

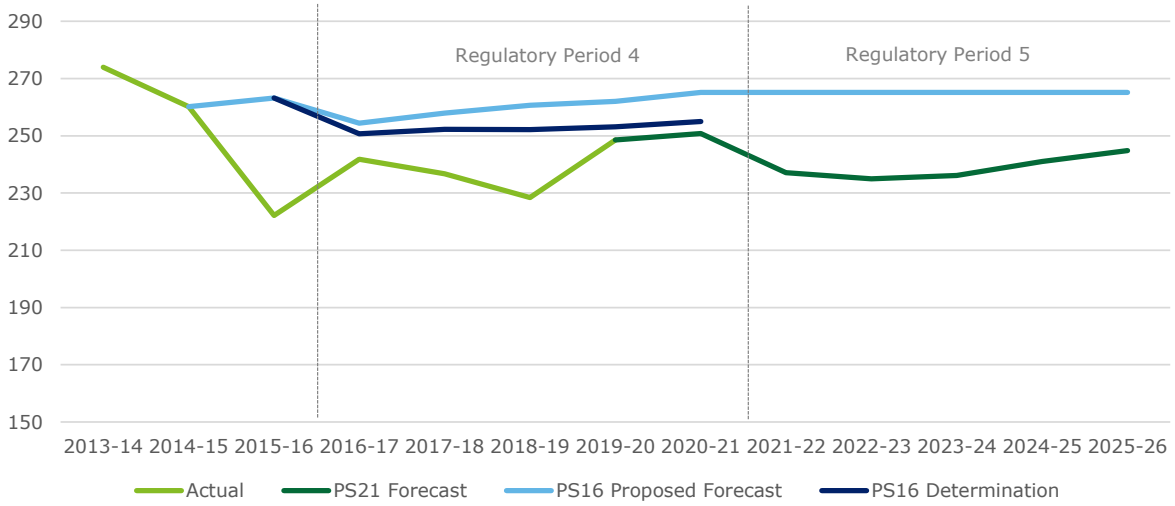
Key features of MW's water and sewerage opex proposal include:

- actual opex in 2019-20 was $4.5m (1.8%) less than the 2016 price determination for that year and $13.4m (5.1%) below the 2016 proposed forecast for that year
- baseline opex in 2019-20 is 8.8% ($20.2m) higher than opex in the previous year, noting that the two prior years experienced a decrease in controllable opex. The increases in the baseline year are primarily driven by:
  - a 14% increase in operations and maintenance opex, offset by a decrease in corporate opex (8%)
  - an 11% increase in sewerage opex between 2018-19 and 2019-20.
- removal of $43.8m from baseline controllable expenditure (2019-20) for non-recurring expenditure items. This mainly consists of the removal $44.4m for energy costs (which MW has treated separately to other costs) offset by other smaller changes to the baseline
- addition of $173.8m[14] (in total) back to future baseline controllable expenditure over RP5 for additional expenditure, largely related to the re-inclusion of energy costs.

[14] Excludes revised energy cost forecast provided by MW during the review process.

Figure 2.2 shows that annual controllable opex over RP5 is below the baseline year, however opex by 2025-26 is 3.3% higher than opex in the start of the period (2021-22). The compound annual growth rate over RP5 is 0.8%.

Figure 2.2: Water and sewerage controllable opex ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020). Note: Does not include revised energy forecast due to limited information on the split of revised energy costs between service areas.

2.2.2 Waterways and drainage

Waterways and drainage services account for the remaining 37% of MW's controllable opex.

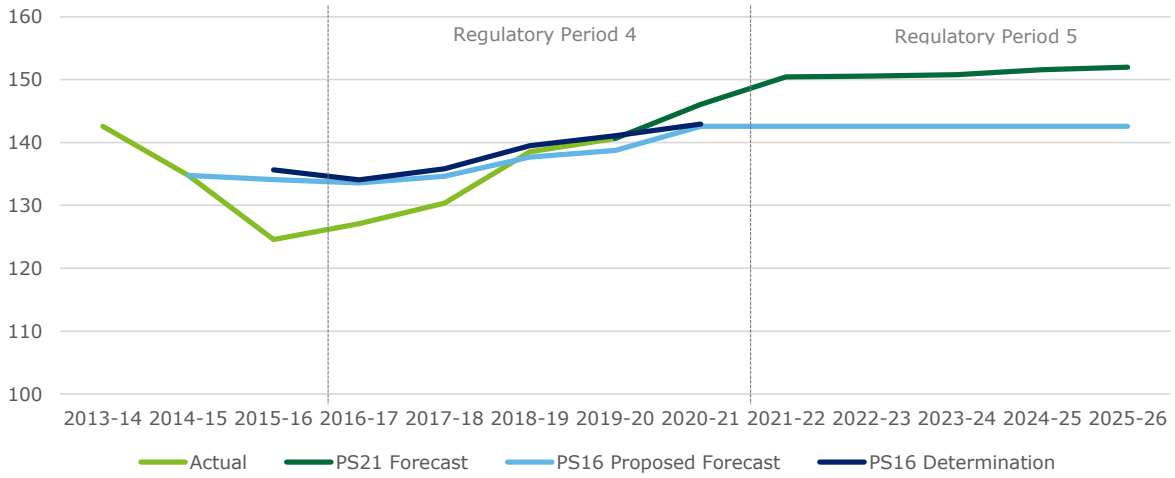
Key features of MW's waterways and drainage opex proposal include:

- actual opex in 2019-20 was $0.5m (0.3%) below the 2016 price determination for that year, but $1.9m (1.4%) above the 2016 proposed forecast for that year
- the compound annual growth rate of controllable opex over RP4 is anticipated to be 3.5% from 2016-17 to 2020-21
- baseline opex in 2019-20 is 1.5% ($2.1m) higher than opex in the previous year in 2018-19
- an addition of $1.16m to the baseline controllable expenditure (2019-20) to account for abnormal cost changes in 2019-20
- addition of $48.8m[15] (in total) back to future baseline controllable expenditure over RP5 for additional expenditure.

Figure 2.3 below shows that controllable opex has risen over RP4, with opex in 2020-21 anticipated to be 14.9% higher than opex at the start of RP4 (2016-17). Forecast opex for 2020-21 is expected to be $3.5m (2.5%) more than the 2016 proposed forecast. However, annual controllable opex over RP5 is forecast to plateau compared to RP4 opex growth with a 0.26% compounded annual growth rate over RP5 (from 2021-22).

[15] Excludes revised energy cost forecast provided by MW during the review process.

Figure 2.3: Waterways and drainage controllable opex ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020). Note: Does not include revised energy forecast due to limited information on the split of revised energy costs between service areas.

2.3 Capital expenditure

MW's capex forecast is $3,702.2m[16] over the next regulatory period. capex is estimated to peak in 2022-23, notably due to the proposed WTP 55E ASP Upgrade and HBM Yarra Crossing Duplication projects which will reach peak construction in that year.

This is a 39% increase compared to RP4 capex[17] (using actuals for 2015-16 to 2019-20 and forecasts for 2020-21[18]). This is primarily driven by increases in:

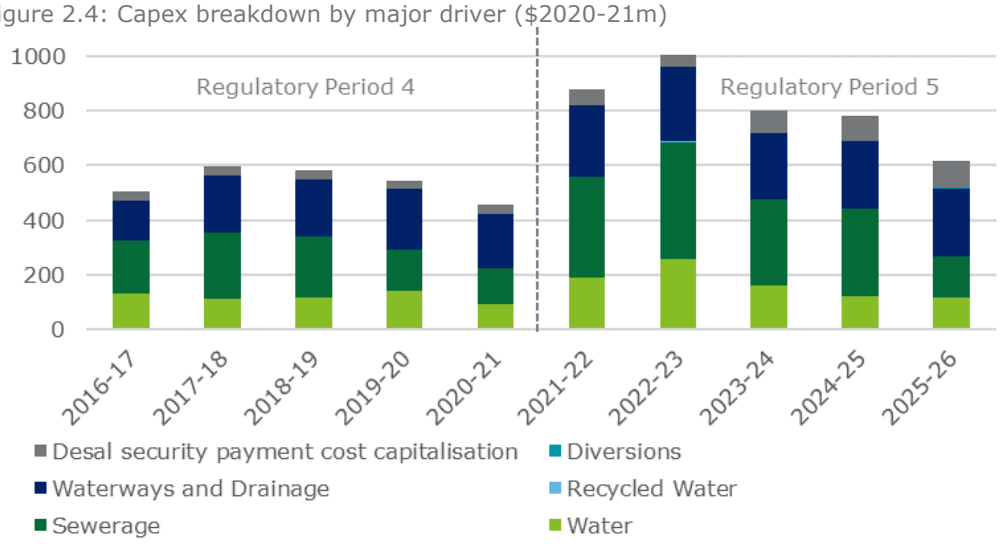
- 'growth' capex in response to strong population growth over the past five years. A number of critical assets (particularly at the WTP) have absorbed the additional demand and now require augmentation.
- 'renewals' capex to keep current assets fit-for-purpose as they age and deal with the challenges presented by climate change. The key 'renewals' project is a large atypical sewer main renewal project (Hobsons Bay Main Yarra Crossing Duplication).
- 'improvement' capex to deliver higher levels of service in response to customer willingness to pay analysis. For example, customer-led uplifts in stormwater quality management.

In addition, the desalination security payment cost capitalisation proposed in RP5 is $398.6m (increased from $163.7m in RP4).

Figure 2.4 below presents forecast capex by major drivers. Sewerage projects comprise the most significant proportion of spend for all years except 2025-26 where waterways and drainage is the major capex driver.

[16] Excluding desalination security payment cost capitalisation and corporate capex. Total RP5 capex is $4,100m including desalination security payment cost capitalisation and corporate capex.
[17] Excluding corporate capex
[18] Using 'pre-populated' values from PS16 for 2020-21 as per the ESC template.

Figure 2.4: Capex breakdown by major driver ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)
*values for 2020-21 represent 'pre- populated' values using forecasts from the PS16 submission, MW forecast (at the time of the submission) capex of $663.0 (including desal security payment cost capitalisation) in 2020-21. The updated forecast (February 2021) for capex in 2020-21 is $670.2million (including desal security payment cost capitalisation).

Over the past 15 years (completed financial years) total capex of $8.7 billion has been added to MW's total RAB, with average annual expenditure of $584.1 million and a peak annual expenditure of $1.42 billion.

2.3.1 Water and sewerage

MW's total water and sewerage capex forecast over the next regulatory period is $2,321.9m (Water - $791m and Sewerage - $1,531m).[19]

This represents a 46% increase on water and sewerage capex compared to RP4 (using actuals for 2015-16 to 2019-20 and forecasts for 2020-21[20]). The biggest uplift in capex is related to growth (169%), followed by renewals (24%) and improvement (4%):

- an increase in 'growth' driven by new transfer infrastructure (mains, pumps & service reservoirs) to service the north and northwest of greater Melbourne, augmentation of surface water resource at Cement Creek and sewerage treatment capacity augmentation
- an increase in 'renewals' based on condition assessments that have highlighted the need for an increase in investment in sewer renewals
- an increase in 'improvements / compliance' based on upgrades to meet the new fluoride code and treatment plant disinfection requirements.

The ten largest projects (by RP5 aggregate expenditure) account for $1 billion (44%) of the water and sewerage capex program. The three largest water and sewerage projects are detailed below:

- WTP Primary Treatment Augmentation ($315.3 million) - provide preliminary treatment (screening and grit removal), primary treatment (sedimentation tanks), and sludge treatment (thickening and anaerobic digestion). This will reduce the load on the existing anaerobic pots to sustainable levels and provide capacity for future growth.
- WTP 55E ASP Upgrade ($211.4 million) - upgrade the existing 55 East Activated Sludge Plant to a modern shortcut nitrogen removal process, while reusing existing infrastructure (clarifiers). The new design will reduce energy demand and eliminate safety risks associated with working over water.

[19] Excluding corporate capex
[20] Using 'pre-populated' values from PS16 for 2020-21 as per the ESC template.

- HBM Yarra Crossing Duplication ($135.8 million) - duplicate the Hobson's Bay Main sewer Yarra River crossing, then rehabilitate the existing crossing, which cannot be rehabilitated under live conditions.

2.3.2 Waterways and drainage

MW's total waterways and drainage capex forecast over the next regulatory period is $1,220 million.[21]

This represents a 27% increase on waterways and drainage capex compared to RP4 (using actuals for 2015-16 to 2019-20 and forecasts for 2020-21[22]). The biggest uplift in capex related is to improvement/compliance (51%), followed by growth (19%) and renewals (14%):

- an increase in 'growth' based on forecast land development activity
- an increase in 'renewals' based on increased wetland rectification and sediment removal driven by increased sediment volumes, contamination and landfill levy increases as well as a number of drainage assets reaching end of life including Port Melbourne pump station and Shakespeare Grove drain.
- an increase in 'improvements / compliance' based on MW's customer willingness to pay study that noted a willingness to pay for increases in level of service particularly stormwater harvesting, flood modelling and mapping. In addition, new obligations around social and recreational programs.

The three largest waterways and drainage projects are:
- Port Melbourne Pump Station Renewal ($11.4 million) - Replacement of the four pumpsets, associated internal pipework and valves to ensure the ongoing flood protection of the Port Melbourne area.
- Shogaki Drive DSS Interim Outfall Works ($9.4 million)
- Wylies Drain Section 3 RBPWL2 ($8.7 million).

[21] Excluding corporate capex and including diversions expenditure of $2.14m.
[22] Using 'pre-populated' values from PS16 for 2020-21 as per the ESC template.

3 Operating expenditure assessment

This Chapter provides analysis, conclusions and recommendations on key issues with respect to Melbourne Water's (MW's) operating expenditure (opex).

3.1 Overview of approach

With respect to opex forecasts, the Essential Services Commission's (ESC's) Guidance Paper outlines that a prudent and efficient opex forecast would have the following characteristics:

- baseline year expenditure is reflective of efficient operating costs and is used as a basis to forecast expenditure
- forecast opex incorporates expectations for a reasonable rate of improvement in cost efficiency
- expenditure requirements above the baseline year (adjusted for growth and efficiency improvements) are fully explained and justified, this includes how such expenditure is reflected in proposed customer outcomes and how they represent improved customer value.

Accordingly, opex is disaggregated into four separate elements.

1. **Baseline expenditure**, which refers to opex incurred in 2019-20, adjusted upwards or downwards to reflect any specific factors that mean that expenditure in 2019-20 is not representative.
2. An adjustment for **growth**. The ESC generally considers that increases in opex in line with economic growth are reasonable. This may be linked to customer or population growth, or other key drivers of business growth that water businesses consider reasonable.
3. An **efficiency improvement factor** that acts in conjunction with the growth factor and reflects the ESC's expectation that businesses seek productivity improvements to mitigate the pass through of any cost increases to customers that might arise from growth or real input cost increases. Businesses are able to propose their own individual improvements.
4. **Cost increases or decreases** such as those arising from new obligations imposed by regulators or government, major increases in costs that are not reasonable to expect the business to absorb or manage within the 'ebbs and flows' of expenditure from year-to-year, or new initiatives that customers seek and are willing to pay for.

Table 3.1 below presents the breakdown of MW's proposed opex from 2019-20 to 2025-26. Overall, MW is proposing to recover $1956.9m in controllable opex from customers. This is predominantly made up of the carry-forward of baseline expenditure, with growth factor of 1.95% and efficiency factor of 2% applied to baseline opex each year. This results in a baseline controllable opex of $1726.7m over RP5.

In addition, MW has proposed an upwards adjustment of $230.2m over RP5, this is predominantly made up of an electricity benchmark allowance of $154.8m (which is dealt separately to baseline expenditure, see section 3.5.1 for further details) and increase in waterways and drainage services as a result of a customer willingness to pay study undertaken ($43.5m).

Table 3.1: Breakdown of MW proposed forecast opex ($2020-21m)

	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
	Base year	RP4	RP5	RP5	RP5	RP5	RP5	
Growth		1.80%	1.95%	1.95%	1.95%	1.95%	1.95%	
Efficiency factor		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%	
Base year[1]	387.28							
Base year adjustments	-40.72							
Baseline forecast	346.56	345.87	345.69	345.52	345.35	345.17	345.00	1726.74
Adjustments								
Electricity Benchmark Allowance[2]			29.81	29.61	29.65	31.27	34.49	154.83
Water Quality Management (W&S)_			1.83	2.57	3.74	4.04	4.59	16.78
Carbon Pledge (W&S)			3.01	0.45	0.53	3.53	3.72	11.23
Traditional Owners (W&D)			0.56	0.56	0.56	0.25	0.25	2.17
Marine & Coastal Act (W&D)			0.33	0.34	0.34	0.34	0.34	1.69
Waterways and drainage - Willingness to Pay (W&D)			7.80	7.96	8.30	9.48	9.94	43.48
Total controllable opex			**389.04**	**387.00**	**388.46**	**394.09**	**398.34**	**1956.92**

Source: MW, 9 November 2020, Melbourne Water Price Submission 2021.

Note: 1. Base year numbers are based on MW's original submission. We note that during the review process MW revised its base year figures by a total of $1.93m (as per MW 2021 Price Review Model – ESC Reviewed (provided 24 December 2020)), however, this revised number was excluded from the forecast baseline.2. Includes revised energy forecast provided by MW during the review process.

Our task is primarily to review both the baseline expenditure and the forecast cost increases, and then to consider these in the context of the net impact of all the above factors. For example, we are more likely to consider an opex forecast to be reasonable for a business with a low efficiency improvement factor, but an intention to absorb additional expenditure items within its overall expenditure budget, rather than a business with a higher efficiency factor but cost increases for a large range of items that are not being required by regulators or sought by customers.

The concept of baseline expenditure is that it is the level of expenditure necessary to provide a defined level of service. Implicit is the assumption that the actual activities undertaken by a business from year-to-year to deliver services will change and there will be several one-off expenditures from year-to-year associated with the normal ebb and flow of work requirements and changes in the industry and wider business environment. For example, a business may prepare a sewerage strategy in one year, prepare a water supply demand strategy in another, or do several one-off repairs in another year. Given this, and the additional allowance provided for customer growth, it is therefore not the case that businesses should simply be able to recover increases in all opex line items. An efficient business would be expected to absorb many of these increases within their baseline and growth allowance.

Figure 3.1 provides a hypothetical and simplified example of the above. Data is only shown for a single year, but the same principle applies across all five years of RP5. Under the example below,

and all other things being equal, we would be more likely to recommend reductions to Business A's expenditure, despite it having a nominally higher efficiency factor.

Figure 3.1: Example of adjustments to baseline expenditure

	Business A	Business B
Customer growth (%)	2.0%	1.0%
Proposed efficiency factor (%)	3.0%	1.5%
Growth-efficiency factor (%)	-1.0%	-0.5%
Cost increases ($m)	4	0.3

	Business A ($m)	Business B ($m)
2019-20 Expenditure	100	100
2019-20 Adjustments	1	-2
Baseline expenditure	101	98
Growth-efficiency adjustment	-1	-0.5
Growth adjusted expenditure	100	97.5
Cost increases	4	0.3
Proposed expenditure	104	97.8
Change compared to baseline	3	-0.2

Source: Deloitte Access Economics.

The tools and approaches we have applied to consider each of the elements and the overall proposed opex package includes:

- benchmarking against historic and peer expenditure
- comparing MW's forecasts to independent forecasts of changes in key expenditure items (for example, labour and energy)
- an assessment of the extent to which the expenditure reflects government and regulator policies and requirements.

3.2 Historical controllable expenditure (2019-20)

The first step in the approach to assessing expenditure is to define efficient expenditure in the baseline year of 2019-20. As set out in the ESC's Guidance Paper, the baseline should comprise 'efficient recurring controllable costs from the last full year of actual data (2019-20) for those activities and services that are expected to be incurred throughout the next regulatory period'.[23] Accordingly, the baseline expenditure should be adjusted to remove:

- non-controllable expenditure
- one-off or non-recurring expenditure items or add any normally occurring items that did not occur in 2019-20
- ongoing costs savings or efficiency commitments that will be realised in the final year of the current regulatory period (2020-21).

In 2019-20, MW's actual total controllable expenditure was $389.2m. In its 2016 price review, the ESC approved $394.2m for 2019-20. MW's actual expenditure (before removal of adjustments) was approximately 1.3% ($5.0m) below the ESC's determination. Actual controllable opex in 2019-20 was 6.1% higher than the previous year, 2018-19.[24]

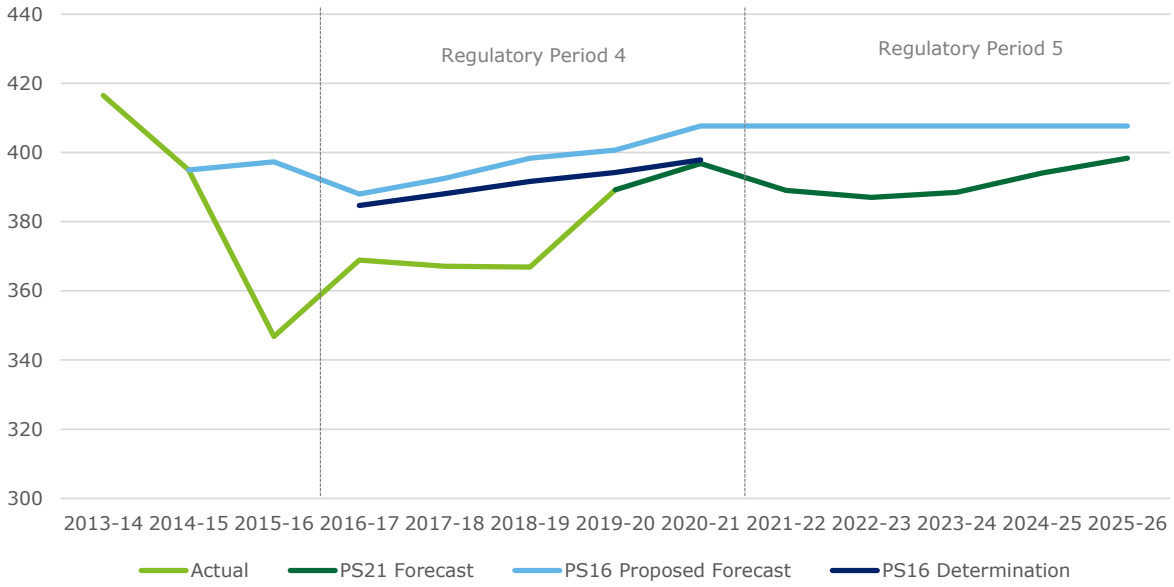
We note that total baseline controllable opex is $1.9m higher than the figures presented in MW's original price submission; this is due to revisions provided during the review process to reflect the

[23] ESC, *Western Water 2020 water price review: Guidance paper* (December 2018) 22.
[24] Deloitte analysis based on MW, *2020 Price Review Model – ESC Reviewed* (provided 17 November 2020).

final statutory accounts for 2019-20 as well as costs associated with pumping of desalination plant water from Cardinia to Silvan.

Figure 3.1 below shows opex in 2015-16 and 2018-19 was significantly lower compared to MW's PS16 forecast and the ESC's final determination. However, in the last two years there has been an increase, such that base year expenditure is expected to be closely in line with the ESC's final determination.

Figure 3.1: MW historical controllable operation expenditure ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020). Notes:

1. Base year (2019-20) actual expenditure is slightly higher than the original price submission due to revisions provided by MW during the review process.
2. Includes revised energy forecast provided by MW during the review process.

MW's actual opex in 2015-16 was 12.7% lower than forecast in PS16. MW has commented that the main driver for this reduction was the introduction of the Fairer Water Bills initiative by the Victorian Government in 2014. This involved an efficiency review of Victorian urban water corporations to identify cost savings to be passed to households. MW was required to identify and deliver significant efficiencies and meet adjusted annual targets for 2014-15 onwards, which overrode MW's proposed PS16 forecasts.

MW also noted that it outperformed its Fairer Water Bills targets in 2015-16 as a result of:

- maintenance cost savings from improved insourcing of waterways and catchment maintenance as well as realisation of further continuous improvement programs
- energy cost savings as a result of:
    - increased monetisation of Renewable Energy Certificates (RECs) due to higher market prices driving a larger benefit
    - increased mini hydro activity across the water supply system.
- insurance premium savings resulting from the Victorian Water Corporation's shared services procurement tender.

It appears that, while there was a small increase in expenditure in 2016-17, some of these efficiencies were retained in the first three years of RP5.

Opex in 2018-19 was 6.3% below the ESC's determination for that year, driven primarily by low maintenance expenditure (3.7% reduction from prior year). MW noted that the reduction in

maintenance was primarily driven by the introduction of a policy enabling the capitalisation of major inspections on critical assets that occur less than once each year. This includes inspections performed on critical water mains, sewer pipes, dams and tanks, with a scheduled frequency of more than one year.

Figure 3.1 also shows opex increased significantly in 2019-20, the base year of analysis. This appears to be driven primarily by increased actual energy costs by 20.7% from prior year, as well as an increase in external services costs (7.3% from 2018-19).

Energy costs

MW has identified that increased electricity costs were primarily driven by an increase in water volumes harvested at Yering Gorge to support Sugarloaf reservoir storages, as demonstrated in Table 3.2. This involved pumped water uphill from the Yarra River into the reservoir and resulted in higher electricity consumption. MW noted the increased volume in water harvesting in 2019-20 was a result of:

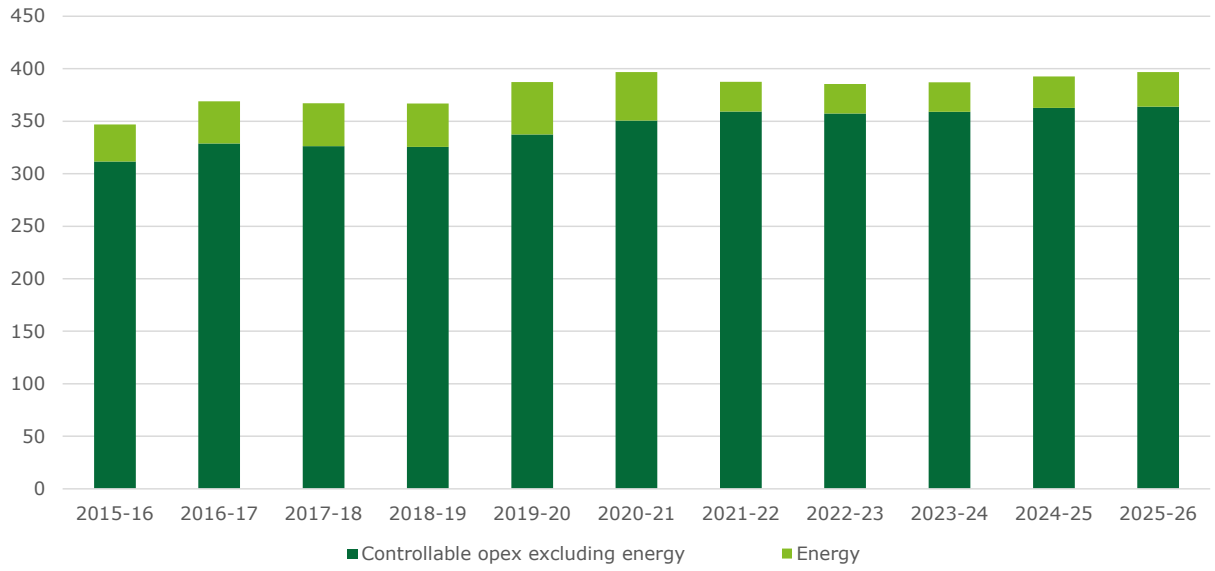
- low harvesting in prior years (2016-17 and 2018-19), due to:
    - limited pump availability during renewal works
    - poor environmental conditions due to low water levels in the Yarra River with harvesting potentially damaging habitats
- increased opportunity to harvest in 2019-20 as result of:
    - the Upper Yarra Dam upgrade enabling increase release of water into the Yarra River than past years
    - a wetter than typical January-June period enabling the harvest volumes to exceed annual average.

Table 3.2: Planned vs actual water volume harvesting at Yering Gorge (GL)

Harvest (GL)	2016-17	2017-18	2018-19	2019-20
Actual	108	101	94	166
Plan	134	114	60	90
Variance	26	13	-34	-76
Four-year average				**117**

Figure 3.2 demonstrates that removing energy costs from total controllable opex shows that 2019-20 expenditure is 3.6% higher than the previous year. Based on this, we consider that using 2019-20 as the base year is not unreasonable, noting that MW has proposed to remove energy costs from the adjusted base year (see section 3.5.1).

Figure 3.2: Historical and forecast controllable opex adjusted for energy costs ($m 2021)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020) and revised forecast energy costs provided by MW on 11 December 2020.

External services

In 2019-20 MW actual expenditure for external services was $51.2m. This is a 7.3% increase from 2018-19 expenditure ($47.7m). We note that during this time MW was undertaking increased in-sourcing of contracted works, however MW has indicated that this in-sourcing primarily impacted the maintenance cost category.

MW has identified the major drivers for this increase as billing and collection charges as a result of increased customer numbers, offset by a reduced volume of Supplementary Council Valuations (SCVs) processed, as well as five new initiatives launched in 2019-20. A short description of each activity and associated cost increase is presented in Table 3.3 below.

Overall, the increased expenditure for external services appear to be reasonable and will likely continue into the future, with exception to the Biosolids Reuse Innovation Project ($0.8m) which appears to be a one-off accounting item. Given this is not an ongoing expenditure likely to be incurred in the future, we recommend a reduction of $0.8m to the base year.

Table 3.3: Increased external services expenditure in 2019-20 from previous year ($2020-21m)

	Increase from 2018-19 ($m)	Increase (%)	Description
Billings and collections charges	0.4	2.9%	Increase in customer number bills processed offset by decreased volume of SCVs
Other	3.1	9.2%	
Water literacy	0.5		'Make Every Drop Count' campaign to drive awareness for water storages as part of State Government obligation.
Fishermans Bend and NEICs	0.6		Supporting State Government planning for State Priority Precincts as Floodplain Manager
Price submission engagement	0.2		Increased customer engagement to support MW's 2021 Price Submission

Information management	0.4		A multi-year information management program established to enable improved data usage including sharing and analytics, automation and improved information security and classification.
Biosolids Reuse Innovation Project	0.8		A one-off accrual reversal due to MW's contribution towards a biosolids reuse innovation project led by Southern Oil Refining.
Total	**3.5**	**7.3%**	

Source: MW response to Deloitte query, 11 February 2020

3.2.1 Water and sewage

In 2019-20, MW's actual total water and sewage controllable expenditure was $248.6m. In its 2016 price review, the ESC approved $253.1m for 2019-20. MW's actual expenditure (before removal of adjustments) was approximately 1.8% ($4.5m) below the ESC's determination and actual controllable opex in 2019-20 was 8.8% higher than 2018-19.[25]

MW has made a **net reduction to its baseline of $43.8m** for the following items:

- reduction for energy costs (-$44.4m), which are treated separately
- Western Treatment Plant maintenance – anaerobic pot cover reinstatement (+$2.3m)
- wet weather impact for below average sludge drying conditions resulting in lower than usual biosolid harvest volumes (+$0.2m)
- Telstra refund for charges over 2017 to 2019 (+$0.1m)
- internal Audit program for deferral of two scheduled audits (+$0.2m)
- costs associated with pumping of desalinated water from Cardinia to Silvan (-$2.87m)
- adjustment to reflect final statutory accounts for 2019-20 (+$0.63m)

This results in a total adjusted controllable baseline expenditure of $204.8m.

We note that total controllable opex is $2.24m higher than the figures presented in MW's original price submission; this is due to revisions provided during the review process to reflect the final statutory accounts for 2019-20, as well as costs related to pumping of desalinated water from Cardinia to Silvan. During the review process, MW resubmitted its base year costs to align with the statutory accounts, which was $0.63m less than originally anticipated in their submission (excluding revisions as a result of desalinated water pumping). We note that the adjustment to reflect final statutory accounts for 2019-20 was proposed by MW during the review process purely to reconcile the revised adjusted baseline opex with MW's original adjusted baseline opex ($204.8m). We consider the adjustment of does not reflect a cost that MW anticipates to incur in a normal year, and therefore recommend removing $0.63m from the base year. In line with previous practice adopted by the ESC, we consider any small variations to baseline that are not due to new regulatory obligations should generally form part of the usual ups and downs of business operations and be absorbed within the overall expenditure allowance (i.e. not be included as variations to the baseline). The definition of 'small' depends on the size of the business, however in the case of Melbourne water we consider $1m (below 0.3% of MW's total controllable opex) as a reasonable threshold, and generally consistent with thresholds in previous expenditure reviews.[26]

Three of MW's proposed adjustments to the base year are well within this threshold, and we recommend the removal of the following adjustments:

- Wet weather impact (+$0.22m)

[25] Deloitte analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)
[26] For example see Deloitte Access Economics, February 2018, *Wannon Water - expenditure review for 2018 water price review; Goulburn Valley Water - expenditure review for 2018 water price review; City West Water - expenditure review for 2018 water price review; GWMWater - expenditure review for 2018 water price review; Coliban - expenditure review for 2018 water price review;*

- Telstra refund (+$0.14m)
- Internal Audit program (+$0.15m).

We note that these adjustments each make up less than 0.09% of total controllable opex in 2019-20.

3.2.2 Waterways and drainage

In 2019-20, MW's actual total waterways and drainage controllable expenditure was $140.6m. In its 2016 price review, the ESC approved $141.1m for 2019-20 ($2020-21). MW's actual expenditure (before removal of adjustments) was approximately 0.3% ($0.5m) below the ESC's determination and actual controllable opex in 2019-20 was 1.5% higher than 2018-19.[27]

MW has made a **net increase to its baseline of $1.16m** for the following items:

- reduction for actual energy costs (-$0.4m)
- addition for wet weather impact for below average sediment drying conditions resulting in lower than usual sediment disposal ($1.1m)
- addition from a deferral of usual activities for the Sites of Biodiversity Significance (SoBS) program ($0.17m) due to COVID-19
- adjustment to reflect final statutory accounts for 2019-20 ($0.3m)

This results in a total adjusted controllable baseline expenditure of $141.8m.

We note that total controllable opex is $0.31m lower than the figures presented in MW's original price submission. Similar to above, MW resubmitted its base year costs to align with their statutory accounts, which was $0.31m less than originally anticipated in their submission. We note that the adjustment to reflect final statutory accounts for 2019-20 was proposed by MW during the review process purely to reconcile the revised adjusted baseline opex with MW's original submission ($141.8m). We consider the adjustment of does not reflect a real cost that MW anticipates to incur in a normal year, and therefore recommend removing $0.31m from the base year.

As above, we consider any small variations to baseline should form part of the usual ups and downs of business operations and therefore should be included in the overall expenditure allowance.

We accept the removal of energy costs as these have been considered separately by Melbourne Water in the price review process. However, we consider the two remaining adjustments are small variations that should be absorbed into the baseline. Therefore we recommend the removal of the proposed adjustment for the deferral of SoBS program ($0.17m).

The wet weather impact adjustment sits slightly above the $1m threshold. We note that historically 'wet' and 'dry' year adjustments to the base year have not been made by the ESC in its review process. However, MW has indicated in this instance that desilting activities completed during drier periods (that is, Summer months of December to March) was not able to be achieved due to significant flooding that occurred during Summer 2019-20. We recognise that significant flooding is likely to have an impact on MW's ability to undertake usual desilting program and therefore accept the proposed adjustment to base year.

3.2.3 Recommended adjustment to base year

In summary, we recommend removing $2.43m from MW's proposed adjusted baseline expenditure in 2019-20, reflecting:

- a reduction of $0.8m for external services related to the Biosolids Reuse Innovation Project. We have applied this reduction to the water and sewerage base year expenditure
- a removal of the increase of $0.63m for the adjustment to reflect MW's final water and sewerage statutory accounts

[27] Deloitte analysis based on MW, *2020 Price Review Model – ESC Reviewed* (provided 17 November 2020).

- a removal of the increase of $0.52m for various small variations to base year for water and sewerage services
- a removal of the increase of $0.31m for the adjustment to reflect MW's final waterways and drainage statutory accounts
- a removal of the increase of $0.17m for the deferral of SoBS program.

Table 3.4 reflects the adjusted forecast baseline controllable opex as result of removing $2.43m from baseline expenditure in 2019-20. In total the impact across RP5 to forecast baseline controllable expenditure is $12.11m.

Table 3.4: MW baseline controllable opex ($2020-21m)

	Base year 2019-20	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Water and sewerage							
MW proposed	204.77	204.26	204.16	204.06	203.95	203.85	1020.28
Recommended	202.82	202.32	202.21	202.11	202.01	201.91	1010.57
Difference	**1.95**	**1.95**	**1.94**	**1.94**	**1.94**	**1.94**	**9.72**
Waterways and drainage							
MW proposed	141.79	141.43	141.36	141.29	141.22	141.15	706.45
Recommended	141.31	140.95	140.88	140.81	140.74	140.67	704.06
Difference	**0.48**	**0.48**	**0.48**	**0.48**	**0.48**	**0.48**	**2.39**
Total							
Total proposed	346.56	345.69	345.52	345.35	345.17	345.00	1726.74
Total recommended	344.13	343.27	343.10	342.93	342.75	342.58	1714.63
Total difference	**2.43**	**2.42**	**2.42**	**2.42**	**2.42**	**2.42**	**12.11**

Deloitte Access Economics analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

3.3 Baseline growth-efficiency improvement rate

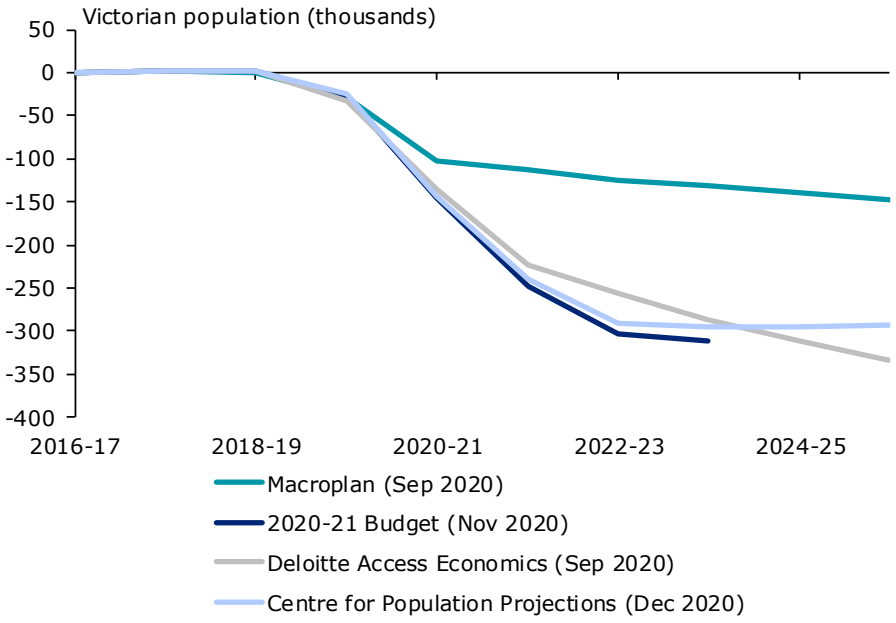
MW has proposed a cost efficiency improvement rate of 2.0% per annum over RP5. This is the same cost efficiency rate it proposed in PS16 (and was accepted by the ESC). With an assumed (population) growth forecast of 1.95%, MW has adopted a net growth-efficiency rate of -0.05% per annum. In PS16 MW adopted a growth rate of 1.8%, resulting in a net growth-efficiency improvement rate of -0.2%.

Growth rate

MW has forecast baseline expenditure growth based on pre-COVID-19 view of population growth, at 1.95%. At the request of ESC, MW also included in their price submission consideration of how a COVID-19 growth scenario impacts expenditure. Based on Macroplan's growth forecast of 1.93%, MW indicated that opex would only be reduced by $1.3m over RP5, approximately $0.26m on average per annum. This is driven by a reduction in chemical and energy costs across water and sewerage services(see Table 3.6 further below for breakdown).

As detailed in section 2.1.2, the VIF (2019) population outlook is substantially higher than more recent population forecasts. Likewise, the Macroplan growth forecasts appear high compared to other available post-COVID-19 forecasts, as demonstrated in Figure 3.3.

Figure 3.3: Victorian population forecasts level difference compared to VIF (2019)



Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

Table 3.5: Population growth forecasts

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
VIF2019 (pre-COVID)			2.17%	2.08%	2.01%	1.93%	1.88%	1.84%
Macroplan			0.97%	2.03%	1.97%	1.93%	1.88%	1.82%
Population	2.1%	1.6%	0.2%	0.4%	1.1%	1.7%		

Source: MW, 9 November 2020, *Melbourne Water Price Submission 2021;* Victorian Budget 2020-21

During the review process, MW was asked to consider the expenditure impact of adopting the Victorian Treasury's latest growth forecast, presented in Table 3.5 above. MW responded that adopting these growth forecasts, which average 1.07% in the first three years of the regulatory period and then adopting VIF2019 forecast growth in the last two years of the period, would reduce expenditure by $3.6m over RP5 compared to a pre-COVID-19 scenario of 1.95% growth. This appeared to be a very conservative estimate, noting that MW previously advised that a 0.02 percentage point reduction in growth would lead to a $1.3m reduction in opex (as shown in Table 3.6 below). Based on this we would have expected a 0.88 percentage point reduction in growth would lead to a greater reduction in operating expenditure.

In response, MW noted that the original COVID-19 scenario opex reduction ($1.3m) was erroneous as it adopted actual electricity contract prices rather than benchmark electricity prices (see section 3.5.1 for a discussion on energy costs). MW provided a revised Macroplan COVID-19 scenario reduction of $1.0m to controllable opex over, based on benchmarked electricity prices. Under these revised figures, a 0.02%reduction in growth under the Macroplan scenario results in a 0.52% reduction in controllable opex. This compares to a 0.57 percentage point reduction in growth CAGR under the DTF scenario, which MW has estimated would result in a 1.82% reduction in controllable opex (see Table 3.6).

Table 3.6: Total adjustments to controllable opex under various COVID-19 growth scenarios over RP5 ($2021-22m)

	Total original (pre COVID)	Macroplan scenario (Original)	Macroplan scenario (Revised)	DTF scenario
Assumed growth CAGR over RP5	1.95%	1.93%	1.93%	1.38%
Proposed opex ($2020-21m)		**Difference from proposed submission (pre COVID)**		
Chemicals	51.30	-0.28	-0.28	-0.99
Energy	145.82	-1.00	-0.74	-2.59
Total	**197.12**	**-1.29**	**-1.02**	**-3.58**
Percentage difference from original proposal				
Chemicals		-0.55%	-0.55%	-1.94%
Energy		-0.69%	-0.51%	-1.77%
Total		**-0.65%**	**-0.52%**	**-1.82%**

Source: Deloitte analysis based on MW supplied data, 9 February 2020

MW provided supporting models underlying these calculations, however, it is unclear how energy consumption and chemical procurement is varied as a result of the changing water and sewerage demand. Moreover, we note that because the DTF forecasts are only to 2023-24, MW has adopted VIF pre-COVID-19 population growth assumption in the remaining two years (1.9% and 1.8% in 2024-25 and 2025-26, respectively). While there is significant uncertainty regarding growth in later years of the regulatory period, we are concerned these figures remain on the upper-end of other third-party forecasts (see Appendix A) and are marginally higher than the growth forecast provided by Macroplan.

MW's response on COVID-19 scenario impacts also appears to be limited to water and sewerage services (driven by energy and chemical needs) and does not consider any reduced costs in waterways and drainage services from much lower growth rates. Although we acknowledge waterways and drainage services are driven by a range of factors aside from population growth, given MW has adopted population growth as a proxy to escalate forecast waterways and drainage baseline expenditure, we would expect some consideration of how a change in the growth rate would impact operating costs for these services.

Ultimately it is our view that MW's consideration of COVID-19 impacts on reduced future expenditure under the 1.93% scenario, provided in the price submission is likely to understate the reduction in demand and costs likely to be experienced. We would expect a greater reduction or delay in operating expenditure as a result of COVID-19 would be passed on to customers.

Efficiency improvement rate

MW's proposed efficiency improvement rate of 2.0% is in line with the rate adopted in RP4. It is slightly below efficiency targets (average % per annum) proposed by MW's major retailers, including Yarra Valley Water (2.5%), South East Water (2.3%) and City West Water (2.0%), but generally above smaller and regional businesses, as presented in Table 3.7 below.

Overall, the average net growth efficiency improvement rate across proposed by Victorian water businesses in recent price reviews is an annual average reduction of 0.2%. This is slightly higher than the reduction proposed by MW (0.05%). We acknowledge that benchmarking against other Victorian water businesses has limitations because:

- the efficiency targets below are from 2018 and therefore developed without consideration of current economic conditions

- MW's services, as a bulk water provider and catchment manager, are subject to different drivers of cost compared to other Victorian water businesses (retailers and regional businesses), and a higher proportion of expenditure is likely to comprise fixed costs.

Table 3.7: Comparison of Victorian water businesses net growth-efficiency improvement rate

Water business	Efficiency target (% avg per annum)	Growth rate (% per annum)	Net growth-efficiency rate
Goulburn Valley	3.10%	1.30%	-1.80%
GWMWater – urban	1.50%	0.50%	-1.00%
Yarra Valley	2.50%	1.70%	-0.80%
Westernport	2.70%	1.90%	-0.80%
Barwon	2.30%	1.60%	-0.70%
Wannon	1.00%	0.80%	-0.20%
Melbourne Water (2021)	**2.00%**	**1.95%**	**-0.05%**
South East	2.30%	2.30%	0.00%
North East	1.20%	1.20%	0.00%
Central Highlands	1.60%	1.60%	0.00%
South Gippsland	1.50%	1.50%	0.00%
Lower Murray – urban	1.00%	1.10%	0.10%
East Gippsland	1.20%	1.30%	0.10%
Coliban	1.50%	1.70%	0.20%
Gippsland	1.00%	1.20%	0.20%
City West	2.00%	2.60%	0.60%
South Gippsland (2020 submission)	1.00%	1.64%	0.64%

Deloitte analysis based on 2018 and 2020 Victorian water business expenditure reviews

Net growth efficiency improvement rate recommendation

With the likely impact of COVID-19 on population growth in Melbourne now clearer than when Melbourne Water prepared its forecasts, we consider MW should adopt a lower growth rate in the customer growth minus efficiency factor to roll forward opex forecasts.

For the purposes of this report we have adopted a growth rate of 1% which is broadly in line with the latest growth CAGR provided by Victorian Treasury, the Centre for Population Projections and Deloitte Access Economics, noting that we expect MW will provide an updated growth forecast in its response to the ESC's Draft Decision.[28] We recommend applying this growth rate across water and sewerage services and waterways and drainage services.

Based on MW's proposed efficiency factor of 2%, this would result in a net growth-efficiency improvement rate of -1.0% per annum. However we understand that MW has proposed a 2% efficiency rate as a 'backsolve' to achieve a target net growth-efficiency improvement rate of -0.05%. Melbourne Water has advised us that it considers a net growth-efficiency rate of -1.0% as unachievable.

We note that the intention of the ESC's net growth-efficiency improvement methodology is to set top-down improvement factors for businesses so as to:

- set targets for water businesses to achieve
- avoid a detailed bottom-up analysis of cost items and programs.

However, we accept that a net growth-efficiency improvement rate of -1.0% is among the highest improvement rates across Victorian water businesses and would be difficult to achieve given

[28] We recognise that expenditure drivers are not 1:1 correlated with population or customer growth, therefore MW may wish to consider whether there are any factors to be applied to the underlying growth assumption to determine the overall baseline growth factor.

Melbourne Water's cost structure. We note that in PS16, MW proposed a net growth-efficiency improvement rate of -0.2% per annum. As detailed in section 3.2, MW was able to significantly outperform this target during the first three years of RP4.. Taking a balanced view with the reduction to growth, for the purposes of this report we have set the efficiency target to 1.2%, resulting in a net growth-efficiency improvement rate of -0.2% per annum. This is consistent with:

- the average net growth-efficiency improvement rate proposed by Victorian water businesses from 2018 onward
- MW's net growth-efficiency improvement target from PS16.

We also note that it appears MW is proposing to derive the majority of its efficiency gains through reduced energy consumption as a result of behind-the-meter projects and automation (see section 3.5.1). We note that:

- behind-the-meter projects are primarily driven by Government initiatives and therefore not entirely attributable to MW's own drive to gain efficiencies
- efficiency gains should be across multiple cost areas rather than the result of one operational improvement.

Therefore, we consider it reasonable to impose a slightly higher net growth-efficiency improvement rate than proposed by MW to drive broader operational efficiencies across MW.

A net growth–efficiency rate of -0.2% per annum results in a reduction of $7.70m to baseline expenditure over RP5, as presented in Table 3.8.

Table 3.8: Revised efficient based year forecast ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	RP5 Total
Water and sewerage						
Baseline forecast at 0.05% net efficiency[1]	202.32	202.21	202.11	202.01	201.91	1010.57
Baseline forecast at 0.2% net efficiency	202.01	201.61	201.21	200.80	200.40	1006.03
Reduction in baseline forecast	0.30	0.61	0.91	1.21	1.51	4.54
Waterways and drainage						
Baseline forecast at 0.05% net efficiency[1]	140.95	140.88	140.81	140.74	140.67	704.06
Baseline forecast at 0.2% net efficiency	140.74	140.46	140.18	139.90	139.62	700.90
Reduction in baseline forecast	0.21	0.42	0.63	0.84	1.05	3.16
Total						
Baseline forecast at 0.05% net efficiency[1]	343.27	343.10	342.93	342.75	342.58	1714.63
Baseline forecast at 0.2% net efficiency	342.75	342.07	341.38	340.70	340.02	1706.93
Total reduction in baseline forecast	**0.52**	**1.03**	**1.54**	**2.05**	**2.56**	**7.70**

Deloitte Access Economics analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

Note: 1. Figures presented are lower than MW's price submission due to adjustment for base year, refer to Table 3.4.

3.4 Forecast variations to baseline expenditure

MW has proposed several adjustments to its controllable opex in the base year, for both water and sewerage, and waterways and drainage services. While MW has proposed a net decrease to baseline costs (based on forecast growth-efficiency factor) it has also proposed an upwards adjustment of $230.2m to forecast baseline expenditure over RP5, as presented in Table 3.9. The two most material adjustments are $154.83m for energy costs (which MW removed from its baseline due to the need to treat energy forecasts in a unique manner) and increased expenditure on its waterways and drainage function of $43.48m based on customer willingness to pay.

Table 3.9: Total adjustments to forecast baseline expenditure ($2020-21m)

Proposed baseline adjustments	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Energy adjustment to whole of business						
Energy[1]	29.81	29.61	29.65	31.27	34.49	154.83
Water and sewage						
Water Quality Management	1.83	2.57	3.74	4.04	4.59	**16.78**
Carbon Pledge	3.01	0.45	0.53	3.53	3.72	**11.23**
Waterways and drainage						
Traditional Owners	0.56	0.56	0.56	0.25	0.25	**2.17**
Marine & Coastal Act	0.33	0.34	0.34	0.34	0.34	**1.69**
WDIP - Willingness to Pay	7.80	7.96	8.30	9.48	9.94	**43.48**
Total adjustments	**43.35**	**41.48**	**43.11**	**48.91**	**53.33**	**230.18**
Forecast baseline controllable opex	**345.69**	**345.52**	**345.35**	**345.17**	**345.00**	**1,726.74**
Total controllable opex	**389.04**	**387.00**	**388.46**	**394.09**	**398.34**	**1,956.92**

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

Note: 1. Energy adjustments are higher than MW price submission due to a revision during the review process. Figures are shown as a 'whole of business' cost as revised forecast energy costs were not provided at the service area level.

Proposed energy costs are assessed in section 3.5.1. The following sub-sections review remaining forecast adjustments under each service area.

3.4.1 Water and sewerage

MW proposed a total adjustment of $28.0m to forecast baseline water and sewerage expenditure over RP5, excluding energy costs which are considered in section 3.5.1.

3.4.1.1 Water quality management

MW has proposed $16.8 million to be added to the forecast baseline opex for water quality management expenditure over RP5.

Under the *Safe Drinking Water Act 2003*, MW is required to identify, assess and develop steps to manage water quality risks. MW aims to meet the microbial health-based target (HBT) adopted by the World Health Organisation (WHO).

MW identified the need for additional expenditure in RP5 to mitigate risks related to microbial hazards at three catchments (Silvan Reservoir and all upstream sources, Greenvale Reservoir, and Cardinia Reservoir). As a result of recent risk assessments, MW has decided to change the category rating at these reservoirs from category 2 (minimal sources of contamination) to category 1 (negligible sources of contamination).

We also recognise the Safe Drinking Water Act audit 2020 found that MW needs to more systematically and credibly monitor and understand the extent of activity in its protected catchments if it is to remain classified as protected. The audit also noted MW needs to improve its preventive measures to limit that activity to as low as reasonably practicable. Additionally, MW noted unauthorised entry into water supply catchments and off-river storage areas is higher than acceptable.

Table 3.10: Breakdown of proposed water quality management opex ($2020-21m)

Component	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5

Catchment Management - Managing Unauthorised Entry	$1.80	$1.80	$1.80	$1.80	$1.80	$9.02
Catchment Management - Managing exotic fauna	-	-	$0.41	$0.41	$0.41	$1.23
Winneke UV Disinfection	-	-	-	$0.31	$0.87	$1.18
Yan Yean Water Treatment Plant	$0.03	$0.77	$1.52	$1.53	$1.50	$5.35
Total	**$1.83**	**$2.57**	**$3.74**	**$4.04**	**$4.59**	**$16.78**

Source: MW, 9 November 2020, *Melbourne Water Price Submission 2021*

Classification of these catchments as category 1 will involve new activities, including:

- development of a new compliance and enforcement program at 'high risk' sites (including education, surveillance and prosecutions) to complement the installation of new fencing[29]
- eradication of deer from the Silvan and Cardinia reservoir catchments and containing deer numbers within the larger Upper Yarra, O'Shannassy and Thomson catchments. MW noted that the current arrangements for minimising the risk of exotic fauna need to be improved to avoid the decline of water quality. The proposed opex program will maintain the category 1 rating achieved from an intensive shooting program (the costs of which are proposed to be capitalised) in the first two years of the RP5.

Cost benefit analysis provided by MW showed catchment protection (by classification to category 1) to be a more cost-effective approach to comply with HBTs. An alternative approach considered continuing to manage these 'chlorine only' system as category 2 catchments and install additional ultraviolet and/or filtration treatment at a significant capital cost (approximately $450 million). MW also notes that the prevention of contamination provides greater surety than removal of contaminants by treatment.

Based on the above, MW's proposed water quality management adjustment appears prudent and no adjustments are proposed.

3.4.1.2 Carbon pledge

MW has proposed an additional $11.2m to forecast baseline opex over RP5 to address carbon emissions reduction requirements. This is driven by two obligations for emissions reduction:

1. carbon emissions obligations for scope 1 emissions at major sewerage treatment plants under the Clean Energy Regulator's National Greenhouse Emissions Reporting Act (2007) Safeguard Mechanism
2. carbon pledge entered into with the Victorian Government through its Statement of Obligations in 2018.

Clean Energy Regulator – Safeguard Mechanism

At the federal level, MW's two major sewerage treatment plants are subject to the Clean Energy Regulator's Safeguard Mechanism, which applies to any facility that emits more than 100,000 tonnes of carbon dioxide equivalent (tCO2e) per annum (scope 1 emissions). Both the ETP and WTP have a baseline target that, if exceeded, MW must purchase carbon offsets, Australian Carbon Credit Units (ACCUs).

In 2021-22, WTP is expected to exceed the baseline for the first time, driven by both a reduction in the baseline target and an increase in emissions at WTP. To take each in turn:

- the current baseline target for WTP (145,847 tCO2e per annum) is based on a historical reported emissions baseline. From 1 July 2021, reported baselines will cease to apply due to a

[29] Within sites where water treatment is higher (e.g. Yan Yean, Sugarloaf and Tarago reservoirs) reduced effort is proposed.

recent change in the Safeguard Mechanism rules. Instead, a default emissions target of 100,000 tCO2e per annum will apply to all facilities unless the business applies to adopt a new method for determining forecast baseline emissions.[30] We understand MW has decided to rely on the default baseline rather than apply for another approach to determining the baseline target. We note defaulting to an emissions baseline of 100,000 tCO2e per annum for WTP places an additional emissions reduction cost of approximately $1.4 million over RP5, compared to the existing baseline.[31] Upon seeking further information, MW confirmed they did not attempt to apply for another approach to determining the baseline target, noting that there is no guarantee that another methodology would be accepted by the CER.[32] While this is a real obligation, we consider MW should be more proactive in applying for another methodology, rather than defaulting to the 100,000 tCO2e minimum which likely incurs an additional cost to MW's customers.

- MW is forecasting a significant rise in WTP emissions in 2021-22, and it is this increase in emissions that result in the vast majority of MW's above-baseline emissions over RP5. This is due to the large covers on the lagoons at the WTP being removed during 2021-22, which is expected to significantly increase emissions from the facility. MW notes the covers need to be periodically removed to remove scum and sludge that accumulates. In addition, the build-up of scum also damages the covers and is a safety issue (therefore cover removals provide an opportunity to repair and replace segments of the covers as required). WTP emissions are forecast to reduce back to normal levels in the remaining years of RP5.

To address these obligations, MW has proposed a budget of $3.0m to purchase ACCUs against scope 1 WTP emissions. Table 3.11 indicates this will commence in 2021-22 but will vary year to year based on changing emissions at WTP.

Table 3.11: WTP carbon offsets (ACCUs) fore CER Safeguard Mechanism (tCO2e)

	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	Total
Scope 1 WTP emissions	106,376	101,277	126,368	-	232,115	99,862	100,987	102,039	117,419	
Safeguard baseline	145,847	145,847	145,847	-	100,000	100,000	100,000	100,000	100,000	
ACCUs required					132,115	0	987	2,039	17,419	152,560
ACCU Price ($/tCO2e)					$19.42	$20.44	$21.46	$22.48	$23.50	
Cost ($m)					**$2.57**	**$0**	**$ 0.02**	**$ 0.05**	**$0.41**	**$3.04**

MW has adopted a forecast ACCU price between $19 and $24/tCO2e in line with forecasts provided by Reputex. Historically, average ACCU spot prices varied between $15.85 and $16.40/tCO2e over the year.[33] However, there is significant uncertainty around future ACCU prices as market supply is expected to become increasingly constrained and demand is anticipated to rise. Our own internal market intelligence suggests these prices appear reasonable, if perhaps at the lower end of expectations in later years. Therefore, we accept the proposed cost, noting that MW is implicitly taking on a degree of risk for their customers if prices do rise or there is a supply shortage.

Victorian carbon pledge

[30] A facility may apply to the CER to adopt a new baseline based on a preferred approach (reported, calculated, production-adjusted or benchmark), otherwise a default emissions baseline of 100,000 tCO2e will apply.
[31] Based on the ACCU price (real $/tCO2e) provided by MW.
[32] MW response to Deloitte query, 22 December 2020.
[33] Clean Energy Regulator, 3 September 2020, *Quarterly Carbon Market Report* p6 <http://www.cleanenergyregulator.gov.au/DocumentAssets/Documents/QCMR%20June%20Quarter%202020.pdf>

As part of the Victorian Government's policy commitment to reach net zero greenhouse gas emissions by 2050, MW pledged to reduce scope 1 and 2 emissions in May 2017, along with other Victorian water utilities. MW has committed to a reduction of 50% by 2024-25 from a baseline of 408,760 tonnes CO_2-e per year. This was formalised by the signing of a Statement of Obligations (Emission Reduction) in 2018.[34]

MW has proposed $5.8m to purchase remaining carbon offsets to meet this pledge in 2024-25 and 2025-26. Table 3.12 demonstrates that MW forecasts a need to procure 523,931 tCO2e of offsets at a price of $11.20/tCO2e. This price is based on the mid-point of two scenario projections of international carbon markets undertaken by the United States Environmental Defense Fund in 2018.[35] Although this report is now slightly dated, we understand that there are limited public forecasts of international carbon prices. Similar to the ACCU market, there is significant uncertainty around future availability and price of carbon offsets. Based on our internal market intelligence the adopted price appears reasonable, noting that under the carbon pledge MW's carbon offsets must comply with the National Carbon Offset Standards (NCOS, now known as the Climate Active Carbon Neutral Standard). [36] This restricts the types of offsets available to MW, noting NCOS verified carbon offset products will likely incur a price premium.

We also acknowledge that under the Statement of Obligations, water utilities are generally expected to aim to directly abate carbon emissions rather than procure carbon offsets. However, due to the limited opportunities in reducing emissions at its sewerage treatment plants, MW is able to procure carbon offsets to address scope 1 emissions. We note MW has also included scope 2 emissions in its proposed carbon offset budget. However, in accordance with the Statement of Obligations, MW will need to directly abate these scope 2 emissions. We accept the budget proposed for the carbon offset of scope 2 emissions, noting that MW may need to consider any cost implications of scope 2 emissions abatement.

Table 3.12: Carbon offsets for Victorian carbon pledge (tCO2e)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total
Total emission (Scope 1 & 2)	610,079	478,689	478,543	471,217	470,933	2,509,461
Minus ACCUs acquired for Safeguard Mechanism	(132,115)	0	(987)	(2,039)	(17,419)	(152,560)
Victoria Carbon Pledge Target	N/A	N/A	N/A	204,380	204,380	408,760
Total offsets required for carbon pledge				264,797	249,134	513,931
Price (real $/t-CO2e)				$11.24	$11.24	
Cost (real $m)				**$2.98**	**$2.80**	**$5.78**

Additional programs

In addition to the carbon offset budget, MW has proposed an additional $2.5m for a range of carbon reduction activities:

- development of a carbon forestry project to gain expertise in self-generating offsets and help meet customer preferences for local offsets ($0.1 million).
- scope 1 abatement projects ($0.9 million), emission measurement ($0.7 million) and investigations ($0.2 million), and associated labour and other supporting expenditure ($0.4 million).
- additional energy storage and scope 2 abatement projects to support the Carbon Pledge ($0.2 million).

[34] Statement of Obligations (Emissions Reduction) signed 14 March 2018
[35] MW, August 2020, *Pricing Submission Information Supplement: Carbon Offsets*
[36] Statement of Obligations (Emissions Reduction) signed 14 March 2018

Overall, MW has a clear obligation to undertake carbon emissions reduction and the proposed expenditure appears reasonable.

3.4.2 Waterways and drainage

MW has proposed an additional adjustment of $47.3m to waterways and drainage opex over RP5 (excluding energy). This is driven by new obligations under the *Water Act (1989)* (the Water Act) and *Marine and Coastal Act 2018*, as well as customer driven initiatives based on willingness to pay study commissioned by MW.

3.4.2.1 Traditional Owners

In 2019, amendments to the Water Act imposed new obligations on MW to consider opportunities to provide for Aboriginal cultural values as well as social and recreational values of waterways. In practice, these obligations require MW to:

- consider aboriginal cultural values and uses
- consult and engage with traditional owners through strategic planning and development, and
- integrate economic, environmental and equity considerations with Aboriginal cultural considerations.

MW has proposed $2.2m of additional opex ($0.43m per annum on average) above the baseline over RP5 to address these new obligations. The forecast opex includes support for formal partnerships with traditional owners as well as research agreements allowing traditional owners to document and determine their cultural values for three of the five major waterways.

Given the new obligation, the proposed expenditure appears reasonable.

3.4.2.2 Marine & Coastal Act

MW has new obligations under the Marine and Coastal Act, to provide technical advice on coastal erosion upon request by the Minister for Water. This includes matters relating to the marine and coastal environment in Victoria. MW may also be required to provide advice to DELWP, councils and property owners.

MW forecast $1.5 million of additional costs ($0.34m annually) associated with these obligations based on similar advice-based programs. While we generally consider any small variations should form part of the usual ups and downs of business operations, given this is a new obligation that MW must meet on an ongoing basis, we consider it reasonable to include this expenditure in the forecasts.

3.4.2.3 Willingness to pay – customer derived levels of service

In February 2020, MW commissioned a study to identify service preferences and determine customer's willingness to pay for them. The study, undertaken by Newgate Research using a stated preference survey, suggests that customers are willing to pay an additional $7.92 on their annual bill for a higher level of waterways and drainage services than their current baseline.[37]

Based on this study, MW has proposed a cumulative uplift of $47.3m to waterways and drainage expenditure over the period, a 32% increase on existing (base year) expenditure. Ultimately, MW has justified a number of projects primarily on the basis of the study.

The proposed expenditure accounts for 6.3% of MW's total waterways and drainage controllable opex over RP5. MW indicated that $3.8 million of this will be absorbed within efficiency and growth factor hurdles. MW has proposed the remaining $43.5 million as an addition to the efficient base year. MW has noted that the proposed expenditure would equate to a customer bill increase of roughly $1 per annum. [38]

MW also established a Waterways and Drainage Customer Council (WDCC), which endorsed at least a 5% increase in charges for improved waterways and drainage services.

[37] MW, 9 November 2020, *Melbourne Water Price Submission 2021* and MW response provided
[38] Deloitte analysis based on MW, 9 November 2020, *Melbourne Water Price Submission 2021*

Table 3.13: Customer derived levels of services new expenditure ($2020-21m)

Activity	***Base year***	***Proposed expenditure***			***Cumulative cost over RP5***		
	2019-20	*Annual average*	*Average annual uplift*	*% change*	*Base year aggregate*	*Proposed aggregate*	*% change*
Managing Litter and Pollution	$1.1	$1.1	$0.1	0%	$5.5	$5.7	4%
Stormwater quality treatment assets	$11.3	$16.1	$4.8	42%	$56.5	$80.4	42%
Large Scale Stormwater Harvesting	$0.8	$1.5	$0.7	88%	$4.0	$7.5	88%
Vegetation for Environment	$12.7	$14.1	$1.4	11%	$63.5	$70.6	11%
Wetland Condition	$0.9	$1.2	$0.3	33%	$4.5	$6.0	33%
Estuary Condition	$0.2	$0.2	$0.0	0%	$1.0	$0.9	-10%
Vegetation for Amenity	$1.4	$2.1	$0.7	50%	$7.0	$10.4	49%
Land access (retarding basin activation)	$0.2	$0.3	$0.1	50%	$1.0	$1.7	70%
On water access (recreational paddling access)	$0.0	$0.0	$0.0			$0.1	
Flood Preparedness	$0.3	$0.6	$0.3	100%	$1.5	$3.0	100%
Flood Mitigation	$0.3	$1.1	$0.7	267%	$1.5	$5.3	253%
Waterway restoration (liveable waterway corridors)	$0.0	$0.0	$0.0			$0.2	
Community involvement in waterways	$0.2	$0.5	$0.4	150%	$1.0	$2.7	170%
Totals (annual)	***$29.5***	**$38.9**	**$9.5**	**32%**	**$147.3**	**$194.6**	
Cumulative uplift to meet customer service level expectations						**$47.3**	
Absorbed within efficiency and growth factors						**$3.8**	
Additions to efficient base year – cumulative						**$43.5**	

Source: Deloitte Access Economics analysis based on MW, 9 November 2020, *Melbourne Water Price Submission 2021*

As presented in Table 3.13, MW is proposing a substantial increase across of range of service areas, most notably (by average annual uplift and % change):

- Stormwater quality treatment assets - $4.8m (42%) uplift per annum
- Vegetation for the environment - $1.4 (11%) uplift per annum
- Flood mitigation - $700k (267%) uplift per annum
- Large scale stormwater harvesting - $700k (88%) uplift per annum
- Community involvement in waterways - $400k (150%) uplift per annum.

We recognise that MW has made an effort to engage directly with end customers to identify preferences for levels of service and expenditure. We also acknowledge the difficulty in deriving a realistic view of customer willingness to pay through stated preference surveys.

During the review process, ESC has engaged a third party consultant to provide an expert review of the willingness to pay study. Although the results of this work are not yet available, and we understand the ESC has been in discussions with MW to gain a greater understanding of the methodology and modelling underpinning the study, we also understand that the ESC has concerns about the extent to which the results can be relied upon.

Given this, we have considered the evidence or justification for the projects over and above willingness to pay. For others we consider there is a strong case for inclusion over and above willingness to pay – for others this is less clear and we have recommended their removal from the forecasts pending the ESC's review of the willingness to pay work.

In reviewing the initiative we note that MW has indicated many are consistent with, or driven by, the Healthy Waterways Strategy and/or the Waterways and Drainage Investment Plan (WDIP). We recognise that the Healthy Waterways Strategy is a comprehensive document which involves various stakeholders and was approved by the Minister for Water in 2018. However, we also note that the Healthy Waterways Strategy does not include costings beyond 2021 and that the WDIP is ultimately subject to review by the ESC through this price review process.

The aggregate uplift in expenditure proposed is significant and should be viewed in the context of cost pressures on customers and businesses, particularly during the current economic environment. We have kept these factors in mind when considering proposed expenditure below.

Table 3.14: Activities and drivers for increased waterways and drainage expenditure

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
Managing Litter and Pollution	$0.50	• Clean-up of new wetland assets ($0.2m) • Litter removal from MW land ($0.11m) • Opex to inspect and maintain investment in 5 new litter trap assets ($0.02m) • Litter investigation for one creek with a serious litter problem (Dandenong Creek) ($0.15m)	• Approximately 9 new wetlands per annum and increased land area to maintain from land development works • Investment in 5 new additional litter traps	We consider the anticipated new wetlands and land area handed over by developers (based on historical levels) is part of business as usual activities and should be adequately captured in the growth-efficiency baseline opex. We also note that MW expects developer contributions will decline from 2018-19 levels (see Appendix A) and therefore assuming a continuation of historical levels of developer contributions may overstate required opex for new wetlands. We consider the relatively small amount of additional litter expenditure should be able to be incorporated within baseline expenditure.
Stormwater quality treatment assets	$24.00	• Wetland maintenance and sediment disposal ($20.5m) • Partner capacity for stormwater treatment ($3m) • Research to inform most effective stormwater treatment systems and locations ($0.5m)	• On average approximately 9 new wetlands per annum from land development works requiring maintenance to comply with State Environmental Protection Policy obligations ($1.5m) • Increased sediment disposal due to ageing asset base and backlog from 2016 ($6.5m) • Increased landfill levy for sediment disposal ($8 m) • Support capex for stormwater harvesting schemes, justified based on the Healthy Waterways Strategy ($4.5m) • Co-investment with partners; MW has indicated that partnerships leverage a co-investment of $1.30 for every $1 MW invests ($3m)	As above, we consider the anticipated new wetlands and land area handed over by developers (based on historical levels) is part of business as usual activities and should be captured in the growth-efficiency baseline opex. We understand MW is facing increasing cost pressures on sediment disposal as a result of a backlog of disposal from RP4, an ageing asset base and increasing landfill levies. Therefore, we have maintained $14.5m over RP5 in the forecasts. MW has sought an additional $4.5m associated with capital investment in stormwater harvesting schemes, including in Upper Merri Creek ($49m capex), Sunbury ($24m capex) and regional schemes ($25m capex). MW provided Business Needs Identifier (BNI) case for each of these stormwater harvesting projects, which identified the main driver as meeting objectives of the Healthy Waterway Strategy. While the BNI cases did not quantify non-market benefits (such as waterway condition and value of waterway health), we consider the BNI cases did not sufficiently demonstrate that each of the projects would result in a net incremental benefit. We also note that while the BNIs identified opportunities for stormwater harvesting, they did not identify how

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
			• Research ($0.5m)	harvested water would be used, which would be a major driver for the potential benefits derived from a scheme. While there can be merit in stormwater harvesting schemes, further scoping of the proposed projects' uses and benefits, and undertaking a more robust cost-benefit analysis is necessary to justify the schemes. On this basis we have removed capex ($98m) and opex ($4.5m) related to stormwater harvesting schemes from the forecasts. While MW has indicated that partnerships leverage a co-investment of $1.30 for every $1 invested by MW, the benefits of such investments are unclear. Therefore, it is hard for us to assess the merits of this expenditure over and above willingness to pay and have removed it from the forecast. MW was not specific about the research project to be undertaken to inform most effective stormwater treatment systems and locations and therefore it is hard for us to assess the merits of this expenditure over and above willingness to pay. We have therefore removed it from the forecast.
Large Scale Stormwater Harvesting	$3.50	Support delivery and operation of 8 GL of stormwater harvesting for Upper Merri Creek, Sunbury, and regional areas.	Investment in new stormwater harvesting schemes justified based on achieving the objectives of the Healthy Waterways Strategy which is approved by the Minister for Water.	As above, it is our view that there is insufficient evidence of the merits of the proposed stormwater harvesting schemes over and above willingness to pay and we recommend a reduction in opex of $3.5m over RP5, as well as the reduction in capex ($98m) noted above.
Vegetation for Environment	$7.00	Maintenance of an additional 440 Ha of vegetation, contributing to a total of 5,000 Ha under the program	Increased expenditure proposed to maintain existing levels of service. Modelling by the University of Melbourne indicates that maintaining existing levels of expenditure would result in a likely decline in waterway condition in all five major catchments,	The benefits of this expenditure are difficult to quantify, however we note that modelling suggests that maintaining existing expenditure would result in a decline in waterway condition. Given this we have retained the expenditure in the forecasts.

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
			including the irreversible decline of high and very high-quality vegetation areas.	
Wetland Condition	$1.50	An uplift in spending is proposed to manage 20 priority wetlands to benefit wildlife. This includes improving in-stream habitats including creeks, rivers, wetlands and estuaries, and the different elements that contribute to healthy waterways. This involves working closely with private landholders (on whose properties these wetlands are mostly found) taking a more proactive rather than reactive approach.	Increased management of wetlands is proposed under the Healthy Waterways Strategy which indicates that increased action and investment is required to manage the threats they are facing, particularly climate change pressures.	There are limited details regarding the benefits of this expenditure although we note that it is difficult to quantify benefits for projects of this nature. We have removed it from the forecast pending the ESC's review of the validity of the WTP work.
Estuary Condition	$0.00	No increase.		
Vegetation for Amenity	$3.50	Vegetation will be improved and programmed maintenance undertaken to maintain existing amenity levels, this includes opex to support investment in: • 14 ha (50% of current) of streamside vegetation established for social value outcomes • 50 ha (4% of current) of streamside vegetation established for urban cooling outcomes.	Increased expenditure proposed to maintain existing levels of service. Modelling by the University of Melbourne found that if current levels of investment are maintained, then it is likely that the Yarra, Maribyrnong, Werribee and Westernport catchments will experience a decline in some social key value condition (amenity, community connection and recreation) over the next fifty years. Other drivers to maintain vegetation for amenity includes MW's Statement Obligations to, "effectively integrate economic, environmental and social	Noting the modelling that suggests that without increases in spending there will be a decline in service levels, we have retained this expenditure in the forecasts.

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
			objectives into business operations and support sustainable and liveable communities".	
Land access (retarding basin activation)	$0.50	Maintenance of 7 ha (3-4 sites) of newly activated retarding basins for public, including: • grass cutting • water sensitive urban design (i.e. maintenance of bioretention system) • graffiti removal.	Increasing recreational space for community in line with MW's Ministerial Letter of Expectations (2018-19), Water for Victoria, and MW's Statement of Obligations.	We have included this project in the forecasts noting its size and the strong Government support for increased community use of public assets.
On water access (recreational paddling access)	$0.10	One-off $90,000 investigation to identify priority locations for recreational use on the Moonee Ponds Creek to inform the PS26 submission around on-water access assets.	Identifying opportunities for increased recreational space for community.	Similar to the above project we have retained this project in the forecasts noting the strong Government support for increased community use of public assets.
Flood Preparedness	$1.50	MW's Waterways and Drainage Investment Plan identified key activities as: • community flood education in partnership with Victoria State Emergency Service (VICSES)	Meeting objectives of the Healthy Waterways Strategy.	During the review process we requested further information around the costs and benefits of flood preparedness. MW provided analysis undertaken by Jacobs in 2020 on the cost of flooding to Melbourne. The report identified the Average Annual Damage (AAD) of floods is approximately $735m. However, there was limited information regarding the net benefits (that is, avoided damages compared to expenditure required) for specific flood preparedness activities. MW has indicated that flood preparedness is a less mature program and

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
		• flood warnings including monitoring and agency notifications before, during and after flood events, and flash flood warnings and notification to residents via SMS in pilot areas • collaboration with the SES and local government in developing and reviewing flood emergency management plans.		requires further research for calculating these benefits, which is currently underway. We endorse MW's decision to undertake this research, however, we consider existing information is insufficient to justify the project at this time. Therefore, we have removed this project from the forecasts, pending the ESC's review of willingness to pay.
Flood Mitigation	$3.50	Undertake the Flood Risk Reduction Program, a pilot program to trial flood resilience strategies on approximately 12 properties that have experienced repeated flooding, This will predominantly be to reduce flooding from above to below floor level to provide greater protection.	Meeting objectives of the Healthy Waterways Strategy.	MW has indicated that this program will target private properties that do not meet current drainage standards, as they were constructed prior to 1970s when the standards were introduced. As above, MW has provided information on the overall costs of floods to Melbourne, however no specific benefits for this program. While we recognise it is a pilot program, the expenditure is relatively large for a relatively small number of private properties. Moreover, we question the prudency of $3.5m expenditure, to be spread across the whole customer base, to support a small number of private properties. Therefore, we have removed this project from the forecasts, pending the ESC's review of willingness to pay.
Waterway restoration	$0.00	No cost increase		

Activity	Est. Total uplift RP5 ($m)	Activities involved	Driver (excluding willingness to pay study)	Discussion
Community involvement in waterways	$2.00	New community engagement programs will include: • waterway informational signage and infographics ($0.2m) • community events - River Blitz ($0.04m) • Social media ($0.03m) • Interactive digital media ($0.01m)	Customer preferences.	Limited justification beyond customer preferences from the willingness to pay study was provided for this activity. Therefore, we have removed this project from the forecasts, pending the ESC's review of willingness to pay.

Deloitte analysis based on:

- MW responses to Deloitte queries provided 8 December 2020, 15 January 2020, 5 February 2020 and 9 February 2020
- Supporting documents, including the WDIP, the Healthy Waterways Strategy, Regional Stormwater Harvesting for Healthy Waterways Allocation, Sunbury Stormwater Harvesting Infrastructure Allocation, Upper Merri Creek Stormwater Harvesting Allocation, Stormwater Portfolio – Litter Management Allocation, Waterway Social Vegetation Condition Allocation, Activation of MW Retarding Basins Allocation, and Land Development Works Allocation.

Recommendation

Based on the analysis above, and pending the ESC's assessment of the willingness to pay study, we recommend a total reduction of $22m over RP5 in relation to increased opex for waterways and drainage services. We have applied an average reduction of $4.4m per annum. A summary of our recommendation for each service area is provided in Table 3.15 below.

In addition, we recommend a reduction of $98m in capital expenditure over RP5 associated with proposed stormwater harvesting schemes. We consider this reduction should be included as part of the overall capital program reduction of $50m per annum - further details are in section 4.9 below.

Table 3.15: Recommended adjustment to waterways and drainage customer derived levels of service expenditure increase ($2020-21m)

Activity	Proposed Average annual uplift ($m)	Decision	Annual reduction					
			2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Managing Litter and Pollution	0.1	Remove full amount	0.10	0.10	0.10	0.10	0.10	0.50
Stormwater quality treatment assets	4.8	Accept $2.9m p.a.	1.90	1.90	1.90	1.90	1.90	9.50
Large Scale Stormwater Harvesting	0.7	Remove full amount	0.70	0.70	0.70	0.70	0.70	3.50
Vegetation for Environment	1.4	Accept full amount	0.00	0.00	0.00	0.00	0.00	0.00
Wetland Condition	0.3	Remove full amount	0.30	0.30	0.30	0.30	0.30	1.50
Estuary Condition	0	Accept no change	0.00	0.00	0.00	0.00	0.00	0.00
Vegetation for Amenity	0.7	Accept full amount	0.00	0.00	0.00	0.00	0.00	0.00
Land access (retarding basin activation)	0.1	Accept full amount	0.00	0.00	0.00	0.00	0.00	0.00
On water access (recreational paddling access)	0.1 (once off)	Accept full amount	0.00	0.00	0.00	0.00	0.00	0.00
Flood Preparedness	0.3	Remove full amount	0.30	0.30	0.30	0.30	0.30	1.50
Flood Mitigation	0.7	Remove full amount	0.70	0.70	0.70	0.70	0.70	3.50
Waterway restoration (liveable waterway corridors)	0	Accept no change	0.00	0.00	0.00	0.00	0.00	0.00
Community involvement in waterways	0.4	Remove full amount	0.40	0.40	0.40	0.40	0.40	2.00
Recommended reduction			4.40	4.40	4.40	4.40	4.40	22.00

Deloitte Access Economics analysis

3.5 Individual controllable expenditure items

3.5.1 Energy

MW's energy costs account for 12.8% of total controllable opex in 2019-20. These costs have been removed from base year expenditure and a benchmarked (lower priced) electricity cost has been proposed for RP5. This is a continuance of the approach adopted in the PS16 expenditure review whereby a benchmarked electricity price has been used for forecasting purposes rather than MW's actual energy prices, which are significantly higher than market rates due to a long-term contract previously entered into.

MW has forecast actual energy costs will be $185.8m over RP5[39] compared to $218m in RP4 (noting the final year 2020-21 is based on forecast actual energy cost).

Consistent with the ESC's determination for its 2016 price review, Melbourne Water considers the price premium which MW pays for its energy contract should not be entirely paid by customers. In line with this view, MW has provided a forecast energy price benchmark made up of the components set out in Table 3.16 below.

Table 3.16: Proposed energy benchmark cost methodology

Energy cost component	MW Proposed approach
Electricity consumption	Total electricity consumed forecast on a site-by-site basis (noting there is no reduction for energy used from new on-site generation), with a reduction for desalination pumping costs which MW propose to treat as a cost pass through.
Wholesale energy price	An energy price of $87.10/MWh over the forecast period based on: • Wholesale price of $72.60 per MWh based on the ESC's Minimum electricity feed-in-tariff to apply from 1 July 2020. • A 20% additional mark-up to the wholesale price to allow for retail margin.
Network charges	A 25% mark-up on forecast energy costs, this mark-up is based on historical network costs as a proportion of MW's energy bill.
Electricity feed-in income	Anticipated exported energy multiplied by the wholesale energy price ($72.60/MWh).

Deloitte Access Economics analysis based on MW, 9 November 2020, *Melbourne Water Price Submission 2021*

In its submission, MW proposed $147.3m as an adjustment to baseline for energy costs over PR5, based on the benchmarked price. During the review process, MW provided a revised benchmark energy cost of $154.8m over RP5, representing adjustments to wholesale and network charges for:

- removal of electricity consumption related to pumping of desalinated water from Cardinia to Silvan (which MW has proposed to treat as a cost pass through, see section 3.5.1.5)
- additional electricity exported to the grid related to hydro revenue typically accrued.

As presented in Figure 3.4 below, a benchmark energy cost of $154.8m is approximately $31.0m per annum on average, higher than the average benchmark energy cost determination in 2016 of around $25.8m. It's not clear whether MW is seeking to recover the full revised energy cost of $154.8m, noting that although these revised forecasts were provided to Deloitte, they were not included in MW's revised pricing template provided to the ESC. MW should clarify in its response to the Draft Decision whether they are seeking to recover $158.8m or $147.3m from customers. In principle, we are comfortable with the adjustments associated with the removal of pumping energy related to Desalinated Water Orders. However, we did not receive the underlying methodology for how these cost adjustments were estimated, particularly in relation to the network charge adjustment of $14m over RP5. Therefore, we are unable to validate whether the adjustment is efficient and reasonable.

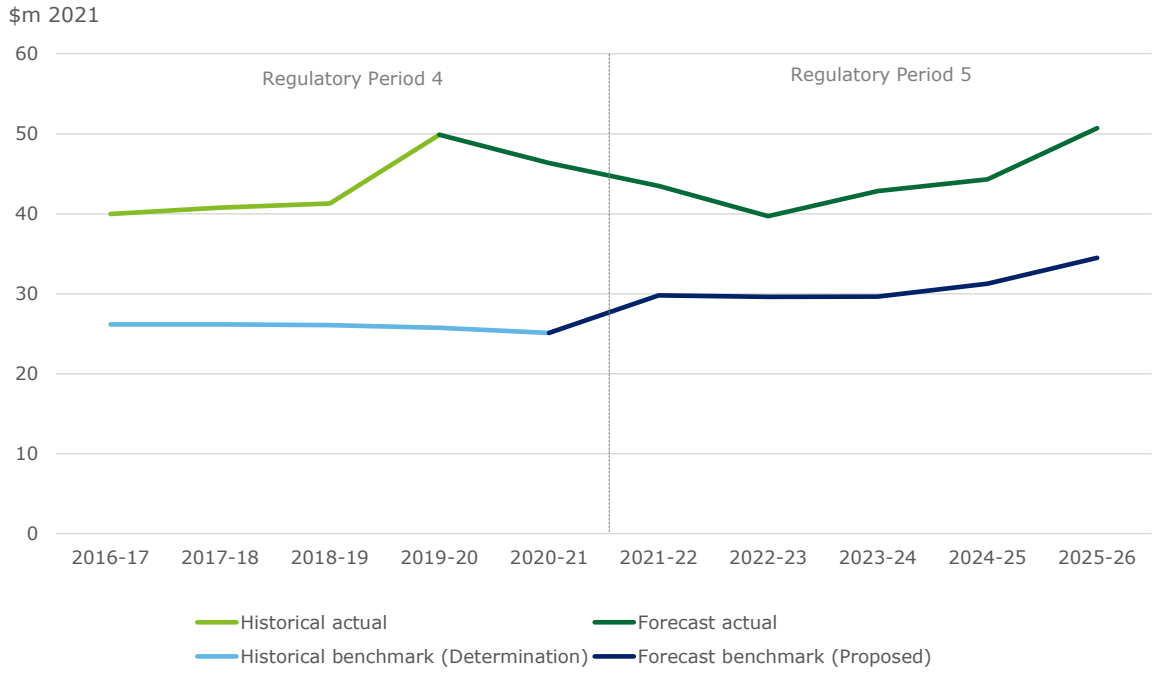
Moreover, the way in which MW has included its energy expenditure in its forecasts is somewhat complex, and this has proven challenging for our analysis. Our understanding, based on Melbourne Water's explanation, is that MW:

[39] Note that MW's submission suggests that total energy costs will be $221m over RP5, however, this includes electricity consumption that will be avoided from behind-the-meter generation and automation. Excluding avoided grid consumption from forecast energy results in a total actual cost (including the price premium) of $185.8m.

- included a net $185.8m in its initial opex cost build up, (i.e. $221m less $35.2m). The $221m reflects $35.2m of costs that that will not actually be purchased in the next regulatory period due to proposed behind the meter generation and automation.
- removed $221m to generate the total opex figure net of electricity costs, however, have implicitly kept $35.2m in 'efficiency savings' as part of the baseline 2% efficiency target (at the full contract rate)
- added back $154.8m which reflects the benchmarked cost of electricity (including electricity which will not be purchased)

As such, we have found it somewhat difficult to understand and assess MW's proposed energy allowance. Overall, MW has indicated it will only recover $119.6m ($154.8m less $35.2m) from customers, however, given the complexity in the calculation of energy costs and the relationship between energy costs and the overall efficiency target we are unable to confirm with certainty whether this is the case.

Figure 3.4: MW historical and forecast energy costs, actual and benchmark ($m 2021)



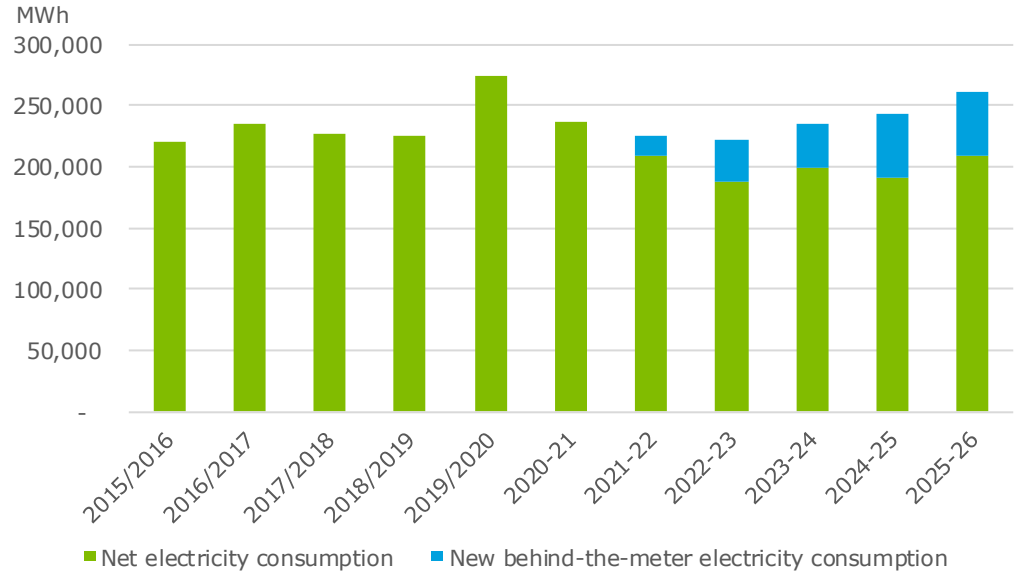
Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020) and revised forecast energy costs provided by MW on 11 December 2020.

3.5.1.1 Electricity consumption

Over RP4, MW's electricity consumption averaged about 239GWh per annum. However, in 2019-20 electricity consumption peaked at 274GWh. This is primarily due to increased pumping at Yering Gorge (see section 3.2). Because 2019-20 energy costs are removed from the base year, cost increases associated with this higher than usual consumption have not been carried forward in the baseline forecast.

MW has forecast an annual average electricity consumption of 238 GWh over RP5 which includes new behind-the-meter generation that is self-consumed. Figure 3.5 demonstrates that total electricity consumption is expected to fall in 2021-22 and rise towards the end of the regulatory period. The volume of electricity provided through new behind-the-meter generation (shown by the blue bar) increases as a result of new solar capacity and energy reductions.

Figure 3.5: Historical and forecast electricity consumption (MWh)



Source: Forecast energy costs provided by MW on 11 December 2020.

We consider the forecasts of consumption provided by Melbourne Water are reasonable.

3.5.1.2 Wholesale energy price

MW's adopted benchmark wholesale price, which is based on the ESC's feed-in-tariff (FiT) Determination for 2020, is a reasonable benchmark. We note that while the determination is now a few months old and only provides a static figure for 2019-20 (i.e. it is not a forecast for RP5), it is below the forecast wholesale energy prices developed by the Australian Energy Market Commission in their 2019 Residential Electricity Price Trends report.[40] Our own internal electricity market analysis suggests a wholesale price of $72.60/MWh is reasonable over the RP5 period. In addition, MW has assumed a mark-up of 20% to allow for retail costs. Under the ESC's Victorian Default Offer energy bill cost-stack for 2021 retail costs (including margin) make up 18% of the standard bill. Based on this we consider MW's assumed mark-up of 20% is not unreasonable, albeit on the upper bound.

3.5.1.3 Network tariffs

MW has based forecast network charges on historical charges, accounting for future changes in consumption. On 3 December 2020 the five Victorian distribution networks (Powercor, CitiPower, United Energy, Jemena and AusNet Service) submitted their revised regulatory proposals to the Australian Energy Regulator (AER) for the 2021-22 to 2025-26 regulatory period. On average, they are proposing a 13% reduction in network prices in the first year of the regulatory period. MW's proposed network charges do not take these changes into account and MW has suggested that price reductions proposed by distribution businesses will primarily be passed through to residential and small businesses, rather than large commercial and industrial site (which make up around 90% of MW's network charges). MW has referred to Ausnet Services' revised regulatory proposal which estimates the average final bill reduction for large customers will be between 0.7% and 1.5%, despite the proposed price X-Factor being 6.04% in 2021-22.[41] Reflecting this information, during the review process MW proposed a reduction in network tariffs of 1.5% for large sites and 5% for small sites and other non-demand tariffs.

[40] Australian Energy Market Commission, December 2019, *Residential Electricity Price Trends 2019*, p 10 <https://www.aemc.gov.au/sites/default/files/2019-12/2019%20Residential%20Electricity%20Price%20Trends%20final%20report%20FINAL.pdf>

[41] AusNet Services, 3 December 2020, *Electricity Distribution Price Review 2022-26: Revised Regulatory Proposal,* p9,210 <https://www.aer.gov.au/system/files/AusNet%20Services%20-%20Revised%20Regulatory%20Proposal%20-%202021-26%20-%20December%202020.pdf

However we note that:

- Ausnet Services accounts for about a third of MW's network charges, and other distribution businesses have identified significant bill reductions to large customers, for example Jemena have estimated a 15% reduction in large customer bills[42]
- the estimated impact on customer bills are also driven by other assumptions adopted by the network business (e.g. consumption, demand time of use and capacity) and therefore is a less appropriate proxy to forecast network tariff changes
- on balance the final determination made by the AER is likely to apply a larger price reduction than the rates proposed by distribution businesses in their revised submissions.

Based on this, we believe MW's estimate of network charges is overestimated by $8.47m. Table 3.17 demonstrates our approach to estimating the network charge, using the following methodology:

1. Estimate forecast variable charge:
   - determine the proportion of consumption in each distribution zone in the base year, due to limited information provided this is based on consumption of large sites only
   - determine the weighted average variable charge across distribution zones in the base year, due to limited information this is based on large sites only
   - calculate the weighted average X-Factor across distribution zones, based on the proportion of consumption. This was estimated to be a reduction of 13.45% in 2021-22 followed by an annual reduction of 0.46% over the remaining period
   - apply the weighted average X-Factor to the base-year variable charge to determine the forecast variable charge
   - multiply the forecast variable charge by MW's forecast total grid-based electricity consumption (including small site consumption), resulting in a total variable charge of $13.96m over RP5.
2. Estimate the forecast fixed network charge:
   - determine the total fixed network charge in each distribution zone in the base year, due to limited information this cost covers large sites only
   - apply the X-Factor for each distribution zone to the actual fixed charge incurred in 2019-20 to calculate the forecast fixed network charge across large sites
   - noting that small sites also incur a fixed charge, we have applied a 7% increase to the forecast fixed network charge. The estimated 7% reflects the ratio of small site network charges to large site network charges forecasted by MW over RP5
   - this results in a total fixed charge of $24.3m over RP5.
3. An additional allowance for other costs included in the network charge (including market and renewable costs), based on MW's forecast charges as per the Envizi model provided.

This approach draws together various pieces of data available to estimate the forecast variable and fixed network charges based on a reduction in network tariffs. We also note that this approach assumes there is no change in network tariffs in 2020-21.

Table 3.17: Forecast energy cost reduction ($2020-2021m)

Distribution zone	Base year	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
	Weighting[1]	X Factors					
Ausnet Services	33%	6.04%	1.23%	1.23%	1.23%	1.23%	
Jemena	7%	11.22%	0.90%	0.90%	0.90%	0.90%	
Citipower	1%	15.66%	0.00%	0.00%	0.00%	0.00%	

[42] Jemena, December 2020, *Jemena Electricity Networks: 2021-26 Revised Regulatory Proposal* pviii <https://www.aer.gov.au/system/files/Jemena%20-%20Revised%20Regulatory%20Proposal%20-%202021-26%20-%20Overview%20-%20December%202020.pdf>

Powercor	16%	10.44%	0.00%	0.00%	0.00%	0.00%	
United Energy	44%	20.38%	0.00%	0.00%	0.00%	0.00%	
Variable network charge							
Weighted average X Factor		13.45%	0.46%	0.46%	0.46%	0.46%	
Variable network tariff ($/MWh)	16.33[2]	14.13	14.07	14.00	13.94	13.87	
Consumption (MWh)		208,706	188,451	200,014	190,352	209,176	
Total variable charge ($m)		**2.95**	**2.65**	**2.80**	**2.65**	**2.90**	**13.96**
Fixed network charges							
Ausnet Services	574,966	540,214	533,592	527,052	520,592	514,212	
Jemena	937,954	832,712	825,218	817,791	810,431	803,137	
Citipower	185,128	156,140	156,140	156,140	156,140	156,140	
Powercor	1,779,241	1,593,510	1,593,510	1,593,510	1,593,510	1,593,510	
United Energy	1,817,792	1,447,313	1,447,313	1,447,313	1,447,313	1,447,313	
Adjustment for small sites	7%	319,892	318,904	317,926	316,959	316,002	
Total fixed charge ($m)		**4.89**	**4.87**	**4.86**	**4.84**	**4.83**	**24.30**
Total network charges		7.84	7.53	7.66	7.50	7.73	38.26
Other[3]		2.19	2.23	2.28	2.20	2.27	11.17
Total recommended cost		**10.03**	**9.76**	**9.94**	**9.69**	**10.01**	**49.43**
MW proposed network and other cost[3]		**11.22**	**11.34**	**11.51**	**11.69**	**12.13**	**57.90**
Appropriate reduction		**1.19**	**1.59**	**1.57**	**2.00**	**2.13**	**8.47**

Notes:

1. Based on the proportion of large site network consumption in each distribution zone.
2. Based on weighted average variable cost per MWh for large sites across the five distribution zones.
3. Figures are slightly higher than those reported in MW's price submission as they present MW's revised energy network (and other) costs provided during the review process.

Given the above we have calculated the reasonable costs of grid energy consumption that should be recovered from customers in the table below:

Table 3.18: MW energy expenditure forecast breakdown, actual and benchmark ($2020-21m)

	Energy cost component	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
	Actual forecasts						
A	Base year energy costs carried forward	43.49	39.70	42.83	44.29	50.71	**221.03**
B	Reduction in expenditure from off-grid generation and automation (captured in baseline efficiencies)	-3.25	-6.19	-6.61	-9.52	-9.62	**-35.20**
C	Actual forecast energy costs	40.24	33.51	36.22	34.77	41.09	**185.83**
	Benchmark allowance						

D	Proposed expenditure adjusted for benchmarked price due to unfavourable contract arrangement and based on existing energy consumption levels[1]	29.81	29.61	29.65	31.27	34.49	**154.83**
E	Reduction for avoided off-grid generation and automation	1.49	2.90	3.11	4.55	4.60	**16.64**
F	Reduction for network charges (see section 3.5.1.3)	1.19	1.59	1.57	2.00	2.13	**8.47**
G	**Deloitte reasonable benchmark allowance** (D minus E and F)	**27.13**	**25.12**	**24.97**	**24.73**	**27.76**	**129.72**
H	**MW proposed energy costs to be recovered from customers** (D minus B)	**26.56**	**23.42**	**23.04**	**21.75**	**24.87**	**119.64**

Deloitte Access Economics analysis

Note: 1. Forecast proposed controllable opex includes revised energy cost adjustment provided by MW during the review process. MW should clarify in its response to the Draft Decision whether it intends to recover this higher amount.

Overall, we consider a reasonable energy allowance would be $129.7m. Given that it appears that MW is proposing to recover $119.6m in energy costs from customers, we accept MW's forecast. However we suggest MW provide greater clarity and transparency regarding the energy costs proposed to be recovered from customers in response to the ESC's Draft Decision.

3.5.1.4 Solar maintenance

In preparing its opex forecast, MW also proposed an additional allowance of $1.9m over RP5 for operations and maintenance expenditure for the new ETP solar plant. In preparing the opex forecasts, the ongoing maintenance for the new assets has been built in as an additional cost.

The ETP solar investment is a 19MW ground-mounted solar plant scheduled for completion in April 2022. MW has estimated opex costs for the plant will be $664,235 per annum, based on the preferred tenderer's estimation. However, due to uncertainty of maintenance expenditure required, MW has proposed to take on in risk of $227,089 per annum. Therefore, MW proposes an allowance for maintenance costs of $436,146 per annum. This equates to approximately $23 per kW installed capacity per annum.

For comparison, other market benchmarks indicate annual opex for large-scale solar ranges from around $17 per kW[43] to $26.11 per kW[44]. Based on this, we consider MW's forecast of $436,146 for ETP solar opex is reasonable.

3.5.1.5 Pumping cost pass through

MW has also proposed that pumping costs associated with water orders from the Victorian Desalination Plant be treated as a cost pass through. We understand that while energy used from pumping desalination water orders are not fully controllable by MW, the electricity price at which MW pays for the energy to pump water orders is. While cost pass throughs are not within the scope of our review, we suggest that if, and when, MW puts forward a pumping cost pass through, the allowance be made for pumping costs at the benchmarked price.

3.5.2 IT Costs

MW has forecast an average annual increase of IT opex over the fifth regulatory period of 3.7%. This compares to the fourth regulatory period actual IT opex growth of 2.7% per annum. MW proposed IT opex growth for the fourth regulatory period was 1.8% per annum.

[43] Commonwealth Scientific and Industrial Research Organisation, 6 May 2020, *GenCost 2019-20* <https://publications.csiro.au/publications/publication/PIcsiro:EP201952>

[44] Australian Energy Market Operator, 17 October 2019, AEMO ISP inputs <https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2020-integrated-system-plan-isp/2020-isp-inputs-and-assumptions>

The increase in IT opex in recent years is associated with a significant increase in IT capex, which MW has described as due to 'the increasing pervasiveness of IT in all areas of MW's business.[45] MW expects the trend of increased investment in IT will continue during the fifth regulatory period.

Key aspects of the IT investment program over the fourth regulatory period included:

- improvements for field staff technology, which allow remote work including downloading and reviewing work order requests, logging service requests, undertaking risk assessments and calibration of field assets and recorded results.
- enhancements to the way that MW interacts with its customers, including a re-designed website and the development of an information-sharing portal
- improvements to staff learning including simulated operational training and mobility solutions, and procurement functions.[46]

MW's IT opex is forecast to exceed the forecast over the fourth regulatory period by $2.6m. The additional support, maintenance, servicing and licensing costs for the new IT capex implemented over the period exceeded forecast by $13.1m, however these were offset by other IT opex efficiencies of $10.5m (particularly savings in data, communications, professional services and SCADA costs).

MW has indicated that the $10.5m of IT opex efficiencies realised in the fourth regulatory period to offset its increasing opex costs are unsustainable, and that the base year IT opex is now overstretched. MW also proposed (as stated in its IT Business Case) to continue its approach of not passing on the additional support, maintenance, licensing and servicing costs associated with its IT Investment program onto customers during the fifth regulatory period.[47]

> '*Whilst overall IT operating expenditure levels are not sustainable at current levels, Melbourne Water is retaining its policy of not passing on the additional support, maintenance, licensing and servicing costs associated with the IT Investment Program costs onto customers during the 2021-26 period. Forecast increases in IT operating expenditure during this period will be recouped from other areas of our business and not passed onto customers.*[48]

However, MW's IT business case does appear to include an additional step change for 'opex over the 2021-26 period, driven by the IT investment Program', of $16.2m over the 2021-26 period, as shown in the following table from its IT Business Case.

[45] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, p. 9.
[46] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, p. 8.
[47] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, pages 11 and 21.
[48] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, page 21.

Table 3.19: MW's proposed IT opex increases for 2021-26

Category	Description	Amount ($M)
Base Year Actual (x 5 years)		**128.2**
Add:		
Opex over 2021-26 period driven by the IT Investment Program	Ongoing operating expenditure for software licensing, maintenance, servicing and support driven by the IT Investment Program – not included in base year actuals. ➢ 2021-26 Capital Investments ➢ 2019-20 and 2020-21 Capital Investments	 16.2 4.6
Security and Disaster Recovery	Additional costs required to secure Melbourne Water from external digital security threats. Includes additional penetration testing across IT and OT networks ($1.3M), disaster recovery testing ($0.6M) and cloud security ($0.2M)	2.1
Other Adjustments	Includes net base year licencing and support corrections ($1.3m), business strategy implementation decisions ($1.9m), contract price adjustments ($0.5m) and other adjustments ($0.3m)	4.0
Less:		
Efficiencies	Identified efficiencies to be delivered through contract renegotiations and product simplification.	3.5
SUBTOTAL		***23.4***
2021-26 IT operating expenditure forecast (real terms)		**151.7**

Source: MW, Information Technology 2021-26 Pricing Submission Business Case, page 21

When we discussed the discrepancy between the proposed opex and statements in the IT business case, MW clarified that it has included other efficiencies in its opex forecasts, but not specifically excluded the expected ongoing opex for software licensing, maintenance, servicing and support driven by the IT investment program, despite stating this in the IT business case. [49]

Setting this aside, MW has indicated that this step change for opex over the 2021-26 period, driven by the IT investment Program, will be offset by efficiency savings of approximately $13.5m realised across various parts of the business, including:

- $5m in water and sewerage maintenance (enabled through proposed IT investment in better data capture, storage and analytics technologies for our water and sewerage services)
- At least $2.5m net opex benefits identified and committed each year (enabled through proposed IT investment in innovation and IT system functional enhancements which deliver automation and resulting Opex savings).
- $2.5m saving in contract management (enabled through proposed IT investment in contract management and finance systems which will deliver greater visibility of spend and drive savings in both opex and capex through better decision making)

In addition, MW has identified $3.5m in IT efficiencies which have been removed from the IT expenditure budget proposed.

As outlined in the table above, MW proposed three step changes in IT opex for the next regulatory period:

- ongoing opex associated with new capex (both for the current and next regulatory periods)
- security and disaster recovery – additional penetration testing across IT and OT networks, disaster recovery testing, and cloud security
- other adjustments – net base year licensing and support corrections, business strategy implementation decisions, contract price adjustments.

IT capex

[49] Melbourne Water – email to Deloitte, 'Offsetting efficiencies for IT costs' 11 December 2020.

MW's IT Business Case contains high level information on the basis of its proposed IT cost increases, noting that the proposed IT capital program is an allocation, not a project per se:

> '*Note: The IT Investment Program is an allocation, not a project. Cost estimations determine the overall allocation funding required at this point. Detailed costings at a project level, involving full consideration of solution options and associated costs and benefits have not been undertaken at this point. Detailed project cost-benefit analysis will be undertaken once individual projects are more definitively known and detailed solution options, costs and benefits are prepared. This will occur progressively on a project-by-project basis over the duration of the 2021-26 pricing period'*[50]

For application growth and transformation, and infrastructure growth and transformation, MW's IT Business Case noted that costs are driven by its customer needs and business strategies, and that investments are needed to deliver on stated strategic investments. It indicated that forecast costs are based on:

- comparison of proposed investment with similar historical projects, to determine sizing estimates
- forecast sizing estimates determined by MW staff and service providers based on experience in delivering 'like' projects historically.

A high level 'options assessment', which compares investing only in Renewals, to a 'Balanced growth and Transformation' (preferred option) and 'Fully-enabled Business and Customer Strategies' cases (high case option, approximately 30% above the preferred option) was provided.

A summary of the 'anticipated projects', including a high-level description and estimated cost was included for the preferred investment case only. Some of the largest expenditure items include:

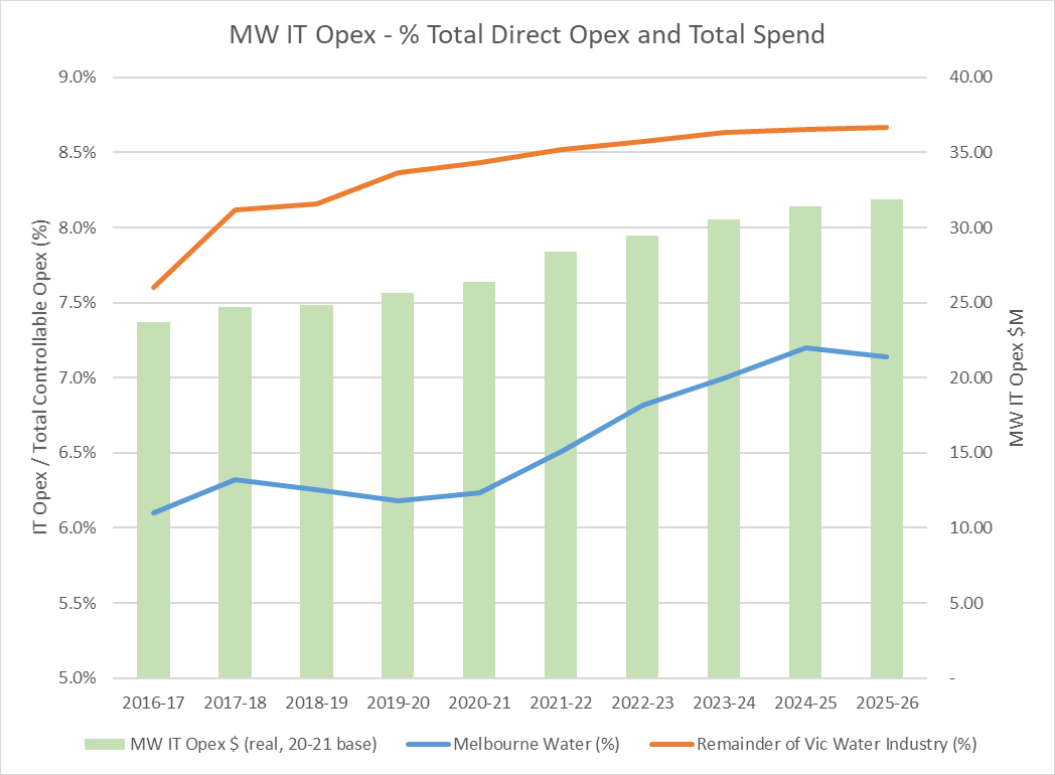
- asset management (Maximo, DFWS, CAD, BIM, DamSmart): Renewal investment in Service Delivery Asset Management Systems over 2021-26. Figures are consistent with actual investment in this category during 2016-21 period. Expected investments over the 2021-26 period include 2 Maximo upgrades plus upgrades for DFWS, CAD, BIM and DamSmart systems in line with 2016-21 period - $4.7m
- service design - Investment in service design and baseline user experience to meet basic business and customer needs for the full suite of IT systems at MW - $5m
- asset refresh Network/Comms/Telco – update end of life routers, software defined networks, internet/site links, WAPs, Network tools - $15.6m
- asset refresh – Printers and Servers - $10m
- portal, Website essential services (continuous value stream) - focussed on the delivery of customer portal and website enhancements. Includes expansion of current functionality to include transactional portal to apply & manage all customer application types, plus integration of information across customer systems to facilitate centralised, one-stop interactions for customers - $9.5m
- Business Process Optimisation (Pega) and Integration – Continuous Value Stream - Continuous Value Stream focussed on the development and implementation of process optimisation and integration solutions across MW - $10m.51

In relation to efficiencies to be delivered through the proposed IT capex investment program, MW noted that 'it is uncertain as to the exact quantum of financial benefits that will be delivered by the IT Investment Program during the 2021-26 period.'[52]

IT opex benchmarking

MW provided some benchmarking analysis of its IT opex program, shown below:

[50] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, p. 15.
[51] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, embedded Excel file.
[52] Melbourne Water, Information Technology 2021-26 Pricing Submission Business Case, p. 19.



Source: MW, Information Technology 2021-26 Pricing Submission Business Case, p. 12.

MW currently spends a lower percentage of direct operating expenditure on IT compared to the Victorian Water industry average – a trend expected to continue throughout RP5. This is not surprising given it generally does not need to bill individual households and customers.

MW also presented benchmarks based on IT opex and capex per corporate user, which were developed by KPMG.[53] The benchmarks are based on Australian water businesses' publicly available information, as well as results of KPMG's Utilities IT Benchmarking Survey. The benchmarks showed that:

- MW's IT opex per corporate end user over the current regulatory period was $13,931 per annum, which is within the industry average range of $2,751 to $25,918 per corporate user
- MW's IT capex per corporate end user over the current regulatory period was $12,428 per annum, which is within the industry average range of $606 to $36,430 per corporate user.

Recent experience in utility regulation more broadly confirms that increasing digitisation and hence IT costs are common across most utilities. Some relevant recent decisions by regulators on water utility IT opex increases include:

- In its recent March 2020 price review for Sydney Water, IPART approved a proposed IT opex forecast growth rate of 2.8% CAGR.54
- The ESC's June 2020 Final Decision for Western Water did not approve its proposed IT opex increase of $2m (which reflected a CAGR of 3% over the current regulatory period).[55]

[53] Extract document - KPMG Capex Review – Appendix B IT Expenditure – ICT Benchmarking, provided by Melbourne Water to Deloitte 8/12/2020.
[54] Detail outlined in Atkins Cardo's report for IPART on Sydney Water's proposed expenditure: https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/pricing-reviews-water-services-metro-water-prices-for-sydney-water-corporation-from-1-july-2020/legislative-requirements-prices-for-sydney-water-corporation-from-1-july-2020/consultant-report-by-atkins-cardno-sydney-water-expenditure-and-demand-forecast-review-19-march-2020.pdf , p 152.
[55] Western Water final decision 2020 Water Price Review 10 June 2020.

Conclusion

MW has proposed a $23.4m increase in IT expenditure over RP5, all which will be included within baseline operating expenditure.

The majority of increased expenditure ($16.2m) is in relation to additional support, maintenance, licensing and servicing costs. MW has provided a high-level breakdown of the $16.2m forecast in IT opex associated with new IT capex, based on:

- current available solution options to meet the specified business, customer or service need
- expected technologies that will be leveraged to meet the specified business, customer or service need (i.e. on-prem versus cloud – these costs have been calculated based on 'like' historical investments leveraging similar technologies)
- known licensing costs which MW will likely incur for relevant investments.

It appears that MW has proposed to absorb this increased IT opex within its baseline opex by offsetting increased costs with efficiencies gained elsewhere in the business. We recognise that increased IT investment can provide customer benefits by increasing efficiencies, including beyond the RP5 into subsequent regulatory periods. Therefore, we accept the $16.2m over RP5 on the basis that it will reduce costs elsewhere in the business.

Other proposed increases in IT opex (for current period capital investments, security and disaster recovery and other adjustments) appear to be reasonable, noting that these result in $10.7m of higher opex over the next regulatory period but remain within baseline controllable expenditure.

3.5.3 Labour costs

Over the year to March 2020, wages in the Victorian utilities industry grew by 3.3%. This is above the national average for the utilities industry of 2.7% and also above the Victorian all industry average of 2.7%.[56]

Wage growth in the Victorian utilities industry is expected to slow to 0.5% in 2020-21 as COVID-19 weighs heavily on output across the Victorian economy. From 2021-22 onwards wage gains are then expected to accelerate, reaching 2.7% growth in 2025-26 for the Victorian utilities industries.[57]

More broadly, Victorian annual wage growth is forecast to reduce to 0.7% in 2020-21 and see a small rise to 1.8% by 2024-25.[58]

The Victorian Government's Wages Policy states that increases in wages and conditions should be capped at a growth rate of 2% per annum over the life of the agreement. MW has forecast a 2 % year-on-year wage escalation across all labour categories (all enterprise agreement, executive and management staff), which is below its assumed inflation rate.

Table 3.20: MW wage growth forecast assumption over RP5

	2021-22	2022-23	2023-24	2024-25	2025-26
Nominal wage forecast	2.00%	2.00%	2.00%	2.00%	2.00%
MW assumed inflation rate	2.00%	2.25%	2.50%	2.50%	2.50%
Real wage forecast	0%	- 0.25%	- 0.50%	- 0.50%	- 0.50%

Source: MW, 9 November 2020, *Melbourne Water Price Submission 2021* and MW response to Deloitte query, 2 December 2020

[56] Deloitte Access Economics, *Wage Price Index forecasts,* 2020.
[57] Deloitte Access Economics, *Wage Price Index forecasts,* 2020.
[58] Deloitte Access Economics Business Outlook September 2020.

The *Melbourne Water Enterprise Agreement 2020* was approved in July 2020 and came into effect in September 2020. Its nominal expiry date is 30 June 2023.[59][60]

Labour costs represent MW's largest single opex component. Table 3.21 reflects a decreasing trend (CAGR) for labour costs of 1% from the base year.

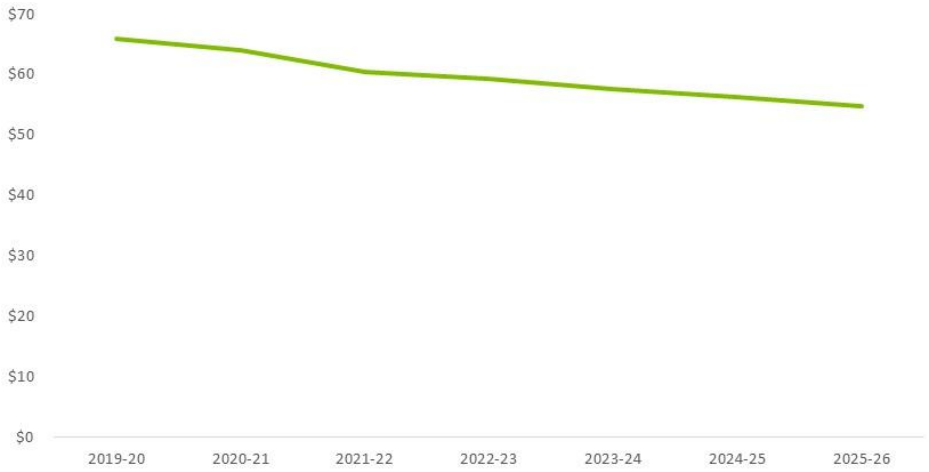
Table 3.21: Labour costs and full-time equivalents (FTEs) 2016-17 to 2025-25 ($2020-21m)

	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26
Total FTEs	1002.10	1029.30	1085.00	1128.30	1165.10	1165.10	1165.10	1165.10	1165.10	1165.10
Total labour costs ($m)	135.58	135.77	139.81	144.69	143.14	137.52	137.87	137.28	137.15	136.57
Annual cost growth	5.11%	0.14%	2.97%	3.50%	-1.07%	-3.93%	0.26%	-0.43%	-0.09%	-0.42%

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

MW has assumed labour volume (FTE) will remain flat post the forecast June 2021 position. The growth in FTE across RP4 is largely due to the insourcing of previously outsourced activities. For example, waterways and land delivery maintenance functions, delivery execution contractors, IT functions (across activities such as application development, mobility functionality, business intelligence and automated digital processes) and a standalone safety function.

Table 3.22: MW forecast labour cost per customer ($2020-21)



Source: Deloitte Access Economics analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

Based on MW's wage forecasts being consistent with the Victorian Government's Wages Policy cap (2%), MW's labour forecasts, although at the upper end of recent forecasts, appear reasonable.

3.5.4 Chemicals

MW has proposed a total chemical expenditure of $51.82m over RP5, incorporating a 2.2% CAGR across RP5. This compares to a 1.6% increase (CAGR) in chemical costs over the last four years. MW's chemical cost increases are primarily driven by increases in demand (and not the unit price

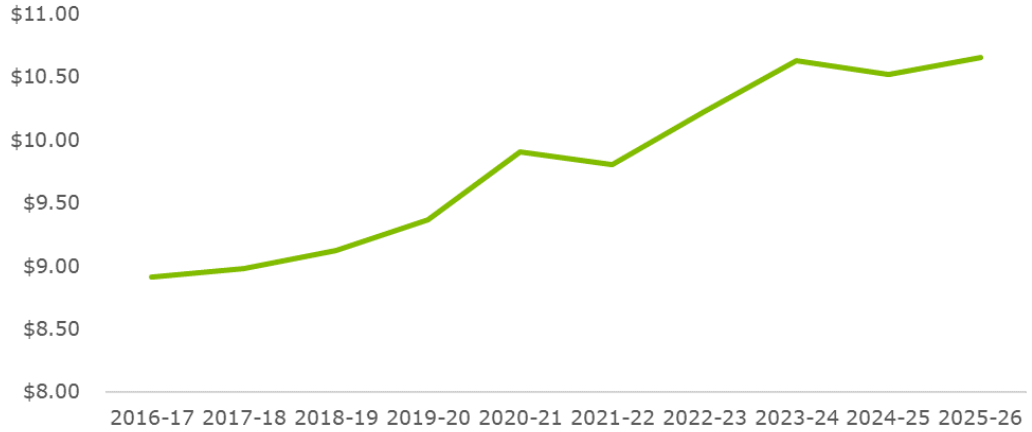
[59] Fair Work Commission, Melbourne Water Enterprise Agreement, 2020, available at <https://www.fwc.gov.au/documents/documents/agreements/fwa/ae509049.pdf>

[60] Waterways and land delivery crew staff are covered by an additional enterprise agreement (Melbourne Water Waterways and Land Delivery Enterprise Agreement 2017) which expired on 30 June 2020. The assumptions of the primary agreement have been used in preparing labour forecasts for these staff.

of chemicals) and operational decisions. Specifically, the increase in chemical costs from the base year during RP5 is driven by:

- polyelectrolyte increase driven by an increase in quantity consumed (77 tonnes) at ETP following the Sludge Digestion Capacity Upgrade due for completion by 2022-23
- sodium hypochlorite driven by an increase in quantity consumed (1,409 kilolitres) at the water treatment plants in line with forecast growth in water treated
- chemicals (non-specific) driven by the Yan Yean treatment plant coming back online in 2022-23

Table 3.23: MW forecast chemical costs ($2020-21m)



Source: Deloitte Access Economics analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

We note that the forecast in chemical costs is based on demand under a pre-COVID-19 scenario modelling. We consider that chemical costs should reflect actual demand likely to occur, recognising demand projection in light of the pandemic. MW advised that under their COVID-19 scenario modelling chemical costs would be lower by $0.3m in total over RP5, based on Macroplan's forecast growth rate of 1.93%. During the review process, MW also provided updated chemical cost reduction based on the Victorian Government's latest growth forecasts, expecting a $0.99m reduction in chemicals.

As discussed in 2.1.2 we anticipate growth will be much lower than the proposed 1.95% pre-COVID scenario and therefore chemical costs are likely to be below that proposed by MW. However, we note that the recommended reduction on the growth assumption used for baseline controllable opex (see section 3.3) will account for a proportional reduction in chemical costs. Therefore, we propose no additional reduction to chemical costs beyond the adjustment to the growth rate.

3.5.5 Cost allocation methodology

MW has modified its cost allocation methodology ahead of PS21. Previously, MW allocated costs on the basis of FTE (e.g. each employee is allocated to one or more of the service areas).

The new approach continues to allocate all corporate costs to one major service area, however, adopts multiple allocation methods (e.g. based on revenues, FTEs or capital spend) for costs with no causal relationship. For example, commercial & technology services are now allocated based on revenues.

The costs are allocated according to structured hierarchy below:

- costs directly allocated to service wherever a clear 'line of sight' exists between the cost incurred and the service / sub-service.
- allocated costing with established causal relationship

- allocated costing – no causal relationship (allocation methods that reflect a reasonable approximation of the scale of resources required by the services to which the shared costs are being applied.

The change in methodology has resulted in minimal overall impact to prices (Table 3.24). MW notes that the updated approach ensures a clearer articulation of the level of corporate support consumed by each service area and therefore aligns more closely with the WIRO principle that prices should be reflective of the efficient cost of providing a service.

Table 3.24: Impact of MW's proposed cost allocation changes

Service	Current allocation	Proposed allocation	% change	Average annual ($)	RP5 price impact
Water	29.9%	25.7%	-4.2%	-$5.7	0%
Sewerage	25.4%	29.1%	3.8%	$5.8	
Recycled Water	1.2%	0.4%	-0.8%	-$1.1	-4%
Waterways	43.5%	44.7%	1.2%	$2.4	0.9%

Source: MW, 9 November 2020, Melbourne Water Price Submission 2021

3.6 Recommendations

The table below summarises the recommended changes to controllable opex. We have recommended a reduction of $41.8m to MW's RP5 forecast controllable opex. This represents 2.1% of MW's proposed controllable opex over RP5.

Table 3.25: Forecast controllable opex and recommended adjustments ($2020-21m)

Opex item	Actual	Forecast RP5					
	Base year 2019-20	2021-22	2022-23	2023-24	2024-25	2025-26	Total
Proposed controllable opex[1]		**389.04**	**387.01**	**388.46**	**394.09**	**398.34**	**1956.95**
Recommended adjustments							
W&S base year adjustment	-1.95	-1.95	-1.94	-1.94	-1.94	-1.94	**-9.72**
Waterways base year adjustment	-0.48	-0.48	-0.48	-0.48	-0.48	-0.48	**-2.39**
Growth rate adjustment to baseline		-0.52	-1.03	-1.54	-2.05	-2.56	**-7.70**
Waterways and drainage service increase		-4.40	-4.40	-4.40	-4.40	-4.40	**-22.00**
Total recommended adjustments	**-2.43**	**-7.34**	**-7.85**	**-8.36**	**-8.87**	**-9.38**	**-41.81**
Recommended controllable opex		**381.70**	**379.16**	**380.10**	**385.22**	**388.96**	**1915.14**

Source: Deloitte Access Economics

Note: 1. Forecast proposed controllable opex includes revised energy cost adjustment provided by MW during the review process. MW should clarify in its response to the Draft Decision whether it intends to recover this higher amount.

4 Capital expenditure assessment

This Chapter provides analysis, conclusions and recommendations on Melbourne Water's (MW's) capital expenditure (capex) forecast. Expenditure is typically quoted from MW's submission template in real $2020-21. Other cost bases are identified where they differ.

4.1 Overview of approach

Our approach to reviewing MW's forecast involved the following tasks:

- reviewing MW's PS21 submission document and price review model
- online interviews to discuss the projects and broader strategic context in more detail
- selecting of a list of major projects for review (see selected projects below)
- submitting a request for information on a sample of major projects for each service area, covering, for example:
  - business cases supporting the proposed expenditure
  - strategic level management plans providing context for the overall programs within which the projects are categorised
  - engineering reports and supporting documentation for cost estimates
  - details outlining the need for the project, for example, Environment Protection Authority (EPA) licence conditions or directions
- reviewing the supporting documentation and forming a view as to the prudency and efficiency of the project for inclusion in PS21
- making recommendations for changes to the capital program were developed (where appropriate).

In performing this review, we have sought to answer the following key questions in determining the prudency and efficiency of the proposed program:

- Are the drivers and risks identified for capex projects realistic and justified?
- Has a robust approach been taken to the identification, assessment and detailing of alternative options for delivery of the program to find the least whole of life cost solution?
- Were capex projects subject to a rigorous challenge process to ensure the most efficient delivery of projects?

The major projects reviewed were:

Water:
- Yan Yean to Bald Hill Pipeline ($95.6m)
- Maroondah Reservoir Outlet and Aqueduct Stage 3A ($58.2m)
- Winneke Treatment Plant – UV Disinfection System ($43.1m)
- Olinda-Mitcham Water Mains Replacement Stage 1 ($37.7m)
- Cement Creek Diversion Works ($27.6m)

Sewerage:
- WTP Primary Treatment Augmentation ($315.3m)
- WTP 55E ASP Upgrade ($211.4m)
- HBM Yarra Crossing Duplication ($135.8m)
- Maribyrnong Main Sewer Augmentation ($43.5m)
- WTP Gas Plant Renewal ($35.5m)

Waterways and Drainage:
- Port Melbourne Pump Station Renewal ($11.4m)

- Regan Street Retarding Basin ($7.7m)
- Shakespeare Grove MD renewal ($7.5m)
- Hallam Valley Retarding Basin Wetland ($6.4m)
- Gladstone St ($5.4m).

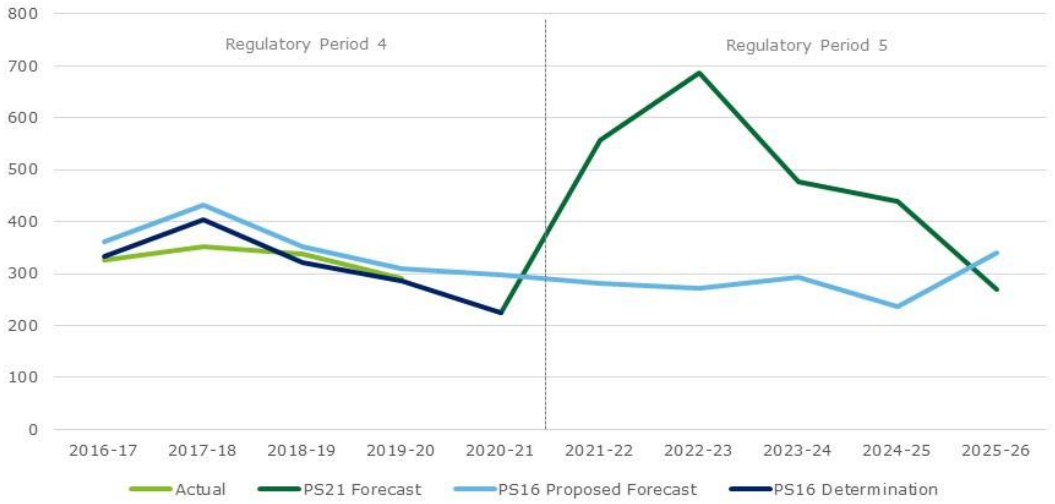
4.2 Historical capex

A review of historical capex is important in establishing the investment context and focus areas for the current and future regulatory periods and in assessing any transition between the two periods, for example, an acceleration of expenditure in the final year reflecting similar forecast conditions in the next period.

Overall MW has delivered investment relatively in line with the PS16 Determination allowances. However, the figures below demonstrate that the capex program proposed for RP5 is significantly higher than anticipated in MW's PS16 submission.

For water and sewerage expenditure, Figure 4.1 presents performance against what was originally proposed in PS16, what was provided in the PS16 Determination and what actual expenditure has been delivered to date (plus forecasts). Total water and sewerage capex over RP4 ($1,534.2m)[61] is expected to be close to the 2016 determination ($1,569.6m).

Figure 4.1: MW's PS16 Proposed, Approved and Actual Expenditure - Water and Sewerage ($2020-21m)

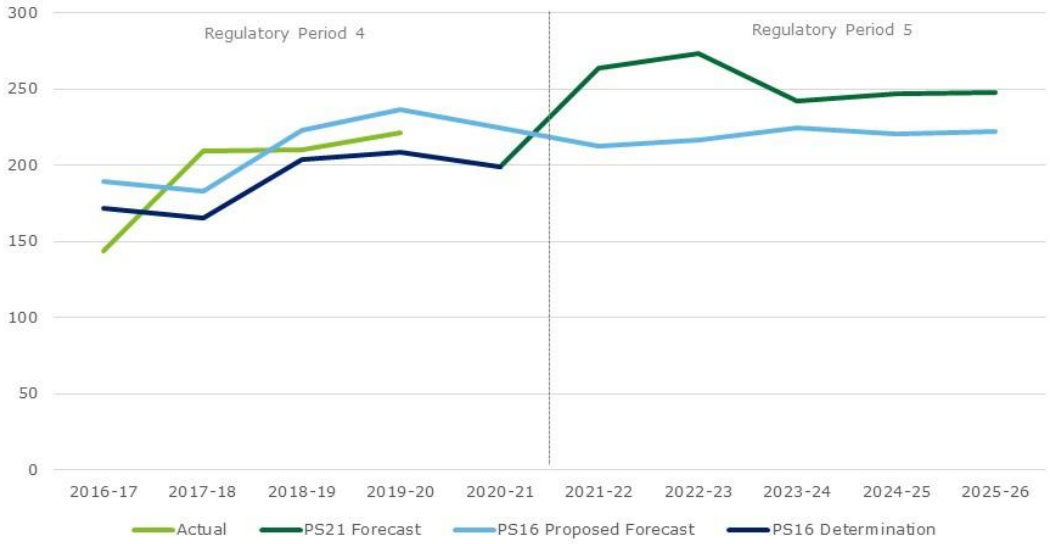


Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020).

For waterways and drainage expenditure, Figure 4.2 following compares what was originally proposed in PS16, what was approved in the PS16 Determination and what actual expenditure has been delivered to date (plus forecasts). Total waterways and drainage capex over RP4 ($983.0m)[62] is expected to be $34.6m higher than the 2016 determination ($948.4m).

[61] Using 'pre-populated' values from PS16 for 2020-21 as per the ESC template.
[62] Using 'pre-populated' values from PS16 for 2020-21 as per the ESC template.

Figure 4.2: MW's PS16 Proposed, Approved and Actual Expenditure - Waterways and Drainage ($2020-21m)



Source: Actual and forecast is based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020), 2016 proposed forecast is based on MW *Price Review Template* and 2016 Determination is based on the ESC's *Final – 2016 MW Price Review Template* (provided 17 November 2020).

MW also provided detailed performance commentary on key projects over RP4, and this is presented in Table 4.1, Table 4.2, and Table 4.3 below.

Within RP4, a number of projects originally scheduled for completion had additional work tasks added, were delayed or were deferred for inclusion in RP5. These include:

- Winneke Treatment Plant UV Disinfection System – project expenditure was removed in the review of PS16 and was deferred by MW to allow additional investigations to be completed.
- WTP 55E ASP Upgrade – the majority of expenditure for this project was recommended to be deferred into RP5 in the review of PS16 expenditure. This project is now included in RP5 and has significantly increased in value since PS16.

Table 4.1 MW – Sewerage Key Projects Expenditure for RP4

Name	Investment Program	Status	Total RP4 Actual and Forecast [1]	Total PS16 Price Determination	Final Forecast Cost [2]	Comments
ETP Sludge Digestion Capacity Upgrade	Sewerage Treatment / Disposal ETP	Delayed	$20.0m	$43.0m	$33.3m	Project construction commenced August 2020 and is within budget and on schedule, with ground foundation works for buildings to be completed by Christmas. Benefit is to increase sludge digestion capacity for future growth, without the need to construct additional digesters.
Upper Hobsons Bay Main Sewer Renewal	Sewerage Transfer	Completed on time	$26.0m	$42.8m	$26.1m	Project completed on schedule and within budget. Benefit is renewal of existing sewer main to prevent uncontrolled spills and service disruptions. Deferred some cost associated with hydraulic upgrade through accepting more surcharging of the sewer. Also used more bypass pumping to enable the renewal aspects of the work.
WTP 55E ASP Upgrade	Sewerage Treatment / Disposal WTP	On schedule	$3.9m	$6.0m	$224.6	The project is currently on schedule (based on revised schedule to deliver via Detailed Design followed by Construct Only delivery strategy) and within budget. Benefit is increased energy efficiency and level of service for asset.
WTP 125W sludge Drying Pans	Sewerage Treatment / Disposal WTP	Delayed	$32.9m	$39.0m	$57.2m	The commencement date of the project was delayed to allow for learnings from optimisation work on existing drying pans to be incorporated into the technical design. Functional design was completed in June 2019. Project early works commenced February 2020 with preferred service provider while unplanned DTF approvals (due to increased project costs) were progressed. Benefit is to increase sludge drying capacity for future growth. Project cost increases are related to several factors including the rising cost of quarry products (due to increased demand), increasing the pan area to maximise use of the allocated land and groundwater management complexities.
WTP Treatment Capacity Increase	Sewerage Treatment / Disposal WTP	Completed late	$139.9m	$180.1m	$152.4m	Practical Completion was achieved on 26 April 2019. The project met the revised schedule and was within budget. Benefit is increased treatment capacity for future population growth.

Source: Adapted from MW supplied document

Notes: 1. Forecast for final year (2020-21). 2. Total cost of projects, may occur over multiple regulatory periods.

Table 4.2 MW – Water Key Projects Expenditure for RP4 ($2020-21m)

Name	Investment Program	Status	Total RP4 Actual and Forecast[1]	Total PS16 Price Determination	Final Forecast Cost[2]	Comments
03295 Holden Inlet Main	Water Transfer	Delayed	$19.5m	$24.6m	$21.9m	The project is currently within budget (BCA P50 $22.3M, P95 $22.8M). Project completion delayed to May 2021 to allow for an outage required to complete the works. Benefit is to provide for future population growth
Q01847 Maroondah Aqueduct Renewal (Sections)	Water Production/ Storage	Complete	$29.6m	$33.8m	$36.5m	Project completed on schedule and within budget (BCA P50 $32M, P95 $36.6M). Benefit is renewal of aqueduct to manage risk of water loss due to condition of asset.
Q04397 Merri Creek to MCG Water Main Renewal	Water Transfer	Complete	$46.1m	$35.4m	$46.3m	The project was completed on time but required an over-expenditure approval associated with responding to unknown services, access restrictions and excess contaminated material (BCA P50 $42.7M, P95 $45.4M). Benefit is renewal of existing critical water main and reduction in water losses.
Q02825 St Georges Road Water Main Renewal	Water Transfer	Complete	$33.3m	$25.6m	$37.7m	Project completed on schedule and within budget (BCA P50 $45.7M, P95 $48.9M). Benefit is renewal of existing critical water main and reduction in water losses.
Q03309 Winneke TP – UV Disinfection System	Water Quality	Deferred	$2.1m	$33.4m	$47.3m	The Winneke UV project was intended to be delivered to align with the anticipated update to the Australian Drinking Water Guidelines (ADWG) where a microbial health-based target (HBT) of 1 microDALY per person per year was to be introduced. The planned update to the ADWG has not yet been finalised. MW made the decision to defer the project in December 2018. This decision provided an opportunity to further understand microbial risks and assess alternative mitigation options. As a result of this work, MW has confirmed that water quality risks at Winneke Water Treatment Plant must be managed in order to comply with the Safe Drinking Water Act 2003 (Refer Drinking Water Quality Strategy) irrespective of the requirements documented in the ADWG. The project is intended to be completed by March 2024 with a FBC P50 $47.M/P95 $52.5M (nominal) scheduled for approval in February 2021.

Source: Adapted from MW supplied document

Notes: 1. Forecast for final year (2020-21). 2. Total cost of projects, may occur over multiple regulatory periods.

Table 4.3 MW – Waterways and Drainage Key Projects Expenditure for RP4

Name	Investment Program	Status	Total RP4 Actual and Forecast[1]	Total PS16 Price Determination	Final Forecast Cost[2]	Comments
Alexandra Parade Main Drain Re-decking	Drainage and Flood Protection	Completed on time	$11.4m	$16.4m	$11.6m	Project completed on schedule and within budget. Benefit of re-decking is improved safety of the asset. Reduced cost due to reduced scope of works identified as part of the normal prudency and efficiency processes applied before construction work was commenced.
Jacana RB Wetland Rectification	Stormwater Quality	Completed on time	$6.7m	$4.4m	$6.7m	Project completed on schedule. Benefit of upgrade is to reduce risk of asset failure and compliance with relevant guidelines. Additional costs related to contaminated (cat C) soil, more silt deposition than forecast, and unsuitable sediment pond base material.
Mile Creek East RB Upgrade	Drainage and Flood Protection	Completed on time	$2.8m	$2.8m	$3.1m	Project completed on schedule and within budget. Benefit of upgrade is to reduce risk of asset failure and compliance with relevant guidelines. Project completed within final BCA P50. Scope change from BNI due to detailed design requirements.
Murrumbeena MD Flood Mitigation	Drainage and Flood Protection	Completed	$42.1m	$37.3m	$42.6m	The project completed late due to delays with other approval authorities and above budget due to high costs associated with managing contaminated land. Benefit is a reduction in the risk of flood events. Increased cost due to contaminated (cat C) soil and additional protection works on other Authorities high criticality assets within Dandenong Rd and Railway track crossings.
Regan St Retarding Basin	Drainage and Flood Protection	Delayed	$2.2m	$8.5m	$10.2m	The Regan Street Retarding Basin project was intended to be delivered as part of land development works with the developer constructing the retarding basin as an integral component of their works. The original developer has delayed delivery of their project and hence the retarding basin construction has also been delayed. Expenditure to date has resulted from land purchase and requisite design stages. The development has changed ownership and the current developer has proposed an alternative solution which is being evaluated by MW and other Authorities before further progress is made.

Source: Adapted from MW supplied document

Notes: 1. Forecast for final year (2020-21). 2. Total cost of projects, may occur over multiple regulatory periods.

4.3 Overall assessment of capital planning and asset management

MW's Statement of Obligations requires it to have in place a system which adequately manages the assets owned and operated and can apply the same requirements to planned assets. The obligations require alignment of this system with the ISO 55000 Asset Management series and the Victorian Government's Asset Management Accountability Framework (AMAF). MW maintains a Total Asset Management Improvement Program (TAMIP) to track improvements with progress reported internally on a monthly basis and through external measures including benchmarking, maturity assessments, and assurance processes.

The asset management system is applied to planned assets through a capital planning framework which encompasses MW's corporate strategy and policies, service strategies, and a Capital Investment Framework. This framework includes an investment hierarchy with decision gates consistent with the AMAF. At each gate, business cases support the planned investment. The investments assessed in this review have business cases at the project initiation stages – Business Needs Identifier (BNI) and Preliminary Business Case. Once projects have a preferred option, a Functional Business Case is prepared while a Business Case Approval is the project budget approval stage prior to delivery.

When assessing investment needs, MW has stated it applies the Victorian Department of Treasury and Finance Investment Management Standard process to all projects over $50 million with this trigger threshold being progressively reduced to apply to all projects over $10 million. MW is using an in-house adaptation of Investment Logic Mapping (ILM) when assessing these larger projects, while smaller projects are assessed using a simpler risk-based process balancing capital and operating expenditure options.

The level, and accuracy, of cost estimates varies at each gate as guided by a cost estimate procedure, with any project exceeding $1 million required to have a Risk Adjusted Nominal Estimate (RANE) developed (previously this was applied only to projects at the Preliminary Business Case Gate. This is done in two stages, development of a base cost and a review and adjustment of this cost using a facilitated risks and opportunities workshop. All cost estimates used in the decision-making process undergo Monte Carlo analysis and represent a P50 cost.

4.4 Overall assessment of capital delivery

MW has been implementing capital delivery systems and processes prior to, and during, the RP4 regulatory period. These systems have been focussed around developing smaller panels of providers to deliver larger volumes of work over set periods. MW's capital delivery model comprises:

- major works
  - open market (for >$50m) and
  - framework (for $5-$50m)
- small scale / minor works
  - Major works – small scale $200k to $10m) – single provider
  - Minor works – up to $200k – single provider
  - Contestable - $200k to $2m) – competitive tender with the two single providers
- minor works (waterways) – typically <$200k but could be up to $5m – using internal contract delivery team, and internal crews (usage increased from 5% to 20% over past few years) and/or sub-contractors (from a Panel)
- other delivery – for IT and developers and other direct procurement (capitalised internal labour)

Table 4.4 highlights the average annual value of capital delivered across periods. The proposed capex for delivery is significantly higher than the previous two regulatory periods including the period within which the current delivery model was implemented. As shown in the table, the average spend per year typically increases by $100m, whereas the proposed increase for RP5 is nearly $200m.

MW has provided supporting commentary on its ability to deliver this significantly increased capital program by referring to the high average annual expenditure and total program delivered in RP1.

However, this period included delivery of the Victorian Desalination Plant which represented a significant proportion of both the total expenditure delivered and the average annual expenditure. As such we do not consider this an appropriate comparison.

There is also a substantial increase in capex proposed between 2020-21 and 2021-22, with capex roughly doubling from one year to the next, and then increasing in 2022-23.

Table 4.4: MW total capital programs across regulatory periods ($2020-21m)

Period	Average /yr.	Peak yr.	Total delivered	Comments
RP5	$740.4	$960.9	$3,700.0	Proposed
RP4	$544.1	$630.2	$2,700.0	Current delivery model introduced at commencement of period
RP3	$434.1	$648.7	$2,170.6	
RP1	$896.0	$1,415.6	$4,479.9	Drought response inc. desal plant

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

The ability to deliver a capital program is a function of not only the size of the program (total value) but also the number of projects being delivered, as each project requires a project management process, and therefore effort and resourcing, to deliver. We have some concerns around the delivery capacity of MW and its delivery partners, given that a program of this size has not previously been delivered (noting commentary above).

MW has provided information regarding the number, and total value, of projects proposed to be delivered and while this information indicates that there is a larger proportion of larger value projects and a significant reduction in the total number of projects proposed in RP5, the information notes that a significant proportion of smaller projects (<$1m) are consolidated into the allocations allowances, thereby not providing a full representation of the total number of projects to be delivered.

4.5 Overview of major programs / allocations

4.5.1 Waterways and Drainage

MW has proposed $857.9m in major waterways and drainage programs/allocations. This is presented in Table 4.5 by major driver. Major programs are not broken down further, making it difficult to connect these with the slightly more detailed breakdown of programs and scopes identified in price submission, which shows:

- drainage and flood protection (9 programs or allocations in total) $98.2m
- land development (9 programs or allocations in total) $437.3m
- stormwater quality (6 programs or allocations in total) $132.2m
- waterways condition (6 programs or allocations in total) $192.3m

Proposed program expenditure is predominantly in new infrastructure, growth and improvements/compliance. We note expenditure for both of these drivers is potentially adjustable if there are changes to the demand growth or willingness to pay attitudes.

MW's proposed capex program for waterways and drainage is 27% higher than the determination capex from RP4. Almost three quarters (72%) of the total expenditure for waterways and drainage is related to a major program/allocation. We note that this is significantly higher than sewerage services, where three quarters (74%) of total expenditure is identified in specific projects.

That said, it is acknowledged that allocations are more commonly used in waterways and drainage due to the geographic spread and sometimes small scale of the works, often in conjunction with private landholders, local councils or developers. Additionally, while the presently proposed

expenditure is significant in absolute terms, MW advises that the proportion of capital programs contained within allocations has reduced from 90% to 72% since the previous regulatory period.

During our review we raised concern that item 34 alone appears to represent a $100m increase in expenditure (assuming the 2021-22 and 2022-23 expenditure reflects a trend from the previous regulatory period). This is a significant rise, noting that average total expenditure on waterways and drainage from RP4 to RP5 increases by only $60m. Meanwhile, customer contributions overall have decreased by about $33m, which could suggest that the broader customer base would be paying for a significant amount of this cost increase.

In response, MW has clarified that item 34 relates to growth projects which are all in the Land Development service area. MW noted that new development schemes typically require construction of major assets in the early years to support growth, and that capital expenditure may exceed contributions over the period but balances over the life of the scheme. In particular, while customers may contribute financially during a regulatory period where there is a net funding shortfall, WWD customer prices reduce when there is a net funding surplus. MW states that PS16 was a period in which revenue comfortably exceeded land development capex by approximately $204m (refer to Table 4.5 below), whereas PS21 developer contributions are expected to be $85m lower than PS21 land development capex. Overall, MW states that its proposed waterways and drainage RAB will be $119m lower at the end of PS21 than its PS16 closing balance, therefore the waterways and drainage charge over PS21 will be lower as a result of higher developer contributions revenue received in PS16.[63]

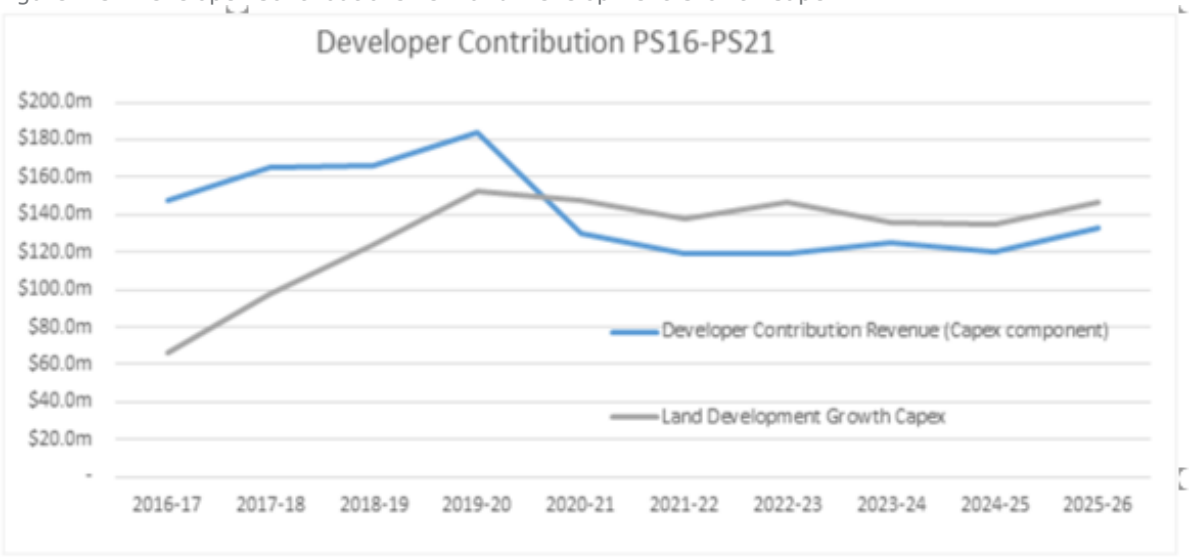
Table 4.5: Waterways and Drainage Allocations ($2020-21m)

No.	Major cost driver	Total	2021-22	2022-23	2023-24	2024-25	2025-26
34	Growth	433.06	9.68	27.11	114.53	135.21	146.52
35	Improvements/ Compliance	184.82	38.89	43.20	40.47	31.66	30.59
36	Improvements/ Compliance	92.72	8.03	12.39	15.60	32.66	24.04
39	Improvements/ Compliance	74.29	3.41	13.90	19.50	18.98	18.50
124	Renewals	39.53	2.67	4.70	10.80	10.68	10.68
141	Renewals	23.87	3.62	3.54	5.71	5.59	5.41
148	Renewals	5.37	1.08	1.10	1.05	1.08	1.07
153	Renewals	4.28	0.85	0.86	0.86	0.85	0.85

[63] MW response to draft report provided 3 February 2021 (*Figure 13 Developer Contributions vs. Land Development Growth Capex)*

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

Figure 4.3: Developer Contributions vs. Land Development Growth Capex



Source: MW response to Arup query, provided 3 February 2021

4.5.2 Water and Sewerage

Proposed water and sewerage expenditure allocations (refer Table 4.6 and Table 4.7) have been extracted from MW's 2021 Price Review Model. These allocations are not broken down further, making it difficult to reconcile these with the slightly more detailed breakdown of programs and scopes identified in Table 67 of MW's Price Submission. The water and sewerage allocations are also not tagged with a specific driver, making it more difficult to reconcile the expenditures against what is included in the pricing model.

Table 4.6: Water allocations ($2020-21m)

	Major cost driver	Total	2021-22	2022-23	2023-24	2024-25	2025-26
141	Renewals	49.40	9.02	10.45	10.21	9.97	9.74
143	Renewals	37.60	4.62	7.76	8.61	8.40	8.20
145	Renewals	67.98	4.47	11.74	18.23	17.55	15.99
147	Improvements/ Compliance	47.66	18.06	8.26	8.04	7.40	5.90
148	Improvements/ Compliance	15.19	2.02	2.37	3.83	3.73	3.24
153	Improvements/ Compliance	11.89	0.94	1.12	3.02	3.70	3.11

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

The key water allocations are relatively small in comparison to waterways and drainage and there is no general allocation under growth. Renewals are the primary expenditure for allocations and it is noted that total renewal expenditure (including separately identified projects) for RP5 is slightly lower than what is forecast to be delivered in RP4 (noting that the final year expenditure for RP4 is still a forecast).

Table 4.7: Sewerage Allocations ($2020-21m)

	Major cost driver	Total	2021-22	2022-23	2023-24	2024-25	2025-26
138	Renewals	89.57	13.23	16.91	20.04	19.94	19.45
139	Renewals	80.99	12.84	16.27	17.93	17.18	16.76

	Major cost driver	Total	2021-22	2022-23	2023-24	2024-25	2025-26
140	Renewals	72.04	7.53	9.66	18.74	18.28	17.83
142	Improvements/ Compliance	67.58	11.17	16.59	16.27	11.14	12.40
144	Improvements/ Compliance	37.07	6.68	8.28	7.58	7.35	7.18
168	Improvements/ Compliance	11.64	1.08	2.35	5.50	1.71	1.00
200	Growth	4.69	4.69	-	-	-	-

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

As for water, the key allocations are relatively small compared to the waterways and drainage and a very small, once-off allocation for growth. Renewals are again the primary expenditure for allocations and it is noted that total renewal expenditure (including separately identified projects) for RP5 are significantly higher (40%) than what was forecast to be delivered in RP4 (noting that the final year expenditure for RP4 is still a forecast).

4.6 Major water projects

MW has proposed a major increase in water capex for RP5 compared to RP4. Table 4.8 shows a 66% increase in water capex is attributed to drinking water quality.

Table 4.8: Bulk water service capex by program (excluding corporate)

Program	RP4	RP5	Difference between periods
Production & Storage	$212m	$232m	$20m / +9%
Drinking Water Quality	$120m	$199m	$79m / +66%
Water Transfer	$276m	$360m	$84m / +30%

Source: MW, 9 November 2020, *Melbourne Water Price Submission 2021*, p.64

The majority of expenditure in water is categorised within specifically identified major projects (66%) and the following major projects make up approximately half of this project expenditure and a significant proportion (31%) of the total expenditure for RP5:

- Yan Yean to Bald Hill Pipeline
- Maroondah Reservoir Outlet and Aqueduct Stage 3A
- Winneke Treatment Plant – UV Disinfection System
- Olinda-Mitcham Water Mains Replacement Stage 1
- Cement Creek Diversion Works.

These are reviewed below.

4.6.1 Project 1 – Yan Yean to Bald Hill Pipeline

Information source	• Preliminary Business Case – Yan Yean to Bald Hill Pipeline • Major Projects 01 - - Q05333 Yan Yean to Bald Hill Pipeline – ESC Requirements overview • Yan Yean Bald Hill System CSDC January 2020 – Customer and Service Delivery Committee (CSDC) recommendation to MW Board • Attachment 2 – CSDC_EW Transfer Yan Yean Bald Hill System – CSDC presentation
Investment Driver	• Growth (100%)

Intended Outcome	• Provide for growing demand for water in the northern and western suburbs of Melbourne
Current Project Status	• BNI approved 21 November 2016 ($58.9m) • Preliminary Business Case approved March 2020 ($113.4m)
Procurement and project delivery Process	• Major Works – Open Market – no contracts awarded yet

4.6.1.1 Project description and key drivers

This project is stated as a key component of MW's east-west water transfer strategy to ensure water supply to Melbourne's growth areas in the northern and western suburbs, where it is expected that around 75% of Melbourne's greenfield growth will occur over the period to 2056.[64] The existing Greenvale Reservoir, which is the primary supply reservoir for the north and west, will be expected to supply approximately 95 GL/a by 2050 but the current transfer capacity to the reservoir is only 50 GL/a.

4.6.1.2 Options

A MW led East-West Transfer Plan (completed in conjunction with the retailers) completed in March 2017 assessed options to increase the transfer capacity. The options assessed were:

- Option 1: Increased pumped supply over ten years with two pump stations and a pipeline from Preston to Epping
- Option 2: Increased gravity supply over fifteen years with a pipeline from Warrandyte to Greenvale
- Option 3: Increased pumped supply over five years from Yarra Crossing with a pipeline and two pump stations
- Option 4: Increased pumped supply with a pipeline from Yan Yean to Bald Hill, a service reservoir at Bald Hill and upgrades to existing pump stations

Option 4 was recommended for adoption in the Transfer Plan given it was the least cost option (net present cost) and had stated less reliability risks to existing northern suburbs supplies.

The recommended option has four related projects, in addition to this pipeline:

- Preston pumping station upgrade works – underway and was scheduled for commissioning June 2020
- Bald Hill service reservoir – scheduled for 2020-21
- Yan Yean Pump Station – scheduled for 2021-22 to 2022-23 with concurrent approval sought in this pricing submission
- Plenty pump station capacity upgrade – scheduled for 2026-27

4.6.1.3 Discussion/analysis

MW has indicated that this project is required due to population growth and resulting increases in demand on the Greenvale Reservoir, which place pressure on the existing transfer system from Silvan Reservoir. MW suggested this may potentially result in the Greenvale reservoir being unable to supply the appropriate level of service (pressure or potentially supply interruptions). However no clear timing on when this might occur, based on current population figures, is provided in the Preliminary Business Case. Neither is an assessment of how changes to population growth (water demands) could accelerate or defer this critical point. This information would make the justification of this project significantly clearer.

We acknowledge the interactions MW has had with Yarra Valley Water as the primary retailer affected by any impacts on customer supply and the general support given by the retailer through this process. Also noted is the timing of investment completion required to ensure the retailer is not affected by supply constraints.

[64] Victorian in Future 2019

It is further noted that this project is 100% related to growth and as such is impacted by any variations to growth rates. While that demand growth in the current regulatory period has been significant, future growth, given current circumstances, may be variable. A simple chart, as identified above, would assist in assessing the implications of possible future scenarios.

Information supplied by MW relating to the cost estimates is limited to a high-level breakdown of the proposed capex by project phases – investigation, design and construction. The original estimates for this project (at BNI stage) have now doubled for the Preliminary Business Case. MW states that this is due to increases in the pipeline depth requirements (50%), unconfirmed geotechnical conditions (30%), increased construction costs (10%) and potential cultural heritage considerations (10%). MW has stated that there are ongoing site investigations to reduce the potential risks and refine the project estimate. Despite these and other potential impacts on the costs, a contingency allowance of only 6% has been added to the costs.

4.6.1.4 Recommendation

Given this project's importance to ensuring adequate water supplies to key development areas and its role in increasing the reliability and security of supply to these same areas, we are inclined to agree it is prudent. The options analysis undertaken is acceptable considering gravity and pumped solutions. We hold some concern over the level of detail in the cost estimates and particularly the relatively low contingency allowed when there are some investigation and design tasks outstanding. Some further detail on the timing of the investment needs would be beneficial to demonstrating the efficiency of the proposed solution. We also recognise that this project is part of a suite of related projects which are required to achieve the desired goals.

We are not inclined to recommend any adjustments for this project at this time. As such the proposed and recommended expenditure for this project are set out in Table 4.9 below.

Table 4.9: Proposed capex for Yan Yean to Bald Hill Pipeline and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	38.15	52.67	4.83			95.66
Recommended adjustments	-	-	-	-	-	
Recommended capex	38.15	52.67	4.83			95.66

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.6.2 Project 2 – Maroondah Reservoir Outlet and Aqueduct Stage 3A

Information source	• Q07143 Maroondah Res Outlet and Aqueduct Stage 3A BNI – Business Needs Identifier business case (undated) • Major Projects 02 - Q07143 Maroondah Res Outlet and Aqueduct Stage 3A – ESC requirements checklist (undated) • Maroondah Res New Outlet Concept Design Final Report – concept options assessment (May 2018) • Maroondah Outlet Tower Future Options Report August 2017 -FINAL (August 2017)
Investment Driver	• Renewals (90%) • Strategic / risk management (10%)
Intended Outcome	• Decommission and replace outlet and transfer system from Maroondah Reservoir to Myers Creek to reduce system losses, improve system flexibility, improve water quality, and improve public safety.

Current Project Status	• BNI approved 31 October 2019 • Preliminary Business Case targeted for completion and approval Sep-Dec 2021
Procurement and project delivery Process	• Major works – open market with expected construction contract award Jan 2024 and Stage 1 completion by Dec 2026

4.6.2.1 Project description and key drivers

In 2008 MW commissioned a review of options to secure water transfers between Maroondah Reservoir and the MW supply system. The review focussed on the management of the aqueducts from the reservoir into the downstream system and recommended a risk-based program to refurbish or replace (like-for-like or with pipe) sections of the aqueduct. Subsequently, a Maroondah and Coranderrk Aqueduct system strategy was prepared which proposed a whole of system approach to updating and replacing the system assets. This strategy divided the overall works into multiple stages with Stage 1 and 2 sections on the Maroondah aqueduct being completed and Stage 3 (this project is Stage 3A) and 4 to be undertaken.

MW studies have identified multiple issues with both the Maroondah Reservoir outlet tower and the aqueduct from the tower to the downstream water supply system. Separate work is being undertaken on the outlet tower while this project focusses on the decommissioning of the existing aqueduct connection to the outlet tower and constructing a new outlet and pipeline to Myers Creek. The coordination of works at the site and throughout the system is important to ensure the overall objectives of the system strategy are achieved.

The Maroondah Aqueduct is considered by MW to be at the end of its service life due to its deteriorating condition and continued water losses (this aqueduct accounts for 13.8% of total system losses). Further, the condition of the aqueduct and its configuration do not satisfy service levels set in the Strategic Asset Management Plan, and contributes to water quality, public safety and OH&S risks.

4.6.2.2 Options

Extensive previous work has been completed for the overall transfer system (2008 systems strategy and capital plan) and the aqueducts and related infrastructure.

Options for the outlet tower were assessed in the 2017 options report however the assessment also included consideration of the transfer system. The preferred options from the 2017 report were assessed in more detail in the 2018 report however this report focussed entirely on the outlet structure with the options for the aqueduct replacement identified as being undertaken separately by MW. Nevertheless, we are generally comfortable with the options assessed given they have been developed within the context of the broader transfer scheme and aqueduct strategies mentioned.

Cost estimates have varied within the various assessment reports produced. In the 2017 report, costs for the outlet structure are identified as around $14.2m and the transfer system at around $57.6m. In the 2018 report the outlet structure is costed at around $35.7m, a significant apparent increase over the previous years' assessment.

The total costs allocated in the pricing submission (the RP5 period and beyond) are around $80.3m which is different to the total pricing achieved by adding the 2017 transfer system cost to the 2018 outlet structure cost ($92.3m). It is noted that the total in the pricing submission does not include any actual costs expended in the current RP4 period or earlier however these costs would need to be in excess of $1.5m per year to arrive at a similar total. Further the BNI business case provides a consistent total P50 cost of $90.2m (nominal) but does not identify a base cost for the preferred option in the financial assessment.

We hold some concern over the identified contingency allowance in the project cost estimate appearing to represent only a little over 10% on the P50 capital plan total. At this stage of the project, we would expect contingencies to be in the order of 30-50%. It is noted that some

contingencies may be incorporated into the P50 capital plan total, however no breakdown of this cost has been provided.

4.6.2.3 Discussion/analysis

A key note of concern for this project is the apparent halt of progress in developing the preferred option further from the options assessment reports in 2017 and 2018. No evidence of further work has been provided, despite references to further works in the BNI including an Investment Logic Mapping exercise and further work required on the base cost for the transfer scheme, which despite appearing in the 2017 future options report, still appears to be founded on original work from 2008.

Overall, we are comfortable in the prudency of this option given it is a key component of the larger transfer and aqueduct strategies. The efficiency of the option is harder to assess given the information available and our stated concerns over the sources of the costs estimates and the breakdown of cost components. Significant further work is planned to be undertaken to progress this project and these issues would be resolved with this work.

4.6.2.4 Recommendation

We recognise that this project is of strategic importance in the overall strategy for the transfer scheme and the aqueducts located in the region. We accept the drivers for the project and recognise the early stage of the project within the investment decision making framework. We can see the future stages of the project work to improve and refine the information available and the timing of these into the latter part of RP5.

Given this, we are not inclined to recommend any adjustments to this project at this stage. We do note, however that opportunities may exist to defer some of the capex within the last year of the regulatory period to assist with profiling of expenditure within the period. The proposed and recommended expenditure for this project are set out in Table 4.10 below.

Table 4.10: Proposed capex for Maroondah Reservoir Outlet and Aqueduct Stage 3A and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	0.65	0.69	2.54	21.35	32.94	58.18
Recommended adjustments	-	-	-	-	-	-
Recommended capex	0.65	0.69	2.54	21.35	32.94	58.18

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.6.3 Project 3 – Winneke Treatment Plant – UV Disinfection System

Information source	• Major Projects 04 - Q03309 Winneke TP - UV Disinfection System – ESC requirements checklist (undated) • Memo_ Winneke UV capital project for endorsement – memo outlining the key differences between the Preliminary Business Case (2016) and proposed FBC (2021) (October 2020) • DRAFT Q03309 Business Case Winneke Treatment Plant UV upgrade – draft business case (assumed FBC) (undated)
Investment Driver	• Compliance (100%)
Intended Outcome	• Introduce a second treatment barrier for the Winneke Treatment Plant to reduce the risks to water quality
Current Project Status	• BNI approved 10 April 2012 • Preliminary Business Case approved 21 April 2016

Procurement and project delivery Process	• FBC under development and targeted for completion in February 2021
	• Major Works - Framework

4.6.3.1 Project description and key drivers

The Winneke Treatment Plant is a key component of the MW supply system with up to 25% of Melbourne's total annual water supply passing through the plant during normal operation and up to 40 % during drought periods. The plant treats water extracted from the Yarra River at Yering Gorge and from Maroondah Reservoir via the Maroondah Aqueduct. The current plant sources approximately 75 GL/yr of water from Sugarloaf Reservoir each year, with up to 61 GL/yr available from the Yarra River at Yering Gorge and up to 53 GL/yr available from the Maroondah Reservoir via Maroondah Aqueduct. Importantly, supply from the Yarra River at Yering Gorge, the mid Yarra catchment, is considered an open, unprotected catchment with a variety of agricultural and urban land uses which can affect the water quality.

Overall, water quality standards are set within the Victorian Safe Drinking Water Regulations 2015 which places a strong emphasis on preventative risk management including multiple barrier approaches to risk reduction and prevention. The current plant, however, is reliant on a single filtration process to remove potential water quality risks including bacteria, virus and protozoa. While this process is sufficient to meet treatment requirements for bacteria and virus risks, it is insufficient to achieve full removal of protozoa risks in the supply from the mid Yarra catchment (the open catchment with higher potential for water quality risks).

The risks to water quality have been assessed in Quantitative Microbial Risk Assessments undertaken for the plant which have recommended additional treatment processes be implemented to reduce the risks of public health impacts and breaches of drinking water quality standards.

4.6.3.2 Options

This project has been in development since the BNI was first completed and approved in 2012 with the project being submitted in PS16. The previous assessment of the project identified some concerns around the level of consideration of non-infrastructure options.

Since this review, further work has been undertaken with the Mid Yarra Catchment Management Investment Standard (CMIS) process in 2017 which identified, costed and shortlisted a variety of land management options. The CMIS process found that with the introduction of Health Based Target ratings for water supply catchments and the residual risks associated with land based management options, these options do not provide a sufficiently reliable barrier to water quality risks or to reduce the Health Based Target rating sufficiently such that an additional treatment process is required.

In relation to project cost estimates we note that the original cost estimates put forward for approval in the PS16 review have increased significantly. The original capital allowance sought for this project was approximately $31.7m ($2016) with estimates of opex at approximately $250,000 ($2016) per year. The current proposal costs are $52.53m (P95) with annual opex of around $485,000.

4.6.3.3 Discussion/analysis

In reviewing the work completed since this project was last reviewed, we are now comfortable with the level of consideration of non-infrastructure options as potential alternatives to the UV disinfection system and are therefore more comfortable with the reasoning behind selection of the UV system as the preferred option.

We are not, however, comfortable with the significant increases in cost estimates (both capital and opex), for what appears to be the same option previously put forward for the PS16 period review. The increases in capital and operating costs have not been explained in the draft Functional Business Case and are well above the escalation that is expected to current day values. It is understood that further investigations have been undertaken to confirm process design, site

layouts and scope of works required; and that preliminary geotechnical investigations have also been undertaken since the project was included for funding approval in PS16. MW has stated that the results of these investigations, along with price rises in the construction industry have contributed to the increase in total cost for the project.

We are not, however, convinced that this further work is justification for the cost increases. The total submitted in PS16 for funding approval reflected the work done at the time and it is normal practice to allow some cost contingencies that take into account work still to be done and indirect costs associated with the project. As a result, it is not unreasonable for us to assume that the total cost submitted in PS16 represents the expected total cost of the project. If this project was accepted as efficient in the PS16 review, then this allowance for PS16 would, in fact, have been accepted as the total cost.

Further, any price rises in the construction industry should be significantly mitigated through the construction delivery partner arrangements MW had, and still has, in place.

The previous review also identified some issues with the timing of the proposed expenditure and recommended some re-phasing of expenditure to match what was thought to be a more realistic construction timeline. Despite the stated original urgency of the project, the current timelines have final stage commissioning and handover of the plant occurring in March 2026, some fourteen years since the BNI was approved.

4.6.3.4 Recommendation

Our review of this re-submitted project has identified that the issues raised in PS16 have been largely resolved and we remain comfortable, as in the PS16 review, in the prudency of the expenditure. For different reasons, we are still uncomfortable with the efficiency of the project. The cost estimates (capital and operating) have been significantly increased for what appears to be the same project. Insufficient reasoning has been provided for the cost increases and we are inclined to reject this increased cost.

We therefore recommend adjustments to the proposed capex calculated by:

5. Escalating the original cost estimate from PS16 to current day value
6. Determining the % reduction from the escalated PS16 expenditure compared to the proposed capex for PS21
7. Applying the % reduction equally to the expenditure profile in each year of the PS21 period

As such the proposed and recommended expenditure for this project are set out in Table 4.11 below.

Table 4.11: Proposed capex for Winneke Treatment Plan UV disinfection system and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	1.34	27.22	14.53	0.01	0.00	43.10
Recommended adjustments	-0.28	-5.38	-2.87	0.00	0.00	-8.53
Recommended capex	1.06	21.84	11.66	0.01	0.00	34.57

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.6.4 Project 4 – Olinda-Mitcham Water Mains Replacement Stage 1

Information source	• Major Projects 03 - D10101 Olinda-Mitcham Water Mains Replacement Stage 1 – ESC requirements checklist • D10101 Olinda-Mitcham Water Mains Replacement Stage 1 Preliminary Business Case (undated)

Investment Driver	• Renewals (100%)
Intended Outcome	• Renew pipelines to reduce high risk of failure and subsequent leakage, third party damages, and loss of supply compromising retail supply agreements and customer expectations
Current Project Status	• BNI approved 19 September 2019 • Preliminary Business Case approved 27 November 2020
Procurement and project delivery Process	• Major Works – Framework for design and construct contract • Engineering Services Panel for functional design and Issued for Tender documentation

4.6.4.1 Project description and key drivers

MW manages three key delivery mains to transfer water between the Olinda and Mitcham Service Reservoirs, the M54, M55 and M56 mains. The M54 and M55 mains are part of the distribution system and have multiple offtakes to supply pressure zones along the pipe alignment servicing 150,000 customers. The M56 main is a dedicated bulk transfer main with over 365,000 customers located in the supply zones of the two reservoirs.

The three mains are very large (DN900 to DN1150) and old (constructed over the period from 1914 to 1936) and have suffered multiple minor failures requiring remedial works. The mains were cement lined in the 1970s but have continued to deteriorate. As they deteriorate further, the three mains present an increasing risk of failure compromising water supplies to a large number of customers.

Over the past decade multiple pipe condition assessments have been undertaken with sections of each main prioritised for renewal or continued monitoring. The condition assessments have been supported by specific investigations to assess the levels of corrosion along with risk mitigation measures such as cement lining, spot repairs for leaks and cathodic protection systems to reduce corrosion.

4.6.4.2 Options

An options assessment to replace the entire length of the pipeline was undertaken in October 2019. The assessment identified optimal alternative routes for three sections of the pipelines but for the Stage 1 works (the subject of this proposal), replacement along the existing route was deemed to be the only viable option. The key reasons for this included the difficulties and additional costs of new, longer easements for the alternative routes (as opposed to the current alignment along which MW owns the land), the additional costs of multiple new distribution system points on mains M54 and M55, and the wider disruption to services, traffic and the community associated with the alternative routes.

The options assessment therefore dismissed the alternative route options for this Stage 1 project and also dismissed the do nothing / business as usual option given that this option would increasingly lead to significant failures of mains and breaching levels of service requirements.

Cost estimates were only prepared for the single option to renew the three mains along the existing alignment. MW has stated that the costs have been updated slightly from the previous BNI level estimates to reflect a better understanding of the operational constraints, risks and delivery efficiencies from similar projects. The key increases relate to a new allowance for concept design and investigation and an increased design and construction allowance which have been offset by a lower functional design allowance and lower contingency (9% down from 18% at the BNI stage)

4.6.4.3 Discussion/analysis

The condition assessment and risk mitigation drivers for the project are relatively well established and the potential impacts are well set out. Clearly these are large and important mains to the supply system and we are comfortable with the prudency of the investment.

In assessing the efficiency of investment, constraints resulted in only one option being developed in detail. However MW has demonstrated some efficiencies updating costs between business cases by incorporating learnings from similar renewal projects delivered, despite the total cost increasing. There is some concern on the levels of contingency allowed at less than 10% for a preliminary business case. At this stage we would expect levels around 30% in total.

The proposed renewals works are planned in stages with this project representing the first stage targeting those sections of pipeline in the poorest condition. The remaining stages are planned for future periods however no expenditure allocations are yet identified. Some further efficiencies could be delivered in the program by reflecting on system performance following the first stage of renewals and further optimising future stages of work.

4.6.4.4 Recommendation

The proposed renewals expenditure is considered essential work that contributes to the continuation of appropriate service levels to customers and minimisation of high risks to the supply system. The prudency and efficiency of the proposed investment have been sufficiently demonstrated and the timing of investment appears appropriate and is backed by multiple condition assessments.

Given this we are not inclined to recommend any adjustments to this investment and as such the proposed and recommended expenditure for this project is set out in the table below.

Table 4.12: Proposed capex for Olinda – Mitcham Water Mains Replacement Stage 1 and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	4.63	33.03				37.66
Recommended adjustments	-	-	-	-	-	-
Recommended capex	4.63	33.03				37.66

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.6.5 Project 5 – Cement Creek Diversion Works

Information source	• Major Projects 05 - Y10227 Cement Creek Diversion Works – ESC requirements checklist • BNI Cement Creek Diversion Works – Business Needs Identifier business case • Cement Creek Investigations and Concept Design Report (FINAL) – refinement of options to support the Preliminary Business Case review and approval process
Investment Driver	• Growth 100%
Intended Outcome	• Infrastructure to divert raw water from Cement Creek to Silvan Reservoir in order to maximise use of existing bulk entitlements and meet future water supply needs
Current Project Status	• BNI approved 21 October 2019 • Investigation and Concept Design completed August 2020 to support Preliminary Business Case
Procurement and project delivery Process	• Major Works – Open Market

4.6.5.1 Project description and key drivers

The Cement Creek catchment is one of the highest rainfall areas in Melbourne's water supply catchments and has an average historical streamflow of around 13 GL/yr. MW has a bulk entitlement for Cement Creek which allows the diversion of up to 70 ML/day but ceased harvesting water from Cement Creek when the O'Shannassy Aqueduct was decommission in the 1990s. Under the MW System Strategy (2017), maximising the use of existing bulk entitlements is preferred over new or amended entitlements.

Estimates for the incremental yield under historic climate conditions are 10 GL/yr while under a median climate change scenario the yield reduces to 8 GL/yr. Given the current estimates of total capex for the proposed infrastructure to divert this yield, the equivalent annual cost for the yield is estimated at around $240/ML, significantly less than other supply sources and the Victorian Desalination Plant.

4.6.5.2 Options

An options assessment for diversion opportunities was conducted as part of a study of centralised supply augmentation options for the entire Melbourne water system in 2017. Specific options identified were:

- Option 1: Do nothing – business as usual with the current supply systems
- Option 2:Construction of weirs on the east and west Cement Creek branches and pipeline to divert water to the Yarra-Silvan conduit
- Option 3:Construction of a weir on the east branch of Cement Creek and a pipeline to divert water to the Yarra-Silvan conduit (assumes water quality risks on the west branch can't be resolved)
- Option 4:Duplicate the O'Shannassy cross connection – O'Shannassy Reservoir to the Yarra Valley conduit
- Option 5:Augment the Victorian Desalination Plant

The key criteria used for this options assessment was a comparison of the levelized costs for each option and more specifically, a levelized cost for the volume supplied. Levelised costs were calculated using the total capital cost spread equally over a 25 year period, plus the expected annual opex and then weighted by the yield supplied by the option to get a $/ML figure for the comparison of options.

4.6.5.3 Discussion/analysis

The fundamental drivers for this project are generally sound and demonstrate a desire for achieving efficiencies in meeting future potential supply shortages by targeting low cost supplies with reliable yields. Maximising the use of existing bulk entitlements also reduces environmental and community costs compared to seeking new or amended entitlements.

The use of a levelized cost analysis tied to the yield delivered is also a useful approach to ensuring a low cost reliable yield option. However we have some issues with the application of the costs to the levelized cost analysis. This includes the simplistic method of allocating the capital cost equally over a 25 year period, and the common assumption for the majority of options of a flat $1m/year opex assumption.

The allocation of capital should reflect the expected construction period including any staging of infrastructure. The consideration of returns on capital, depreciation, asset lives, renewals and the effects of inflation do not add significant complexity to the analysis. Similarly, the application of operating costs should reflect the type of infrastructure required and the energy requirements reflecting yields delivered. It is noted firstly that further work on the levelized costs is scheduled to support future business cases and secondly, that these additions may not have a significant effect on the relative positioning / scoring of the options. Nevertheless, this level of detailed analysis should be expected in this type of assessment.

The options assessment and capital profiling provide limited information regarding the expected timing of the investment. The current profile of expenditure has the work completed and commissioned in 2023-24 while the BNI made references to expectations that supply shortages are possible by 2028 under a possibly unlikely high growth / high consumption / high climate

change scenario. A scenario with median / average assumptions is likely to produce a significantly different trigger point for a supply shortage. This implies that there is no immediate urgency (a current supply shortage) to implement these works.

MW has suggested that this project is essential as a lower cost water source than the Victorian Desalination Plant and that implementing this augmentation as soon as possible would reduce the demand on the Thomson Reservoir allowing storage levels to recover and may subsequently avoid the need to bring forward more expensive system augmentations (e.g. an expansion of the desalination plant).

While we accept the argument that the project is a lower cost supply source than others, MW's explanation of the prudency of this project was clearly related to responding to potential future water supply shortages. An argument was not made for implementing this project to reduce the present average cost of supplying water or to respond to current water supply shortages. The demonstration of prudency and efficiency for an argument related to current average water supply costs would likely be based on clear positive outcomes from a cost benefit analysis – this has not been provided or demonstrated. For a current water shortage, we would expect some modelling to have been done to demonstrate this current shortage – this has not been provided or demonstrated. It was also not clear from the documentation provided that the justification for this project is to improve the reliability of storage levels in Thomson Reservoir, noting that MW has suggested in comments that this might be the result of the project going ahead.

We have assessed this project on the basis that it is an option to respond to future potential water supply shortages; shortages which appear to have been modelled with the result that augmentations would be required around 2028 under a high growth/consumption/climate scenario. The modelling suggested that augmentations would be required to respond to this shortage, with the options considered including this project or an augmentation to the desalination plant. The recommended option from the supporting documentation provided is this Cement Creek Diversion works. At the very least, these works would defer the need for an augmentation of the desalination plant further into future periods. MW has not provided any evidence for the implementation of this project prior to 2028 (noting that this is the earliest time for the only supply shortage identified in the supporting documentation, but under an extreme and unlikely modelling scenario).

4.6.5.4 Recommendation

As identified above, we are generally satisfied with the demonstration of prudency and the approach to identifying an efficient option (noting comments on the levelized costing analysis in the section above).

We are less certain on the required timing of the investment as the only information provided on timing for a water supply shortage is 2028, and this is noted as being an extreme scenario. Given MW's stated desire to achieve just in time works to ensure efficient investment, we are inclined to recommend a deferral of the proposed expenditure to later in the period. Our proposed deferral is still likely quite conservative as it allows for the completion of this project well prior to the very conservative 2028 date nominated. We are not inclined to recommend any specific adjustments to the total expenditure allocation for this project.

As such the proposed and recommended expenditure for this project are set out in the table below.

Table 4.13: Proposed capex for Cement Creek Diversion Works and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	0.35	1.70	25.57			27.63
Recommended adjustments	-0.35	-1.70	-25.22	1.70	25.57	-
Recommended capex			0.35	1.70	25.57	27.63

Source: Arup

4.6.6 Recommendations for water capex

Based on the above analysis, we recommend a total reduction of $8.5m to proposed water capex over RP5, attributed to the Winneke Treatment Plant UV disinfection system. We also recommend deferring $27.6m of Cement Creek Diversion Works to the last two years of the regulatory period.

Table 4.14: Summary of recommended adjustments to major water capital projects ($2020-21m)

Project		2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Yan Yean to Bald Hill Pipeline	Proposed capex	38.15	52.67	4.83	0.00	0.00	**95.66**
	Recommended adjustments	0.00	0.00	0.00	0.00	0.00	**0.00**
	Recommended capex	38.15	52.67	4.83	0.00	0.00	**95.66**
Maroondah Reservoir Outlet and Aqueduct Stage 3A	Proposed capex	0.65	0.69	2.54	21.35	32.94	**58.18**
	Recommended adjustments	0.00	0.00	0.00	0.00	0.00	**0.00**
	Recommended capex	0.65	0.69	2.54	21.35	32.94	**58.18**
Winneke Treatment Plant UV disinfection system	Proposed capex	1.34	27.22	14.53	0.01	0.00	**43.10**
	Recommended adjustments	-0.28	-5.38	-2.87	0.00	0.00	**-8.53**
	Recommended capex	1.06	21.84	11.66	0.01	0.00	**34.57**
Olinda – Mitcham Water Mains Replacement Stage 1	Proposed capex	4.63	33.03	0.00	0.00	0.00	**37.66**
	Recommended adjustments	0.00	0.00	0.00	0.00	0.00	**0.00**
	Recommended capex	4.63	33.03	0.00	0.00	0.00	**37.66**
Cement Creek Diversion Works	Proposed capex	0.35	1.70	25.57	0.00	0.00	**27.63**
	Recommended adjustments	-0.35	-1.70	-25.22	1.70	25.57	**0.00**
	Recommended capex	0.00	0.00	0.35	1.70	25.57	**27.63**
Total	**Proposed capex**	**45.12**	**115.32**	**47.49**	**21.36**	**32.94**	**262.22**
	Recommended adjustments	**-0.63**	**-7.08**	**-28.09**	**1.70**	**25.57**	**-8.53**
	Recommended capex	**44.49**	**108.24**	**19.40**	**23.06**	**58.51**	**253.69**

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7 Major sewerage projects and programs

The following top five sewerage capital projects were assessed in the following section:

- WTP Primary Treatment Augmentation
- WTP 55E ASP Upgrade
- HBM Yarra Crossing Duplication
- Maribyrnong Main Sewer Augmentation

- WTP Gas Plant Renewal.

4.7.1 Project 1 – WTP Primary Treatment Augmentation

Information source	• Preliminary Business Case - Western Treatment Plant (WTP) Primary Treatment Capacity Augmentation • Primary Treatment Capacity Augmentation Concept Design • Concept Design cost estimate, with MW adjustments for entry into Project Online RANE model
Investment Driver	• Growth (100%)
Intended Outcome	• Provide preliminary treatment (screening and grit removal), primary treatment (sedimentation tanks), and sludge treatment (thickening and anaerobic digestion). This will reduce the load on the existing anaerobic pots to sustainable levels and provide capacity for future growth.
Current Project Status	• Preliminary Business Case • Concept engineering design
Procurement and project delivery Process	• The exact approach is still to be determined • MW has committed to an open market tendering process • The WTP Primary Treatment Capacity Augmentation must follow the High Value/High Risk Framework to determine the appropriate contractual arrangement • Due to size of the proposed project, the project may need to follow DTF Gateway process

4.7.1.1 Project description and key drivers

Primary treatment at the WTP currently comprises two (2) covered anaerobic lagoons. Commonly referred to as the 25W and 55E anaerobic pots, they were commissioned in 1991 and 1993, respectively. The anaerobic pots are earthen structures that are around 6 to 8 metres deep. The 25W and 55E anaerobic pots are covered and biogas is extracted to generate electricity and reduce odours. The anaerobic pots provide the primary treatment of the incoming sewage which includes settling of solids and grit.

As the solids and organic load is captured and treated, sludge and scum are progressively generated and these accumulate over time leading to a reduction in the "active treatment volume" and deterioration of the pot's performance, and each pot requires de-scumming and de-sludging regularly to maintain performance.

MW has identified that the current inflows to WTP are reaching the design capacity of the pots, and the organic loading capacity of the system is impacted at times by the replacement of the covers on the pots and their performance. There have also been licence non-compliance events in 2014-15 and damage to the 55E covers due to excessive sludge accumulation.

In addition to the compliance and renewals drivers as described above, population growth and the resulting increase in flows and loads has been estimated by MW to increase by 29% from 2020 to 2040 which is expected to exceed the capacity of the existing anaerobic pots before 2025.

To provide sufficient treatment capacity at the WTP, MW is proposing to construct a primary treatment capacity augmentation to address capacity constraints driven by population growth and to divert some load away from the existing anaerobic pots to return them to a more sustainable operating level.

Table 4.15: Proposed capex for WTP Primary Treatment Augmentation ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	1.80	6.02	128.16	166.02	13.27	315.27

Source: MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.1.2 Options

A detailed options assessment was undertaken in 2019, resulting in four shortlisted options. A high-level options analysis is presented in the business case, comprising a mainly qualitative comparison of advantages and disadvantages. These are summarised below.

- Option 1: Do Nothing
  - No change to existing process
  - Does not address growth drivers
  - Increase in operating costs and risk of regulatory non-compliance
  - Considered to be unacceptable to MW as it does not address growth driver or the current risks of compliance and cover replacements
- Option 2: Anaerobic Baffled Reactor
  - Lowest NPC
  - Unproven technology at WTP scale
  - Potential downstream odour impact
- Option 3: Primary Sedimentation with Anaerobic Digestion – Preferred Option
  - Well known technology, similar to that at ETP
  - Potential to adapt technology in the future
  - Expected to produce a different effluent quality compared to existing which could have some downstream impact
- Option 4: Biologically enhanced primary treatment/HRAS with anaerobic digestion
  - Highest NPC
  - Unproven technology at WTP scale
  - More complex technology

Option 3 was identified as the preferred option which balanced the cost and performance risk better than the other options considered. In the development of the options, MW has identified one of the key functional outcomes for the project is a design horizon of 2034-35, i.e. 10 years from the construction of the proposed works.

A concept design for the preferred option was finalised in December 2020.

4.7.1.3 Discussion/analysis

MW has indicated that the key driver for this project is Growth, and demonstrated the increase in organic load to WTP which has led to the existing pots becoming overloaded. The impact of this growth has also led to potential and realised risks of environmental non-compliance, community odour complaints and failure to meet commitments to greenhouse gas emissions reductions. The business case clearly outlines the issues related to the existing system and the problem definition.

The timing of the proposed project is currently scheduled for commencement of construction in 2023-24 and completion in 2025-26, with all expenditure planned for the 2021 pricing period. Based on the demonstrated need and forecast impact on the performance of the pots, the current level of development of the project and scale, the timing of the project appears reasonable and well justified.

The options assessment appears to generally presume a capital solution is required. An opex solution is not described and, given the significant capital investment, appears to be a gap. Melbourne Water noted that the "Do Nothing" option was based on removal and replacement of existing covers however there were practical limitations on undertaking replacement works on an ongoing basis which necessitated a longer term, permanent solution. These limitations included the long construction time to remove and replace covers, and management of sludge and scum under the covers. In the Preliminary Business Base, the "Do Nothing" option is discounted as being

unviable, however, there is no discussion or evaluation of the net present cost of the "Do Nothing" option in comparison with the other options. Melbourne Water noted that the Do Nothing option presented unacceptable risks and there was negligible benefit in calculating the NPV for this option.

The options assessment summary and list of inclusions built into the cost estimate does not include any waste disposal costs or impact compared with the current approach. A request for information was issued to MW regarding potential waste disposal processes. MW's response noted that there is no existing documentation addressing the comparison of waste disposal processes between the options or in comparison with the "Do Nothing" option. Separately to the Preliminary Business Case, Melbourne Water has estimated the costs for waste disposal to be in the order of $600,000 per year. Further development of the options should include all the operating costs across each option.

Of the infrastructure options considered, the preferred option appears to be the most prudent of the options considered and provides MW with efficiencies due to similar processes being used at ETP. Similarly, the preferred option appears to include allowances for expansion, potential technological changes and opportunities for increasing revenue through offering additional services such as co-digestion with food wastes. To that end, the potential economic benefits of the preferred option have not been detailed sufficiently and the opportunities such as co-digestion, or improved biosolids reuse uptake, should be considered in more detail in the Business Case.

The WTP PTCA project is expected to have an impact on the gas generation and cover replacements required for 25W and 55E pots. This impact could be significant, including delaying the proposed WTP Gas Plant project, and this should be considered in the business case for the PTCA project.

MW has undertaken a Class 4 cost estimate, providing a detailed breakdown of the expected costs of the project. The cost estimate is comprehensive for this phase of the project and includes reasonable allowances for direct and indirect costs.

4.7.1.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended. However, it is strongly recommended that the Business Case is updated with more detailed economic analysis of the "Do Nothing" option, the inclusion of waste disposal costs and the revenue opportunities presented, for example, from co-digestion.

Table 4.16: Proposed capex for WTP Primary Treatment Augmentation and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	1.80	6.02	128.16	166.02	13.27	315.27
Recommended adjustments	-	-	-	-	-	
Recommended capex	1.80	6.02	128.16	166.02	13.27	315.27

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.2 Project 2 – WTP 55E ASP Upgrade

Information source	• 55E ASP Upgrade Functional Business Case • WTP 55E ASP Renewal Cost Estimate – Functional Design • WTP 55E ASP Upgrade RANE Simulation Results • WTP 55E ASP Renewals Functional Design

Investment Driver	• Growth (70%) • Safety (20%) • Renewals (10%)
Intended Outcome	• Construction of Activated Sludge Plant in the existing 55E ASP lagoons to reduce nitrogen discharge to Port Phillip Bay
Current Project Status	• Functional Business Case approved in November 2020 • Functional Design completed in August 2020
Procurement and project delivery Process	• Detailed Design, followed by Construction with an Early Constructor Involvement phase

4.7.2.1 Project description and key drivers

WTP is a unique sewage treatment plant comprising natural lagoon-based treatment processes and mechanised systems. Approximately 120ML/d of the sewage inflow is treated through the 55E Activated Sludge Plant (ASP), which was first commissioned in 2001. The 55E ASP is a lagoon based secondary treatment process which aerates effluent from the anaerobic pots and is discharged to Port Phillip Bay or further treated to produce Class A effluent.

The proposed project involves the construction of a new 150 ML/d Nitrogen Removal Plant to replace the existing 55E ASP in order to address historical and future growth, renew ageing equipment, improve overall plant efficiency and enhance safety for operation and maintenance activities. The proposed works will facilitate the elimination of current high-risk maintenance works (i.e. diving and working over water, from boats) as well as provide the opportunity to implement lower cost, more energy efficient treatment technology (e.g. short cut nitrogen).The 55E ASP Renewals Project was included by MW as part of the 2016 Pricing Submission, with the Final Determination resulting in the expenditure being deferred to the 2021 Pricing Period. MW's 2016 Price Submission indicated the WTP 55E ASP Renewal had a proposed capex of $103.5m ($) and the key drivers for the project were:

- Renewals (50%) and
- Compliance (50%).

MW's 2021 Price Submission proposed capex for the 55E ASP Plant Upgrade is $211.4m ($2020-21) and the key drivers for the project are:

- Growth (70%)
- Safety (20%) and
- Renewals (10%).

Detailed Design is scheduled for completion in 2021-22, with construction intended to commence in 2022-23 and be completed by 2025-26.

Table 4.17: Proposed capex for WTP 55E ASP Upgrade ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	68.38	132.89	6.85	2.19	1.07	211.4

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.2.2 Options

The 55E ASP project is in an advanced stage, with the Functional Business Case being approved in November 2020. As such, the options analysis is limited with respect to the scale and components to be constructed at this stage. The options from the FBC include:

- Option 1: Do Nothing

- Option 2: Upgrade of 55E ASP to a conventional Biological Nutrient Removal (BNR) process
    - Construction a 150ML/d plant to address the key drivers outlined
    - Upgrade utilises similar process to existing 55E plant
    - Highest cost option
- Option 3: Upgrade of 55E ASP to a shortcut nitrogen removal plant – Preferred option
    - Construction of a 150ML/d plant utilising innovative technology to address the key drivers
    - Lowest cost option.

MW's business case acknowledges that Option 1 is unacceptable as it does not address the stated drivers for the project.

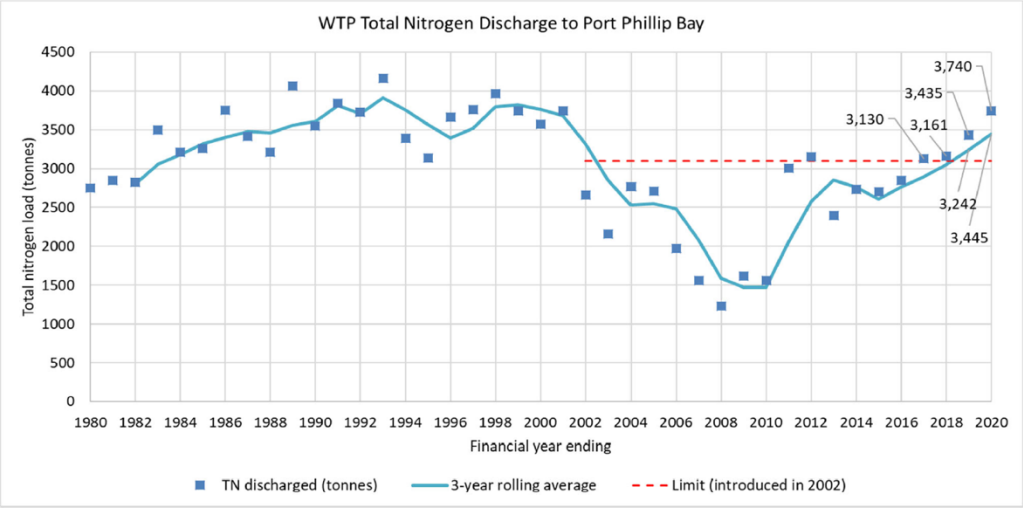
The options assessment does not consider the construction of the 55E ASP Upgrade in a greenfield location which would presumably still be an option at this stage and may present some benefit to MW's operations and the overall capital cost.

Based on our previous review for the 2016 Price Submission, we are satisfied that adequate options assessment has been undertaken for this project.

4.7.2.3 Discussion/analysis

Our review in 2016 noted that there was uncertainty relating to the ammonia and nitrogen concentrations due to a number of significant projects being constructed at WTP over the period which would have an impact on the treatment efficacy. As such our recommendation was that the project be deferred to RP5. MW's Functional Business Case includes data for the Total Nitrogen Load discharged to Port Phillip Bay and Ammonia Licence Compliance.

Table 4.18: Total Nitrogen Discharge to Port Phillip Bay from the WTP



Source: MW FBC, 2020

Since our review of the 55E ASP Renewal project from the 2016 Price Submission, there has been a number of significant changes to the project and business case:

- Project drivers have changed from Compliance and Renewals focus to Growth
- Change in approach from staged delivery to a single construction phase and delivery of full 150ML/d in one stage
- Costs for the project have increased from $103.5m ($2015-16) to $211.4m ($2020-21).

The change in drivers appears to largely seek to address the same underlying issue: compliance with nitrogen discharge to the bay (either total load or as ammonia). The change perhaps addresses the uncertainty raised in our 2016 Price Submission review regarding the future nitrogen discharge concentrations. However, it is clear on the basis of even relatively subdued growth that compliance with the nitrogen discharge limit will likely be exceeded in the RP5.

MW has indicated that updated flows and loads have been provided which require the construction of the full treatment capacity of 150ML/d rather than a staged approach which was previously the basis of the 55E project. This would have a significant impact on the construction costs of the project.

MW's 2021 Pricing Submission proposed capex for the project is stated as $211.4m ($2020-21). This proposed capex is based on the construction of a 150ML/d plant within the existing 55E lagoon and includes the decommissioning of the existing 55E ASP. MW has recently completed the 160S NRP plant which is capable of treating 140ML/d and was delivered for approximately $152m (nominal) in 2019. The 160S NRP was constructed in a greenfield location at WTP. In comparison, the 55E ASP Upgrade project is to provide 150ML/d of treatment capacity and utilise a number of the existing 55E ASP assets including four clarifiers (following refurbishment). Melbourne Water has noted that the functional requirements for the 55E ASP Upgrade project includes treating more nitrogen and managing more variable flows than the 160S NRP plant. In effect, the additional nitrogen treatment and flow capacity required for the 55E ASP Upgrade incurs an additional $50m in capital costs compared with the 160S NRP plant. Moreover, with the reuse of existing clarifiers as part of the 55E ASP upgrade project which would be expected to reduce the costs, the overall capital cost of the project appears inefficient in delivering similar outcomes to the recent 160S NRP project. For example, it is noted that the direct costs associated with the construction of the clarifiers for the 160S NRP was over $17m (nominal), a cost which is not incurred for the 55E ASP Upgrade project.

It is recognised that detailed cost estimates have been provided which appear to include reasonable allowances for design, construction and commissioning phases. It is understood from the Functional Business Case that MW is undertaking a value engineering exercise to find opportunities to reduce the capital cost of the project. MW may have sought to include potential savings in the proposed capex of this project as a means of bearing some of the cost risk associated with the project in line with the PREMO framework.

4.7.2.4 Recommendation

The 55E ASP Upgrade project is considered to be prudent. However, the forecast capex for the project appears somewhat inefficient and represents a significant increase compared with the recently completed 160S NRP and the initial capital cost presented in the 2016 pricing submission. We recommend a reduction of $12m in 2022-23 on the basis that it is reasonable to expect further efficiencies can be found through the procurement process to bring the costs more in line with the actual delivery costs of the 160S NRP project.

Table 4.19: Proposed capex for WTP 55E ASP Upgrade and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	68.38	132.89	6.85	2.19	1.07	211.4
Recommended adjustments	-	-12.0	-	-	-	-12.0
Recommended capex	68.38	120.89	6.85	2.19	1.07	199.38

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.3 Project 3 – Hobsons Bay Main Yarra Crossing Duplication

Information source	• HBM Functional Design Report • HBM Risk Adjusted Nominal Estimate • HBMS Siphon Options Assessment Final Report • Hobsons Bay Main Sewer Yarra River Crossing Preliminary Business Case • HBM Yarra Crossing Duplication - Preliminary Business Case Supporting Memo for ESC
Investment Driver	• Renewals (100%)

Intended Outcome	• Construction of a new Hobsons Bay Main Sewer River Crossing to enable the existing sewer crossing to be taken offline and repaired
Current Project Status	• Preliminary Business Case Approval has been received • Functional Design has been completed in December 2020
Procurement and project delivery Process	• Melbourne has sought tenders for the design and construction of the new sewer.

4.7.3.1 Project description and key drivers

The Hobsons Bay Main Sewer transfers approximately 30% of Melbourne's wastewater to the Western Treatment Plant at Werribee. The sewer alignment includes an existing tunnel under the Yarra River immediately south of West Gate Bridge connecting the eastern bank of the river to Scienceworks on the western bank.

The proposed project includes the installation of a new 1.45m diameter sewer tunnel to convey peak dry weather flows, which will enable MW to rehabilitate the existing sewer.

This is a renewals driven project; the existing Hobsons Bay Sewer Main River Crossing has been identified as having significant deterioration and corrosion loss and is at a point where remedial works to reduce or halt further deterioration should be implemented as soon as practicable, according to a report prepared by GHD in 2019. The existing sewer is not able to be safely entered for repair works, which has led to the proposed option being identified.

The proposed sewer and existing sewer will operate together to transfer the wastewater flows and has been designed to cater for projected flows out to 2051.

This sewer has been the subject of multiple studies, condition assessments and options studies dating back to 2003. MW had included capital projects within Water Plan 3 to extend the life of the tunnel. The proposed project is intended to be operational in 2023-24, and further expenditure on the renewal of the existing sewer planned for the following period in 2027-28.

Table 4.20: Proposed capex for Hobsons Bay Yarra Crossing Project ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	29.08	89.99	16.77	-	-	135.84

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.3.2 Options

The most recent options assessment was undertaken by MW in 2019, following a number of options studies, including a market sounding to investigate market interest in a shared utility crossing. A broad range of options have been considered by MW. The most recent options assessment considered the below alternative arrangements:

- Option 1
  - A new single 1.45 m diameter tunnel to transfer peak dry weather flow and rehabilitate the existing sewer
- Option 2
  - A new single 2.1 m diameter tunnel to transfer peak wet weather flow and rehabilitate the existing sewer
- Option 3A/B
  - Twin pipe siphon inside a 3 m diameter tunnel and rehabilitate the existing sewer
- Option 4
  - Twin pipe siphon inside a 3 m diameter tunnel and abandon the existing Hobsons Bay Main Sewer

Option 1 was identified as the preferred option and was then taken forward for Functional Design.

The 2019 options assessment includes both a qualitative and quantitative assessment of the options. The options assessment, including the various historical studies, demonstrate a robust assessment of potential solutions, including opportunities to share costs with a multi-utility crossing.

4.7.3.3 Discussion/analysis

4.7.3.3.1 Driver and timing

The Hobsons Bay Main Sewer Yarra Crossing has been the subject of a significant number of studies and condition assessments over a period of approximately 17 years. In this period, MW clearly established the need for the project and the driver for the renewal of the existing asset.

Based on the condition assessments, MW has received advice that rehabilitation of the sewer should occur as soon as practicable. It is noted that this advice was received in 2015, and the intended project completion is currently scheduled for 2023-24. It is understood that MW has sought to extend the life of the existing asset since receiving that advice. We therefore consider the timing of investment to be appropriate, and MW has progressed the project through the development of a Functional Design to tendering for Design and Construction of the project.

4.7.3.3.2 Options analysis

A number of options analysis phases have been undertaken by MW over the last 17 years. This has included broad consideration of various solutions as demonstrated by the Business Case, including reviews in 2013, 2015, 2018 and 2019. In addition, MW undertook a market sounding process to investigate opportunities for a shared utility crossing demonstrating consideration of alternative funding and project delivery options.

The preferred option appears to be the most prudent and balances the need for a works to occur in this period and the deferral of works which can occur in the next pricing period.

4.7.3.3.3 Costs

The cost estimates indicated for the selected option appear reasonable and have been tested with the market through constructability and cost estimates from experienced contractors.

4.7.3.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended.

Table 4.21: Proposed capex for Hobson Bay Main Yarra Crossing Project and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Proposed capex	29.08	89.99	16.77	-	-	135.84
Recommended adjustments	-	-	-	-	-	
Recommended capex	29.08	89.99	16.77	-	-	135.84

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.4 Project 4 – Maribyrnong Main Sewer Augmentation

Information source	• Maribyrnong River Main Sewer Augmentation Preliminary Business Case • Maribyrnong River Main Sewer Interceptor Functional Design • Risk Adjusted Nominal Estimate (RANE) Summary • Maribyrnong River Main Sewer Augmentation Memo
Investment Driver	• Improvements/Compliance
Intended Outcome	• Augmentation of existing sewer main to mitigate sewer overflows with the construction of a new interceptor tunnel and storage
Current Project Status	• Functional design has been completed and Preliminary Business Case has been approved by MW Board.

Procurement and project delivery Process	• Currently undefined in the Preliminary Business Case

4.7.4.1 Project description and key drivers

The Maribyrnong River Main (MRM) Sewer transfers wastewater from the north-western suburbs of Melbourne surrounding the airport to the North West Sewer (NWS), which then flows to the Western Treatment Plant via the Western Trunk Sewer. The majority of the catchment is within City West Water's operating area.

MW, working with City West Water, has identified that there have been some non-compliant sewer spills from the MRM, noting several spills in 2018 and again in March 2020. The MRM sewer system does not currently comply with the State Environment Protection Policy (SEPP) (Waters of Victoria) requirement to contain wet weather sewage flows in storms with an annual recurrence interval (ARI) of 1 in 5. Modelling of the system shows that the system spills in an ARI of 1 in 1 with no spare capacity in the network.

As a result of the hydraulic constraints on the sewer, MW is also non-compliant with its Bulk Sewage Transfer, Treatment and Disposal Agreement standard with City Wester Water.

Sewage discharges to the Maribyrnong River present a threat to the beneficial uses of the River. MW are proposing Augmentation works to improve the hydraulic capacity of the sewer and achieve compliance with environmental requirements. The project will involve the construction of 900 m of sewer interceptor tunnel and the construction of a new 5.7 ML storage at Brimbank Park Sewage Pumping Station.

Table 4.22: Proposed capex for Maribyrnong Main Sewer Augmentation ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Proposed capex	29.48	25.81	1.61	-	-	56.90

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.4.2 Options

The MRM has been subject to several investigations and studies over the last decade including the development of various options assessments starting in 2008. MW's Business Case identifies that there have been two preferred options which have since been unable to progress to due to external factors. Subsequently in 2019, a re-evaluation of the options was undertaken in collaboration with City West Water and other external stakeholders to identify the options for achieving compliance in the MRM system. In 2019, CH2M Beca undertook an options assessment for MW (Maribyrnong River Main Sewer Augmentation Options and Preliminary Design Report.Rev2, June 2019), modelling options to contain the 1 in 5-year wet weather event.

MW's Preliminary Business Case presents five options:

- Option 1: Do nothing
  - No capex, does not achieve compliance
- Option 2: New MW Pump Station
  - Construction of a new 450 L/s wet weather pumping station, 2 km of sewer extension, syphon under the River and large gravity sewer through Maribyrnong Defence Site
- Option 3: Full Gravity System and Storage at Brimbank Park
  - Construction of a new 900 m sewer interceptor tunnel and 5.7 ML storage at Brimbank Park Sewage Pump Station
  - This is the lowest cost option and is identified as the preferred option.
  - MW note that the new sewer tunnel is to be constructed by MW, and the storage by City West Water at their existing Brimbank Park Sewage Pumping Station.
- Option 4: Full Gravity System and Storage at Thomson's Reserve
  - Construction of a new 900 m sewer interceptor tunnel and 10 ML storage at Thomson Street Reserve

- Option 5: Duplicate MRM
    - Full sewer duplication of MRM from Keilor Outlet Main to North West Sewer
    - This is identified as the highest cost option

The 2019 options assessment concluded option 3 is the preferred approach for augmentation of the MRM, incorporating:

- A gravity intercepting sewer from the MRMS to NWS 005
- Detention storage tank at two potential locations:
    - Brimbank Park, and/or
    - Thompsons Street Reserve

Workshops with key stakeholders concluded that Brimbank Park is the preferred location for additional detention storage due to the additional value the project brings to the site.

4.7.4.3 Discussion/analysis

MW has identified that the MRM is not achieving compliance with existing environmental regulations and has demonstrated the need and driver for the project. Similarly, the preferred option is considered to be the least cost option and appears to be efficient in achieving the intended outcome.

MW's price submission notes the proposed capex for the project as $56.90m over the period, however the Business Case identifies the costs to MW as $45.6m in total. The difference is outlined in MW's Business Case that the new 5.7 ML storage tank component of the preferred option is to be constructed by City West Water, which is expected to reduce the costs to MW by approximately $13m. In a memo provided by MW, the different figures are due to the timing of the development of the pricing submission and the finalisation of the Business Case. MW notes that there is not yet formal agreement on the delivery of the new storage tank by City West Water and therefore MW may be required to fund the whole project. However, it is our opinion that MW's proposed capex for the project for RP5 should be reduced to the Preliminary Business Case approved amount, a reduction of $13.37m.

4.7.4.4 Recommendation

The proposed capex is prudent and efficient; however, the proposed capex should be reduced to the Preliminary Business Case approved amount as shown in the adjustments below.

Table 4.23: Proposed capex Maribyrnong Main Sewer Augmentation and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Proposed capex	29.48	25.81	1.61	-	-	56.90
Recommended adjustments	-2.92	-9.78	-0.67	-	-	-13.37
Recommended capex	26.56	16.03	0.94	-	-	43.53

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.5 Project 5 – WTP Gas Plant Renewal

Information source	• WTP Gas Plant Renewal – Business Needs Identifier • MW Gas Plant Final Base Cost Estimate
Investment Driver	• Renewals (60%) • Compliance (20%) • Growth (20%)
Intended Outcome	• Construct a new biogas handling plant and associated suction and delivery manifolds
Current Project Status	• BNI Business Case

Procurement and project delivery Process	• Currently proposed for a design and construction contract with Framework Agreement Service Provider

4.7.5.1 Project description and key drivers

The WTP utilises an anaerobic biological process as its primary treatment process which produces biogas, which comprises methane (85%), carbon dioxide (15%) and hydrogen sulphide gas (2000 ppm). The biogas is combusted in the WTP Gas Plants and Power Station which were constructed at the WTP site over the last 22 years, producing electricity. The WTP gas plants include a range of mechanical and electrical equipment and are connected to the anaerobic covers, and therefore impacted by and dependent on the condition and functioning of the covers.

MW has noted that over the last 22 years, there have been a number of augmentations and expansions to the two systems (Gas Plant and Power Station), however, the current system is reaching the end of its useful life and requires significant major upgrades. The business case identifies that the gas plant is currently constrained by the anaerobic cover system condition and deterioration, the available space within the existing gas plant area and capacity of the existing system to manage the volumes of gas being produced.

The project is at an early stage of development, with the Business Need Identified business case having been approved in October 2019. The proposed project will involve the construction of one new WTP Gas Plant to replace the existing system in a greenfield area of the site.

Table 4.24: Proposed capex for WTP Gas Plant Renewal ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	2.42	2.41	4.59	13.21	12.89	35.52

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.5.2 Options

The BNI business case identifies two options:

- Option 1: Do nothing
  - No capex, does not meet Levels of Service required
- Option 2: Biogas Plant Greenfield renewal
  - Construction of new WTP gas plant in greenfield area of the site

No other options are presented in the business case. However, the business case notes that "attempting to renew individual components will not offer value due to the physical footprint limitations and inability to meet the required levels of service".

4.7.5.3 Discussion/analysis

The project is in the early stages of development and further work is to be undertaken to develop the detail and scope of the preferred option. However, the current level of detail is considered to be inadequate to demonstrate the initial prudency and efficiency of the proposed approach. MW has demonstrated the initial need for the project and has established the key drivers, but the options assessment is basic and does not adequately address a range of options available. During the review process MW indicated that an assessment of the full range of options will be undertaken at the subsequent approval gateway (Preliminary Business Case).

It is noted that the condition of the covers of the 25W and 55E anaerobic pots have a significant impact on the existing Gas Plants and vice versa. When the Gas Plants are unavailable, the covers are required to store gas for longer periods leading to accelerated deterioration of the covers and ultimately replacement. MW's Primary Treatment Capacity Augmentation project will also have a major impact on the anaerobic pots and covers and ultimately reduce the load on the existing gas plant system. The WTP Gas Plant BNI does not currently address any impact from the WTP Primary Treatment Capacity Augmentation (PTCA) project which is likely to have significant effect in terms

of gas production in 25W and 55E lagoons and the requirements for storage under the covers. Moreover, the WTP Gas Plant project is currently planned for construction in 2024-25 and 2025-26. Based on current estimates this is within one year of the construction of WTP PTCA project. In response to the suggestion that this may confer benefits in understanding the impact of the PTCA project on the covers and gas production from the existing 25W and 55E pots, MW noted that such an understanding would likely take a longer period of operation, which would delay this project further than the one year between construction delivery dates. Nonetheless, deferring the project by one year potentially presents better opportunities to integrate the systems and manage the impacts of the two significant projects being undertaken related to the gas systems. It's also noted that the PTCA project would be expected to have an impact on the WTP Gas Plant system design and therefore a deferral in its design and construction would accommodate the integration of the two projects.

While it is a secondary consideration, there may also be efficiencies in combining the PTCA and WTP Gas Plant projects to provide cost savings to Melbourne Water.

4.7.5.4 Recommendation

Based on the significant impact of the proposed WTP PTCA project, its timing for delivery and the limited options assessment undertaken to date, we propose the following adjustments to the proposed capex. We recommend delaying this project by one year, resulting in reduction of approximately $12.89m in this pricing period, allowing for further refinement of options and understanding of the impact of the PTCA project on the WTP Gas Plant requirements.

Table 4.25: Proposed capex Maribyrnong Main Sewer Augmentation and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	2.42	2.41	4.59	13.21	12.89	35.52
Recommended adjustments	-2.42	0.01	-2.18	-8.62	0.32	-12.89
Recommended capex		2.42	2.41	4.59	13.21	22.63

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.7.6 Recommendations for sewerage capex

For the top five sewerage capex projects we recommend a total reduction of $38.2m over RP5.

Table 4.26: Summary of recommended adjustments to major sewerage capital projects ($2020-21m)

Project		2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
WTP Primary Treatment Capacity Augmentation	Proposed capex	1.8	6.02	128.16	166.02	13.27	**315.27**
	Recommended adjustments	-	-	-	-	-	
	Recommended capex	1.8	6.02	128.16	166.02	13.27	**315.27**
WTP 55E ASP Upgrade	Proposed capex	68.38	132.89	6.85	2.19	1.07	**211.4**
	Recommended adjustments	-	-12.0	-	-	-	**-12.0**
	Recommended capex	68.38	120.89	6.85	2.19	1.07	**199.38**
Hobsons Bay Main Yarra River Crossing	Proposed capex	29.08	89.99	16.77	-	-	**135.84**
	Recommended adjustments	-	-	-	-	-	
	Recommended capex	29.08	89.99	16.77	-	-	**135.84**

Maribyrnong River Main Sewer Augmentation	Proposed capex	29.48	25.81	1.61	-	-	**56.9**
	Recommended adjustments	-2.92	-9.78	-0.67	-	-	**-13.37**
	Recommended capex	26.56	16.03	0.94	-	-	**43.53**
WTP Gas Plant	Proposed capex	2.42	2.41	4.59	13.21	12.89	**35.52**
	Recommended adjustments	-2.42	0.01	-2.18	-8.62	0.32	**-12.89**
	Recommended capex		2.42	2.41	4.59	13.21	**22.63**
Total	**Proposed capex**	**131.16**	**257.12**	**157.98**	**181.42**	**27.23**	**754.93**
	Recommended adjustments	**-5.34**	**-21.77**	**-2.85**	**-8.62**	**0.32**	**-38.26**
	Recommended capex	**125.82**	**235.35**	**155.13**	**172.8**	**27.55**	**716.65**

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8 Major waterways and drainage projects

4.8.1 Project 1 – FS4903 Port Melbourne Pump Station renewal

Information source	• Business Case: Port Melbourne Drainage Pump Station – Renewal • Port Melbourne Drainage Pump Station Renewal Functional Requirements Statement • Port Melbourne Pump Station Scoping Study Report • Level of Service • Submission Schedule • Stage 1 – Drainage Infrastructure Flood Mapping
Investment Driver	• Renewal (100%)
Intended Outcome	• Replace four pumpsets and associated internal pipework and valves to ensure ongoing flood protection of the Port Melbourne area
Current Project Status	• BNI Business Case
Procurement and project delivery Process	• MW states that some items need to be completed urgently ahead of main pump station renewal – to be completed as "minor under major" capital project • Remainder of works to follow typical three gate major project delivery approach

4.8.1.1 Project description and key drivers

The Port Melbourne Pump Station was built in 1891 and provides flood protection in the Port Melbourne area (a former swamp) to approximately 3000 upstream properties.[65] In early 2020, it was discovered that the steel pipework in the pump station and the four 1700 L/s pumpsets themselves had severely corroded from saltwater ingress caused by an unintended cross-connection in the upstream network and the jamming open of a non-return valve. An emergency event was initiated to manage the risk of further failures, which involved temporarily using bypass pumps to allow full isolation of the pump station. As a result of the corrosion, the pump station assets have prematurely reached the end of their serviceable lives.

[65] Business Case: Port Melbourne Drainage Pump Station – Renewal.

According to the business case, the pump station must provide flood protection for 3000 upstream properties up to a 1% Annual Exceedance Probability (AEP) flood event. Flood modelling was carried out by Cardno and a report on the findings was issued in December 2020.[66]

The project will involve renewal of the four pumpsets and adjacent pipework and valves to restore the required flood protection for the upstream network into the future. Further ancillary improvements may be included (e.g. renewal of station level control system, screening and isolations). The renewed pump station is expected to be operational by 2022-2023, and the capital improvement costs incurred to manage the event would be transferred and capitalised to the renewal project following approval.

Table 4.27: Proposed capex for Port Melbourne Pump Station Renewal Project ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	0.76	10.65	-	-	-	11.41

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.1.2 Options

A high-level options analysis is presented in the business case, comprising a mainly qualitative comparison of advantages and disadvantages. These are summarised below.

- Option 1: do nothing
  - No capex now, high ongoing opex,
  - Expected loss of pumping capability within next six months
  - Full renewal still required at a later stage
- Option 2: refurbish pumps and pipework
  - Keep pumps in pump station with known layout, configuration, maintenance, etc
  - Medium capex, high ongoing opex
  - Some assets beyond point of possible refurbishment
  - Full renewal still required in 2-3 years with similar asset and project costs
- Option 3: renew deteriorated assets (providing floor protection of upstream catchment for next 20+ years):
  - Medium capex
  - May miss broader efficiencies or improvements to be gained by reassessing the broader civil structure and pump station design
- Option 4: Fully renew entire pump station (new pump station for a long period into future, possible broader efficiencies due to modern design)
  - Possible broader efficiencies due to modern design
  - High capex, lengthy design and investigation
  - Delayed renewal, increased risk of failure, greater disruption to community

Option 3 was identified as the preferred option.

On request, MW provided a scoping study report issued by Jacobs in December 2020, which outlines in further detail the options assessment process. 67 A longlist of options was developed including refurbishment, replacement with the same or similar pumps, submersible axial flow pumps, line-shaft pumps and dry-mount centrifugal pumps, and various configurations of these pump types.

An initial workshop was held to narrow the longlist down to four options, which were studied in more detail to define the capital cost, pumping efficiency and key benefits and detriments/risks of each option. A following workshop was then held, during which the refurbishment option was eliminated, and the key differentiators of the remaining options were established. The remaining

[66] Stage 1 – Drainage Infrastructure Flood Mapping Port Melbourne Pump Station, Cardno 2020.
[67] Port Melbourne Pump Station, Scoping Study Report, Jacobs, 10 December 2020.

options were then subjected to a more detailed NPV cost analysis, as well as a cost- and risk-based assessment.

4.8.1.3 Discussion/analysis

4.8.1.3.1 Driver and timing

The flood modelling report notes that while flood mitigation in the catchment varies with the number of operational pumps, it is predominantly limited by the downstream network capacity. The drainage network system is described as acting like a "see-saw" because all the drains share an outlet. As the pump station pushes water to the outlet, the capacity of the Cruikshank St Main Drain and Rouse St Diversion is reduced, thereby increasing flood levels, while reducing flood levels on the Esplanade West and Richardson St main drains.[68]

The business case appears to rest on the premise that renewal will protect the 3000 upstream properties in a 1% AEP event, yet the report found that the pump station and associated drainage infrastructure "provide an operational capacity of at least a 20% AEP event but no more than a 10% AEP event".[69] This is mainly limited by the Council drainage system from the low lying areas, which is estimated to have an operating capacity of a 50% AEP event. The report also notes that the difference in flooding results between a fully operational pump station during 20% and 10% AEP scenarios is minor, compared to the large difference between the 50% and 20% AEP scenarios.

The business case does not openly address this limitation in the overall system (perhaps since the flood modelling report was only issued in December 2020). However, a levels of service discussion[70] documented by MW outlines slightly more nuanced objectives than the business case, noting that flood risk management is complex, and that usually it is impractical to eliminate flood risk. Accordingly, the "desired" levels of service are stated as:

- Flood prevention/minimisation:
  - Reduce hazardous flooding to H1 (generally safe for people, vehicle and buildings) in storms up to and including a 1 in 5-year rainfall event (20% AEP storm)
  - Minimise hazardous flooding as much as reasonably practicable for more intense rainfall events (1% AEP storm)
- Availability/reliability:
  - 3 of 4 pumps to be operationally available during rainfall events
- Safety:
  - Must be safe to operate and maintain

Notwithstanding the system limitations identified, the flood modelling report still indicates that the pump station, at its theoretical operational level, provides a significant alleviation of flood waters in the catchment and is vital for ensuring flood waters within the catchment are conveyed out to Port Phillip Bay. The recommendations in the Levels of Service Discussion were thus to proceed with a pump station renewal design, while acknowledging that there is no benefit in increasing pumping capability (as the outfall is limited by the downstream drainage network).

Therefore, we believe that the driver and timing for this project have been established, in view of the severe corrosion of the pumpsets and pipework to the point of failure, and the fact that the pump station is critical for flood prevention and minimisation.

4.8.1.3.2 Options analysis

On first viewing the business case, the options assessment appeared to lack some detail, particularly regarding the basis of comparative costs across the options, how the options have been assembled and defined, and the methodology to arrive at the preferred option. However, having since been provided with the scoping study report, we are satisfied that the options assessment process appears robust.

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[68] Stage 1 – Drainage Infrastructure Flood Mapping Port Melbourne Pump Station, Cardno 2020.
[69] As above.
[70] Port Melbourne Drainage Pump Station – Level of Service & Bypass Pumping Requirements Discussion, Flood Services, Catchment Asset Management, 3 December 2020.

It was not initially clear from the business case whether consideration had been given to how future corrosion damage can be prevented or mitigated to reduce the likelihood of shortened service lives for the future assets. This question was put to MW, which subsequently provided the following information in response:

- the seawater ingress was due to a faulty cross-connection upstream which has since been closed
- there are further works within the scope to permanently close the cross-connection
- water within the pump station will be tested on a recurrent basis to confirm that no seawater is present in future and to ensure all non-return valves are sealing
- material selection was considered during the scoping study, but it was deemed safer and more cost-effective to eliminate seawater from the pump station.

Overall, the selected option appears to be reasonable: refurbishment (Option 2) was identified but considered to represent high opex with later full renewal still being required; meanwhile, total renewal (Option 4) was identified but may represent potential over-design, as well as result in further delays with increased risk of flooding.

4.8.1.3.3 Costs

While MW has not provided supporting documentation for the qualitative cost estimates indicated in the options analysis, the cost estimates indicated for the selected option appear reasonable.

4.8.1.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended.

Table 4.28: Proposed capex for Port Melbourne Pump Station Renewal Project and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Proposed capex	0.76	10.65	-	-	-	11.41
Recommended adjustments	-	-	-	-	-	
Recommended capex	0.76	10.65	-	-	-	

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.2 Project 2 – Regan St Retarding Basin

Information source	• Business Case: Regan St Retarding Basin • Submission Schedule Q04224 Regan Street Retarding Basin Rev1 • Hydraulic Modelling and Mitigation Report (Cardno, 29 May 2019) • Memorandum: Summary of Summary of St Albans Model Review (Jacobs, 13 November 2019)
Investment Driver	• Compliance (100%)
Intended Outcome	• Construct a retarding basin (with 36,000m^3 of flood storage) within 51 Regan St to minimise flood risks in St Albans West
Current Project Status	• Preliminary Business Case Approval
Procurement and project delivery Process	• This project will be delivered by a developer on behalf of MW in line with both internal and external procurement procedures for projects of this estimated cost

4.8.2.1 Project description and key drivers

The Regan Street underground drain flows into Jones Creek and is within the catchment of the St Albans West Drain. The drainage infrastructure was built in the 1960s and with denser development over time, the impervious area has increased with no corresponding attempts to mitigate overland flows in the catchment. The 10% and 1% AEP flood extent covers local properties and there is often insufficient buffer between the drain alignment and buildings, presenting significant flood risks and resulting in annual average damages (AAD) of $1.039m. Additionally, there are undeveloped tracts of land that may represent areas of future development which would further stress the existing drainage network.

A 36,000 m^3 retarding basin is proposed to be constructed within 51 Regan Street. MW states this will reduce average damages from $1.039m to $674,000 per annum. The proposed development is expected to be operational by 2022-23.

This project was put forward in MW's PS16 and had previously been identified in a 2006 report. It was noted in our 2015 expenditure review[71] that there had been little progression of investigations, detailed options analysis or design. Since the previous review, MW has updated its flood modelling and had it reviewed by a third party, and has commissioned a full options study. It is noted that the proposed cost is 18% less than the previously proposed cost. During the review process MW provided an update noting that it has "substantially progressed" the project over RP4, having acquired the land and readied the project design for construction tendering.

MW also states that the Preliminary Business Case, which was initially expected to be approved in November 2020, may need to be updated in early 2021 to reflect an "alternative proposal" put forward by the developer which would require some land rezoning. The alternative proposal is currently under assessment and would require approval from the council.

Table 4.29: Proposed capex for Regan St Retarding Basin ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total for period
Proposed capex	7.59	0.10	-	-	-	7.69

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

It is noted that additional expenditure is included in the business case (a difference of approximately $0.36M) to account for actual expenditure in RP4 to acquire the land for the retarding basin.

4.8.2.2 Options

A high-level options analysis is presented in the Preliminary Business Case, which is summarised below:

- Option 1: Do nothing
  - Economic damages continue and 197 properties and 25 floors remain exposed to flooding in the 2% AEP
- Option 2: Retarding basin within 51 Regan Street
  - AAD reduced to $674,000 but significant capital outlay and annual maintenance costs
- Option 3: Deepened retarding basin within 51 Regan Street with raised embankment to hold the 1% AEP
  - 1 m increased depth compared to Option 2 with a raised embankment
  - Maximises flood risk reduction in the catchment but increase the flood risk at and adjacent to 51 Regan Street, rendering the option non-compliant.
  - Follow-up design work also found the option to hydraulically infeasible
- Option 4: Smaller retarding basin within 51 Regan Street combined with additional pipe downstream and deepened easement

[71] Melbourne Water Expenditure Review Final Report, Deloitte Access Economics, 12 February 2016.

    - Significantly lower AAD benefit compared to other deepened retarding basin options despite similar costs
- Option 5: Retarding basin within 51 Regan Street
    - 1 m increased depth compared to Option 2 without a raised embankment
    - Provides a 10% improvement to the AAD compared to Option 2 but shown to be hydraulically infeasible

4.8.2.3 Discussion/analysis

4.8.2.3.1 Driver and timing

The driver for this project has previously been established. However, in light of additional complexities recently identified, the timing has not been clearly justified.

Details of the alternative proposal were not provided in the business case. On request for more information, MW provided some brief notes indicating that the land holder would pay for construction of the retarding basin if MW were to gift 9,000 m^2 of additional land for development and move the proposed location of the retarding basin to where a future council road is proposed. In this case, the land holder would need to lobby the council to abandon plans for the road extension, and the council would sell that designated land for the construction of the retarding basin. The land holder would pay for the relocation of a high-pressure gas main currently running through that and provide its existing model for confirming whether the retarding basin delivers the intended benefits without making any areas worse for flood risk.

During the review process MW provided additional information, including:

"…Over PD16, Melbourne Water has acquired the land and readied the project design for construction tendering. Melbourne Water were preparing to enter the construction phase of this project when approached by the new property developer with an alternate proposal that would result in efficiencies for Melbourne Water and a better land development project…Melbourne Water has already purchased the required land for the Retarding Basin and no further land purchase is required. Melbourne Water will have access to the site for maintenance as it is Melbourne Water owned land. Land tax considerations, as with all Melbourne Water owned land, are included in the Price Submission."

Despite the clarifications provided, detailed analysis supporting the decision to proceed with the alternative option has still not been provided. If this is because the analysis has not yet been completed, we have concerns over the proposed timing of the project delivery.

4.8.2.3.2 Options analysis

An options assessment, including hydraulic modelling, was completed by Cardno in May 2019 and a technical review was conducted by Jacobs in November 2019. The business case indicates that Options 3 and 5 were deemed hydraulically infeasible, and that Option 4 provided very limited benefit despite similar costs. It is noted that the supporting analysis for these findings do not seem to appear in the Cardno and Jacobs documents and was not separately provided. That said, assuming these findings are supported, it appears that the option chosen in the business case (Option 2) would be appropriate, given that Option 1 was "do nothing" and was evidently unfavourable.

Ultimately, however, it is not possible to provide a final view on the options assessment process given the incomplete information on the "alternative option" and the fact that this newly identified option does not appear to have undergone the same robust analysis.

To support the decision to proceed with the alternative option, there would need to be consideration of purchasing the land from council and an assessment of the costs and benefits of gifting land in exchange for having the construction costs covered. Moreover, further detailed analysis should be prepared to assess the complexities around lobbying the council to abandon plans for the road extension.

4.8.2.3.3 Costs

The economic benefits of the original options were calculated using an average annual damage (AAD) method. At the time of costing, there had not been a decision made as to which organisation would deliver the project and, as such, cost estimates were sought from the developer (Arcadis) and MW's Major Project Delivery (MPD) team. The estimated costs, which are presented below, varied widely due to uncertainties regarding the presence of hard basalt.

Table 4.30: Summary of cost estimates provided by MW

Cost Estimate[1]	Company/Team	Assessment
$10.7m	MW's MPD team in 2018	The project is not feasible for these costs (i.e. cost outweighs benefits achieved)
$12.4m	Cardno in 2020	
$3.8m	Winslow	Estimation company quote engaged by Arcadis
$3.7m	Bitu-Mill	
$3.7m	BMD	
$4.5M	Arcadis	Developer's estimate based on cost from Winslow

Source: MW supplied

Note: 1. Excludes $2.4M already spent on land purchase and design.

It was later decided that the works would be delivered by Arcadis, which subsequently identified additional costs. Arcadis has been requested to re-cost the works with the latest schedule of quantities and this has not yet been completed.

As noted above, although MW has provided some clarifications on the progression of this project, no additional cost-benefit analysis has been provided for the alternative option, clearly setting out the additional costs including the gifting of the land and any cost associated with the council negotiations. While we accept MW's concerns that there are risks of substantial flood damages if the project is delayed, we nonetheless consider that MW has not yet provided sufficient evidence of a robust assessment of the proposed alternative option. Therefore, we remain concerned about the timing and efficiency of the project.

4.8.2.4 Recommendation

Based on the documentation provided by MW initially, it was not clear which option was actually being put forward (i.e. Option 2 as per the existing business case or the alternative option). Since then, MW has confirmed that it is focused on the newly proposed alternative option. However, beyond the supplementary notes provided in response to our draft report and questions submitted to MW, no further documentation has been provided showing detailed and robust assessment of this option.

As noted above, this project was put forward in MW's PS16 and had previously been identified in a 2006 report. In its comments in response to our draft report, MW has asserted that "delays to date have been in the interest of finding a more cost efficient approach", yet we have not been provided with enough analysis to form our own view on the efficiency of the chosen option.

Although we acknowledge that the driver has been established, the justifications for timing and efficiency have not been demonstrated. Accordingly, it is recommended that the forecast expenditure be delayed by one year.

Table 4.31: Proposed capex for Regan Street Retarding Basin Project and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	7.59	0.10	-	-	-	7.69

Recommended adjustments	-7.09	6.99	0.10	-	-	-
Recommended capex	0.5	7.09	0.10	-	-	7.69

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.3 Project 3 – Shakespeare Grove MD renewal

Information source	• Business Case: Shakespeare MD Renewal • Shakespeare Grove Main Drain Outlet Functional Design Report (Stantec, 1 July 2020) • Stakeholder and Community Engagement and Communications Plan (Updated October 2020) • Shakespeare Grove Main Drain Renewal Functional Comparative Cost Estimates
Investment Driver	• Renewals (90%) Compliance (10%)
Intended Outcome	• Renewal of Shakespeare Grove MD outlet to rectify "poor" structural components and allow for public access again. Twin pre-cast box culverts will be used in the design.
Current Project Status	• BCA Approval
Procurement and project delivery Process	• The project involves 3 Gate Major Infrastructure Design and Construction services • Project timeline will be expedited to take advantage of reduced crowds at St Kilda (COVID-19 restrictions, cancellation of the St Kilda Festival and preference to conduct works during the drier months of 2021)

4.8.3.1 Project description and key drivers

The Shakespeare Grove Main Drain beach outlet is located at the St Kilda foreshore, making it a highly visible and frequently accessed asset. The existing structure was constructed in 1950 with additional works done in 1983 to lower the outlet. The outlet was inspected in 2017 and a June 2018 report was issued showing the outlet to be in "poor" to "very poor" condition for beams 1-80. Additionally, there is a timber baffle that reduces entry and results in stagnation and odour due to seaweed.

The structural integrity of the concrete walls and transverse beams have been shown to be compromised and corrosion of the steel reinforcement has caused the concrete casing to degrade. Structural analysis concluded that beams 1-80 were not capable of supporting pedestrian loads and access has since been restricted for public safety. While the drain itself continues to function, it is expected that the level of service will be affected in the short to medium term.

A functional design has been completed to replace beams 1-80 and remediate beams 81-109, in accordance with the preferred option identified at the BNI stage. This option was considered to increase asset life and be safe and publicly accessible, while enhancing community amenity.

The project is intended to be expedited to take advantage of reduced crowds during COVID-19 restrictions (particularly in view of the cancellation of St Kilda Festival) and a preference to conduct works during the drier months. The proposed new infrastructure is expected to be operational by 2023-24.

4.8.3.2 Options

A very brief options summary is presented in the business case, which is set out below:

- Option 1: Deck and beams spanning concrete walls which are an extension of the foundation treatment and sand invert
- Option 2: Twin precast box culverts
- Option 3: As for Option 1 to end wall, then open channel
- Option 4: Multiple large diameter pipes within rock "groyne"
- Option 5: Engineered channel, based on rocks (or alternatively, concrete)

Option 2 was selected for several reasons, including:

- proven technology/industry standard
- increased flexibility for maintenance
- shorter construction period.

4.8.3.3 Discussion/analysis

Based on the information provided in the business case and functional design report, there is a clear need for renewal of the asset. The site is already unsafe for public access and the drain itself is showing signs of significant deterioration that will likely lead to a reduction in levels of service in the short to medium term. There is also some merit to the approach of taking advantage of reduced crowds and to carry out construction works in the drier months, which are conditions that ordinarily would not coincide.

The options assessment presented in the business case appeared to be very brief, but, on request, MW provided the Functional Design Report, which contained detail on the options assessment with costs and weightings.[72] Taking into account this subsequently supplied information, we are satisfied that a robust assessment of options and costs has been carried out.

4.8.3.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended.

Table 4.32: Proposed capex for Shakespeare Grove MD Renewal ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	7.44	0.01	0.00	-	-	7.46
Recommended adjustments	0.00	0.00	0.00	-	-	0.00
Recommended capex	7.44	0.01	0.00	-	-	7.46

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.4 Project 4 – Hallam Valley Retarding Basin wetland

Information source	• Business Case – Hallam Valley RB Wetland Renewal • Hallam Valley Retarding Basin Wetland Rectification (AquaMetro Services, 26 February 2020) • PS21 Supporting information for Hallam Valley RB Wetland and Gladstone St Wetland (002).docx • Hallam Valley RB Wetland Rectification Report (GHD, March 2020) • Memorandum: Hallam Valley Wetland Rectification Conceptual Design (GHD, 2 May 2018)
Investment Driver	• Compliance (100%)
Intended Outcome	• Restore the Hallam Valley RB Stormwater Quality Treatment System which is designed to remove 3.9 tonnes of nitrogen. • Address and mitigate risks
Current Project Status	• BCA Approval

[72] Shakespeare Grove Main Drain Outlet Function Design Report, Stantec 2020.

Procurement and project delivery Process	• Aqua Metro Services (AMS) were asked to submit a price under the Small-Scale Capital Framework for the Hallam Valley RB Wetland Renewal. This is in accordance with Delivery Approach for Infrastructure Major Capital Projects procedure and Capital Delivery Strategy.

4.8.4.1 Project description and key drivers

The condition of MW's Stormwater Quality Treatment System (SWQTS) is currently insufficient to meet its regulatory obligations under the Victorian Environmental Protection Authority (EPA) to achieve reductions in nitrogen, phosphorus and suspended solids into Port Phillip Bay.[73] The Hallam Valley wetland currently removes only 1.5 tonnes of nitrogen per annum.

The project is intended to restore the wetland function to its designed treatment capacity of 3.9 tonnes nitrogen p.a. and comprises:

- lowering of the water level at the outlet structure
- increased drawdown rate via modification of the size of the outlet
- modification of bathymetry to ensure connectivity of the wetland pools and enable required Emergent Aquatic Vegetation (EAV) coverage
- formalise the sediment pond areas
- improve flow distribution in upper cell via modification of embankment
- revegetate wetland to required level of coverage.

The site is ranked as a medium-high risk asset based on vegetation cover and wetland size.

During the previous price period, MW assessed the performance of the wetlands against the Waterways Drainage and Investment Plan KPI baseline metrics. Although MW met its KPI baseline nitrogen removal in 2018-19 (169.4 tN), the design nitrogen removal is 234.2 tN for wetlands discharging to Port Phillip Bay, and MW has a statutory obligation under the State Environment Protection Policy to ensure the wetland assets "function for the purpose they were built".

4.8.4.2 Options

The business case states that no other options were considered due to size and importance of the site to the SWQT program. However, specific options to renew the assets were developed during a detailed site investigation and design program.

4.8.4.3 Discussion/analysis

4.8.4.3.1 Driver and timing

A design report produced by GHD in March 2020 states that the Hallam Valley Retarding Basin wetland does not meet MW's constructed wetland guidelines. Large areas of water have been left open where aquatic plants have died off.

It is understood that wetland cells are "typically designed for 80% EAV coverage of the total surface area" and to draw down to a normal water level (NWL) over a maximum of three days.[74] The Hallam Valley Wetland is estimated to currently have 30% EAV cover. Analysis of water level data and streamflow gauge data in recent years suggest that this is caused by a combination of:

- water being too deep to sustain appropriate EAV cover; and
- the hydraulic loading through the wetlands is too long, not letting water return to designed NWL in sufficient time to support EAV cover.

Additionally, once constructed, it takes two to three years for the vegetation to be established.

Based on the above, it is considered that the driver and timing have been demonstrated.

[73] Hallam Valley RB Wetland Renewal Business Case
[74] PS21 Supporting information for Hallam Valley RB Wetland and Gladstone St Wetland (002).docx.

4.8.4.3.2 Options analysis

A design report was produced by GHD in March 2020, which outlined the design options considered. It is understood that options available were significantly constrained based on several considerations, such as the location of the wetland within an active retarding basin and the receiving waterway (due to the NWL needing to be above the water level of the receiving drain).

The design option selected was for a lower standard %EAV (60% instead of 80%) due to the significant cost of implementing a design with the standard 80% EAV.

Based on the information presented, it appears that the option selected is reasonable within the constraints.

4.8.4.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended.

Table 4.33: Proposed capex for Hallam Valley RB Wetland Project and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	2.25	4.19	-	-	-	6.44
Recommended adjustments	0.00	0.00	-	-	-	0.00
Recommended capex	2.25	4.19	-	-	-	6.44

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.5 Project 5 – Gladstone St

Information source	• Business Case Gladstone Street Rectification • PS21 Supporting information for Hallam Valley RB Wetland and Gladstone St Wetland (002).docx
Investment Driver	• 80% compliance • 20% strategic/risk management
Intended Outcome	• To investigate wetland function, develop a detailed design to restore the wetland to its designed treatment capacity of 1.8 tonnes nitrogen per annum and perform capital works to achieve treatment expectations
Current Project Status	• BNI Approval
Procurement and project delivery Process	• Not possible at BNI stage

4.8.5.1 Project description and key drivers

The Gladstone Street Wetland was constructed in 2005 to contribute to MW's 100 tonne nitrogen removal target under the State Environmental Protection Policy (SEPP) and provides other stormwater treatment for gross pollutants, suspended solids and phosphorus.

The emergent aquatic vegetation (EAV) cover is estimated at approximately 40% and is stated to have been designed to the best standard at the time of construction. However, the water levels in shallow and deep marsh zones do not meet current Wetland Design Manual guidelines. Of note, it is understood that the proportion of EAV is a critical driver of stormwater treatment and wetland cells are typically designed for 80% EAV coverage.

The MW Stormwater Quality Treatment System (SWQTS) asset base does not currently meet its regulatory obligations. In particular, Gladstone Street SWQTS and has the following specific issues:

- discoloration of water, which MW believes may suggest that the clay liner in the wetland cell may have disintegrated
- avian botulism outbreaks in recent years, which may be related to the condition of the wetlands

The project comprises investigation of wetland function, development of a detailed design to restore the wetland to its designed treatment capacity of 1.8 tonnes nitrogen per annum and to perform capital works to achieve treatment expectations.

4.8.5.2 Options

The business case identifies the following options:

- Do nothing:
  - no capex expenditure
  - poor water quality and failure to meet statutory obligations, increased opex for managing botulism outbreaks
- Construct new assets to replace nitrogen removal capacity of Gladstone Street Wetland
  - significant capex if locations could be identified (few suitable options)
  - does not address avian botulism outbreaks and poor water quality (reputation and safety risk)
- Investigate operation of the wetland and prepare detailed design for rectification works
  - capex to investigate, prepare designs and construct
  - improved water quality and meeting statutory obligations
  - likely reduced occurrence of avian botulism

Option 3 was selected as the best approach.

4.8.5.3 Discussion/analysis

The dual drivers of compliance and risk management (primarily health and reputation) have been demonstrated to a reasonable level. That said, there remain hypotheses to be tested through further investigation, such as the link between the botulism outbreaks and wetland condition. However, overall, we are satisfied that the existing information supports the need for further investigation of the wetland function. Assuming the findings of those investigations confirm MW's current assumptions, it appears that the proposed renewal of the wetlands is appropriate.

At this early stage, no supporting documentation has been provided other than a document responding to our specific queries in relation to this project[75]. MW has indicated that it has used a developer offset charge of $6645/kg N as a base rate to build alternative assets, which would suggest a significantly higher cost ($11.9m) than the proposed option.

MW also notes that construction of alternative assets and decommissioning of the wetland would still not resolve the issue of the avian botulism outbreaks, assuming that these outbreaks are indeed linked to the wetland condition.

Hydrographic data, vegetation data and reports of botulism outbreaks will be used to support the business case, and new hydrographic data is currently being collected to inform investigations. The cost estimate was prepared based on costing of other wetlands of similar size and complexity and appears reasonable.

4.8.5.4 Recommendation

The proposed capex is considered to be prudent and efficient, and no adjustment is recommended.

Table 4.34: Proposed capex for Gladstone St Wetland Project and recommended adjustments ($2020-21m)

	2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Proposed capex	4.22	1.19	-	-	-	5.40
Recommended adjustments	0.00	0.00	-	-	-	0.00

[75] PS21 supporting information for Hallam Valley RB Wetland and Gladstone St Wetland (002).docx

Recommended capex	4.22	1.19	-	-	-	5.40

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.8.6 Recommendations for waterways and drainage capex

In summary, we recommend pushing back the Regan St Retarding Basin project but no overall reduction to waterways and drainage capex over RP5.

Table 4.35: Summary of recommended adjustments to major waterway and drainage capital projects ($2020-21m)

Project		2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Port Melbourne Pump Station renewal	Proposed capex	0.76	10.65	-	-	-	**11.41**
	Recommended adjustments	-	-	-	-	-	
	Recommended capex	0.76	10.65	-	-	-	
Regan St Retarding Basin	Proposed capex	7.59	0.10	-	-	-	**7.69**
	Recommended adjustments	-7.09	6.99	0.10	-	-	**-**
	Recommended capex	0.5	7.09	0.10	-	-	**7.69**
Shakespeare Grove Main Drain renewal	Proposed capex	7.44	0.01	0	-	-	**7.46**
	Recommended adjustments	0	0	0	-	-	**0**
	Recommended capex	7.44	0.01		-	-	**7.46**
Hallam Valley RB Wetland	Proposed capex	2.25	4.19	-	-	-	**6.44**
	Recommended adjustments	0	0	-	-	-	**0**
	Recommended capex	2.25	4.19	-	-	-	**6.44**
Gladstone St	Proposed capex	4.22	1.19	-	-	-	**5.4**
	Recommended adjustments	0	0	-	-	-	**0**
	Recommended capex	4.22	1.19	-	-	-	**5.4**
Total	**Proposed capex**	**22.26**	**16.14**	**0**	**0**	**0**	**38.4**
	Recommended adjustments	**-7.09**	**6.99**	**0.1**	**0**	**0**	**0**
	Recommended capex	**15.17**	**23.13**	**0.1**	**0**	**0**	**38.4**

Source: Arup analysis based on MW *2021 Price Review Model – ESC Reviewed* (provided 24 December 2020)

4.9 Recommendations

We have summarised our review of the major capital projects in Table 4.36 below, providing the proposed forecast, our recommended adjustments and the net change or impact of our recommendations.

Across the major projects assessed, a total reduction of approximately $46.8 million is recommended, which reflects a 4.4% reduction on MW's 2021 price submission proposal for these projects. This is driven by reductions to:

- Winneke Treatment Plant UV disinfection system

- WTP 55E ASP Upgrade
- Maribyrnong River Main Sewer Augmentation
- WTP Gas Plant.

We have also recommended reprofiling capex for the Cement Creek Diversion Works project, WTP Gas Plant, and Regan Street Retarding Basin.

Table 4.36: Recommended adjustments to top 15 major capital projects by service area ($2020-21m)

Project		2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Water Top 5	Proposed capex	45.12	115.32	47.49	21.36	32.94	**262.22**
	Recommended adjustments	-0.63	-7.08	-28.09	1.70	25.57	**-8.53**
	Recommended capex	44.49	108.24	19.40	23.06	58.51	**253.69**
Sewerage Top 5	Proposed capex	131.15	257.13	157.97	181.42	27.23	**754.90**
	Recommended adjustments	-5.34	-21.77	-2.85	-8.62	0.32	**-38.26**
	Recommended capex	125.81	235.36	155.12	172.80	27.55	**716.64**
Waterways and Drainage Top 5	Proposed capex	22.26	16.14	0.00	0.00	0.00	**38.40**
	Recommended adjustments	-7.09	6.99	0.10	0.00	0.00	**0.00**
	Recommended capex	15.17	23.13	0.10	0.00	0.00	**38.40**
Total top 15	**Proposed capex**	**198.53**	**388.58**	**205.46**	**202.78**	**60.17**	**1055.52**
	Recommended adjustments	**-13.06**	**-21.86**	**-30.84**	**-6.92**	**25.89**	**-46.79**
	Recommended capex	**185.47**	**366.72**	**174.62**	**195.86**	**86.06**	**1008.73**

Source: Arup

We have highlighted concerns about the ability of MW to ramp up to deliver such a significant increase in capex over the upcoming regulatory period. Overall MW is proposing a 47% increase in capex (excluding desalination capitalisation) compared to the current regulatory period, with capex doubling from 2020-21 to 2021-22 and then increasing again in 2022-23. While there are some large projects and programs in the forecast, no single project dominates. Further, the number of projects is a key determinant of deliverability, often having a greater impact than the size of the individual projects themselves. We discussed this issue further in section 4.3 above.

This is not to suggest that we have major concerns about MW's current delivery model, simply that it has not been tested with such an increase in expenditure. Rather, our experience simply suggests that such increases in average annual capex are difficult to deliver, no matter how strong the delivery model. And the fact that MW's proposed program is highly front-loaded across the regulatory period means that customers will be assuming much of the risk should the total program not be able to be delivered.

Although we have not made any specific adjustment, as discussed in Appendix A and elsewhere in this report, we believe that MW's demand forecasts are overstated, with population growth only likely to be around half that forecast over the next 5 years. Given that around 25% or $900m of MW's capex is attributed to growth, this brings into question the need for some of the spend. While some of the growth expenditure is due to growth that has already occurred, some expenditure will be attributable to forecast growth.

We also note that we have recommended removal of a number of capital investment items associated with the waterways and drainage increased customer service levels (see section 3.4.2),

approximately $98m over RP5. We consider these capex reductions should be included as part of the broader $50m per annum reduction to the capital program.

Given the above, our view is therefore that an overall reduction across the capital program, excluding the major projects already reduced, is appropriate. We are proposing a reduction of $250 million ($50m per annum as outlined above) across these projects, pro-rated across the period according to proposed expenditure in each year.

Table 4.37: MW's forecast capex (excluding top 15 projects) and recommended adjustments by service area ($2020-21m)

Service area		2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Water	Proposed capex	145.20	143.21	114.46	99.58	85.08	**587.529**
	Recommended adjustments	-13.71	-13.53	-10.81	-9.41	-8.04	-55.50
	Recommended capex	131.48	129.68	103.65	90.17	77.04	532.03
Sewerage	Proposed capex	234.99	171.10	156.70	138.21	124.06	**825.064**
	Recommended adjustments	-22.20	-16.16	-14.80	-13.05	-11.72	-77.93
	Recommended capex	212.80	154.94	141.89	125.16	112.34	747.13
Waterways and Drainage	Proposed capex	240.70	257.10	241.91	246.80	247.60	**1234.11**
	Recommended adjustments	-22.74	-24.28	-22.85	-23.31	-23.39	-116.57
	Recommended capex	217.96	232.81	219.06	223.49	224.21	1117.54
Total adjustments (excluding individual projects)	**Proposed capex**	**620.88**	**571.41**	**513.07**	**484.59**	**456.74**	**2646.70**
	Recommended adjustments	**-58.65**	**-53.97**	**-48.46**	**-45.77**	**-43.14**	**-250.00**
	Recommended capex	**562.24**	**517.44**	**464.61**	**438.82**	**413.60**	**2396.70**

Source: Arup

Overall, the impact of our recommendations is an 8% reduction ($296.8m) on total capex over the 2021 price submission period.

Table 4.38: MW's forecast total capex and summary of recommended adjustments ($2020-21m)

		2021-22	2022-23	2023-24	2024-25	2025-26	Total RP5
Total top 15	Proposed capex	198.53	388.58	205.46	202.78	60.17	1055.52
	Recommended adjustments	-13.06	-21.86	-30.84	-6.92	25.89	-46.79
	Recommended capex	185.47	366.72	174.62	195.86	86.06	1008.73
Remainder of program	Proposed capex	620.88	571.41	513.07	484.59	456.74	2646.70
	Recommended adjustments	-58.65	-53.97	-48.46	-45.77	-43.14	-250.00
	Recommended capex	562.24	517.44	464.61	438.82	413.60	2396.70
Total adjustments	**Proposed capex**	**819.41**	**959.99**	**718.54**	**687.37**	**516.91**	**3702.22**

(including individual projects)	**Recommended adjustments**	**-71.71**	**-75.83**	**-79.30**	**-52.69**	**-17.25**	**-296.79**
	Recommended capex	**747.70**	**884.16**	**639.23**	**634.67**	**499.65**	**3405.43**

Source: Arup

We note that in its submission to the ESC MW has also proposed some smoothing of the capital expenditure profile for pricing purposes to share the delivery risk with customers. We understand from Melbourne Water that this has a broadly similar effect on prices to our recommendations above.

Appendix A – Demand forecast review

The ESC has requested that Deloitte Access Economics undertake a detailed review of the assumptions and methodology applied by MW in developing its growth forecasts, and comment on the implications of any findings for the proposed expenditure. This analysis is provided below. Note that while we were asked to review the assumptions and methodology adopted by MW, we were not asked to develop fresh forecasts.

Overall our view is that it is likely that demand is overstated, and to the extent that expenditure is in part related to demand, it will also be overstated.

Key findings of the demand review

A major driver of demand across MW's water, sewerage, and waterways and drainage functions is the underlying size of the population. The Victoria in Future (VIF (2019)) population forecasts that underpin MW's submission, in our view, are unreasonably high as they were prepared prior to the COVID-19 pandemic and therefore do not reflect its impact on underlying drivers of population, including migration, fertility and mortality. While MW did commission population forecasts from MacroPlan, these forecasts are stronger than recent population projections released by other participants in the market following MW's submission.

The VIF (2019) population outlook has been applied relatively consistently, except where bespoke property market modelling was undertaken (waterways and drainage) and small-area population forecasts were required (water and sewage). However the VIF (2019) population outlook is substantially stronger than more recent population forecasts from the Victorian Treasury, Centre for Population Projections and Deloitte Access Economics. This is due to the fact that the VIF (2019) outlook does not consider the impacts of COVID-19 on underlying drivers of population, including migration, fertility and mortality. As noted MW did consider COVID-19 impacts on population by obtaining a COVID-19 adjusted outlook from MacroPlan, but this forecast was also substantially higher than recent forecasts in the market.

Table A.1: Victorian population forecasts comparison

	CAGR **2018-19 to 2023-24**	Population **Difference to VIF (2019) by 2023-24**
VIF (2019) (Jul 2019)	1.9%	-
MacroPlan (Sep 2020)	1.5%	132,000
Deloitte Access Economics (Sep 2020)	1.1%	286,000
Centre for Population Projections (Dec 2020)	1.0%	296,000
2020-21 Victorian Budget (Nov 2020)	1.0%	312,000

Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

COVID-19 impacts on the demand outlook have been considered in some parts of the demand forecast. In particularly, developer contribution forecasts in the waterways and drainage demand outlook have taken into account COVID-19 impacts on the near-term outlook. However, this has not been applied consistently across the demand outlook.

There are also inconsistencies across key assumptions underpinning the demand outlook. In particular:

Waterways and drainage

- Potential COVID-19 impacts have not been directly included in forecasts for waterways and drainage services demand. MW has determined that pre-COVID-19 forecasts for property growth and developer contributions are still applicable, however this is unlikely given the material change in key growth factors such as interest rates, house prices and stimulus measures.
- Property contribution forecasts, produced by BIS Oxford Economics, are underpinned by an in-house macroeconomic and demographic model. MW has extended these forecasts from 2026-27 to 2030-31 using household growth projections from VIF (2019).
- The property market outlook used to forecast connections has not been used in the longer-term developer contributions analysis.

Sewage demand

- The population forecasts used were finalised prior to the outbreak of COVID-19 and are likely to overstate forecast sewage demand.
- Employment growth is likely to be a more appropriate growth factor for non-residential sewage demand compared to population growth.
- Demand from larger non-residential customers is derived using customer-level insights. While this approach is considered reasonable it is recommended that these are revised to incorporate potential changes in planned investments following the impact of COVID-19.
- Sewage demand forecasts are broadly stronger than history. However, data is only available for 2010-11 and 2018-19 and may be affected by high rainfall in 2010-11.
- Forecast growth in BOD for the WTP appears unreasonably high relative to historical trends. Forecast non-residential demand for South East Water at the ETP also appears high when compared to South East Water's residential demand forecasts and Yarra Valley Water's non-residential demand forecasts.

Water demand

- The population forecasts that underly water demand were finalised prior to the outbreak of COVID-19 and hence are too high and likely to overstate forecast water demand.
- Water retailers also use different sources for population forecasts creating internal inconsistencies.
- Retailers use different approaches to forecast key growth factors such as the number of non-residential connections and total water use per connection (residential and non-residential). While this may be appropriate it is difficult to verify.
- Reductions in residential usage per connection to 2025-26 appear high for City West Water, Yarra Valley Water and Western Water, as well as Yarra Valley Water non-residential usage per connection to 2025-26. This is driven in part by assumptions regarding behaviour change campaigns.
- The connection forecasts from retailers used in the water demand forecast have not been used in the waterways and drainage demand forecast.

Population forecast comparison

Population growth is a key driver of demand across all three of MW's major service areas – waterways and drainage, water, and sewage.

This section examines the population projections prepared by MacroPlan for MW. The forecast period is 2019-20 to 2025-26 (year-end 30 June) and includes the impact of COVID-19 on the Victorian population.

Water demand forecasts prepared by retail water companies are underpinned by population forecasts from the 2019 and 2016 Victoria in Future (VIF) reports, waterways and drainage forecasts are underpinned by population forecasts prepared by BIS Oxford Economics, while sewage forecasts are underpinned by forecasts from the 2019 VIF report. The VIF reports and BIS Oxford Economics modelling were finalised prior to the outbreak of COVID-19 and the subsequent negative impact of the virus on Victorian population growth.

MW has used MacroPlan population forecasts to undertake a scenario analysis of potential changes to expenditure forecasts resulting from COVID-19. MacroPlan population forecasts are not a direct

input into the baseline forecasts for MW expenditure in PS21. However, the decision to not use MacroPlan forecasts was based on the assessment that the different population outlook did not materially change the expenditure forecast. To that point, this segment of the review considers if MacroPlan forecasts have fully considered the impact of COVID-19 on the population outlook.

Findings

Reasonableness and application of growth factors

MacroPlan forecasts of population growth are materially higher than the more recent projections by Victorian Treasury, Federal Treasury and Deloitte Access Economics. This is partly due to forecasts for a relatively modest impact of COVID-19 on Victorian net overseas and net interstate migration as well as a sharp fall in mortality which outweighs a decline in the fertility rate. In our view the MacroPlan forecasts of population growth are unreasonably high and in need of revision.

Consistency of assumptions across forecasts

MacroPlan forecasts of Victorian population are internally consistent with underlying drivers of population growth such as mortality and fertility (natural increase) and migration (overseas and interstate). Forecasts for Melbourne and the rest of Victoria are also consistent with forecasts for Victoria.

Comparison of assumptions and growth factors to other available forecasts

MacroPlan forecasts for key assumptions are considered unreasonable. The rate of natural increase – the difference between the number of new births and deaths – is much higher than more recent forecasts by other forecasters such as Victorian Treasury, Federal Treasury and Deloitte Access Economics. The level of migration, both net interstate and net overseas, does not appear to fully capture the negative impact of COVID-19. While there were no other market forecasts of Victoria's population available at the time of submission, the July Economic and Fiscal Update from the Federal Treasury does suggest that the MacroPlan forecasts were on the high side.

Consideration and implementation of COVID-19 impacts

MacroPlan incorporate the impact of COVID-19 in their forecasts for Victorian population growth, but the magnitude of COVID-19 impacts is much smaller than seen in forecasts produced by other forecasters such as Victorian Treasury and Deloitte Access Economics. As a result, MacroPlan is not fully capturing the negative impact of COVID-19 on growth in the Victorian and Melbourne population.

Comparison to third party forecasts

MacroPlan forecast the Victorian population to grow by 1.6% in 2019-20 before slowing to a 0.9% gain in 2020-21. The rate of population growth is then forecast to accelerate to 1.8% in 2021-22. Over the period from 2018-19 to 2025-26 the Victorian population is forecast to grow from 6.6 million to 7.3 million persons, a CAGR of 1.6%.

It is possible to compare these Victorian population forecasts against those published by the Victorian Department of Environment, Land, Water and Planning in the VIF (2019) report (released in July 2019), Victorian Treasury forecasts encompassed in the 2020-21 Victorian Budget (released in November 2020), Deloitte Access Economics' forecasts (finalised in September 2020) and the Australian Government Centre for Population (released in December 2020). The VIF (2019) report does not incorporate the impact of COVID-19 on Victorian population growth. Forecasts produced by Victorian Treasury, MacroPlan, Deloitte Access Economics and the Centre for Population do incorporate the impact of COVID-19 on Victorian population growth.

Table A.2: Victorian population forecasts comparison, summary

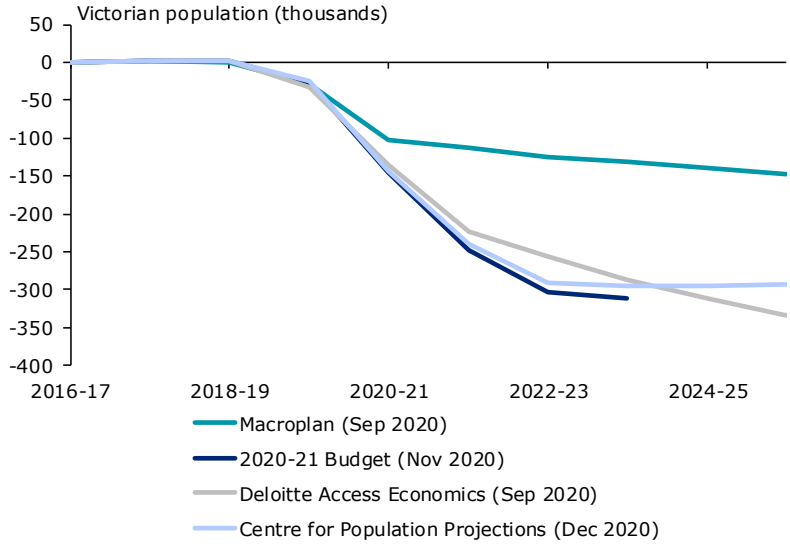
	History	Forecast						
	2018-19	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**2025-26**
VIF (2019) (Jul 2019)								
Persons (thousands)	6,596	6,730	6,862	6,992	7,120	7,246	7,371	7,495
% growth	2.1%	2.0%	2.0%	1.9%	1.8%	1.8%	1.7%	1.7%
MacroPlan (Sep 2020)								
Persons (thousands)	6,596	6,701	6,759	6,878	6,996	7,114	7,231	7,347
% growth	2.1%	1.6%	0.9%	1.8%	1.7%	1.7%	1.6%	1.6%
Deloitte Access Economics (Sep 2020)								
Persons (thousands)	6,596	6,696	6,726	6,769	6,864	6,960	7,060	7,162
% growth	2.1%	1.5%	0.5%	0.6%	1.4%	1.4%	1.4%	1.4%
2020-21 Victorian Budget (Nov 2020)								
Persons (thousands)	6,598	6,703	6,717	6,744	6,818	6,934	-	-
% growth	2.1%	1.6%	0.2%	0.4%	1.1%	1.7%	-	-
Centre for Population Projections (Dec 2020)								
Persons (thousands)	6,598	6,705	6,719	6,751	6,829	6,950	7,075	7,202
% growth	2.1%	1.6%	0.2%	0.5%	1.2%	1.8%	1.8%	1.8%

Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

MacroPlan forecast a smaller Victorian population when compared to the forecasts published in the VIF (2019) report, and a larger population when compared to forecasts published by the Victorian Treasury, Deloitte Access Economics and the Centre for Population. In 2023-24, MacroPlan forecasts 132,000 fewer people in Victoria compared to VIF (2019) (a pre-COVID-19 forecast), 154,100 additional people compared to Deloitte Access Economics, 163,800 additional people compared to the Centre for Population and 180,400 additional people compared to Victorian Treasury.

The chart below compares VIF (2019) (forecasts used by MW) to those produced by MacroPlan, Victorian Treasury, Deloitte Access Economics and the Centre for Population. By 2023-24, Victorian Treasury forecast 312,400 fewer people in Victoria, the Centre for Population forecast 295,700 fewer people, Deloitte Access Economics forecast 286,100 fewer people, while MacroPlan forecast 132,000 fewer people. As such, MacroPlan forecast only 42-46% of the decline in Victorian population seen among other population forecasters.

Chart A.1 Victorian population forecasts level difference compared to VIF (2019)



Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

Over the period from 2018-19 to 2023-24, MacroPlan forecast population to grow at a CAGR of 1.5%. This is below the 1.9% CAGR in VIF (2019), but above the 1.0% CAGR forecast by the Centre for Population, the 1.0% CAGR forecast by Victorian Treasury, and the 1.1% CAGR forecast by Deloitte Access Economics.

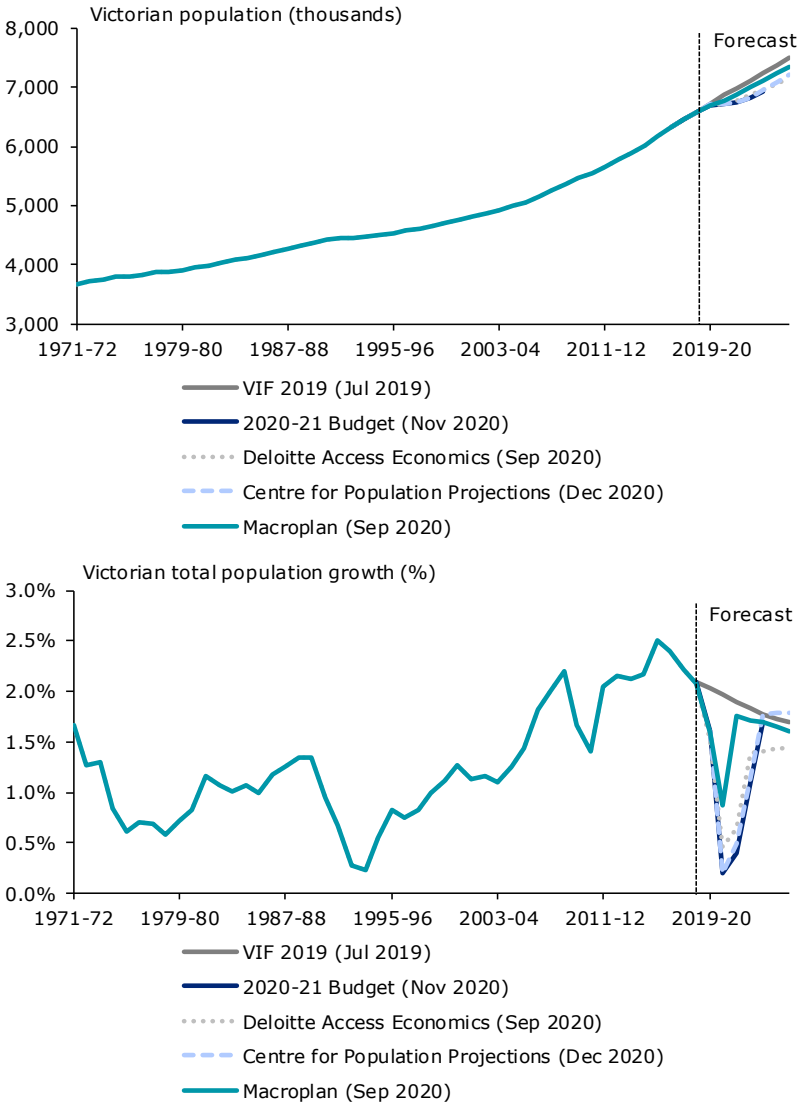
Table A.3: Victorian population forecasts comparison, CAGRs

	History	Forecast		
	1971-72 to 2018-19	**2008-09 to 2018-19**	**2018-19 to 2023-24**	**2018-19 to 2025-26**
VIF (2019) (Jul 2019)	1.3%	2.1%	1.9%	1.8%
MacroPlan (Sep 2020)	1.3%	2.1%	1.5%	1.6%
Deloitte Access Economics (Sep 2020)	1.3%	2.1%	1.1%	1.2%
2020-21 Victorian Budget (Nov 2020)	1.3%	2.1%	1.0%	-
Centre for Population Projections (Dec 2020)	1.3%	2.1%	1.0%	1.3%

Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

The impact of the various forecasts on population levels and growth rates can be seen in the chart below.

Chart A.2 Victorian population forecasts comparison



Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, Deloitte Access Economics, Victorian Budget 2020-21, the Centre for Population Projections.

At the time of submission, MW did not have access to these alternative forecasts. However, the Federal Treasury released a population forecast at a national level as part of the July Economic and Fiscal Update that provided some indication that the MacroPlan forecast may be higher than other market participants were forecasting.

Historically, Victoria has experienced stronger population growth than the national average due to a high share of NOM. Between 2008-09 and 2018-19 Victoria received 30% of total NOM to Australia, which accounted for 50% of the state's population growth. This would indicate that population growth would likely be impacted more heavily than the national average, yet MacroPlan forecast a stronger rate of population growth at 0.9% compared to the Federal Treasury's forecast of 0.6% for the whole of Australia.

Table A.4: Population forecasts comparison, CAGRs

	History **2008-09 to 2018-19**	Forecast **FY19-20**	**FY20-21**
VIF (2019) (Jul 2019) – Victorian population	2.1%	2.0%	2.0%
MacroPlan (Sep 2020) – Victorian population	2.1%	1.6%	0.9%
July Economic and Fiscal Update (July 2020) – Australian population	1.6%	1.2%	0.6%

Source: Australian Bureau of Statistics, MacroPlan, Victoria in Future 2019, July Economic and Fiscal Update

Comparison of components of population change to third party forecasts

Demographic forecasts are underpinned by assumptions about each component of population growth including fertility, mortality and migration (overseas and interstate) are typically based on a combination of past observed trends, administrative data (such as migration targets), and future predictions. The assumptions made for each of the components determine the future size and distribution of the forecast population, with different assumptions leading to a different population outcome.

Population growth across Victoria is expected to slow in 2020-21 amid falls in the fertility rate, overseas migration to Victoria and interstate migration to Victoria. And although the mortality rate may fall there is also likely to be a decline in the fertility rate as growth in new births slows.

This section compares the underlying assumptions made by MacroPlan to third-party forecasters such as the Centre for Population Projections and Victorian Treasury (where published).

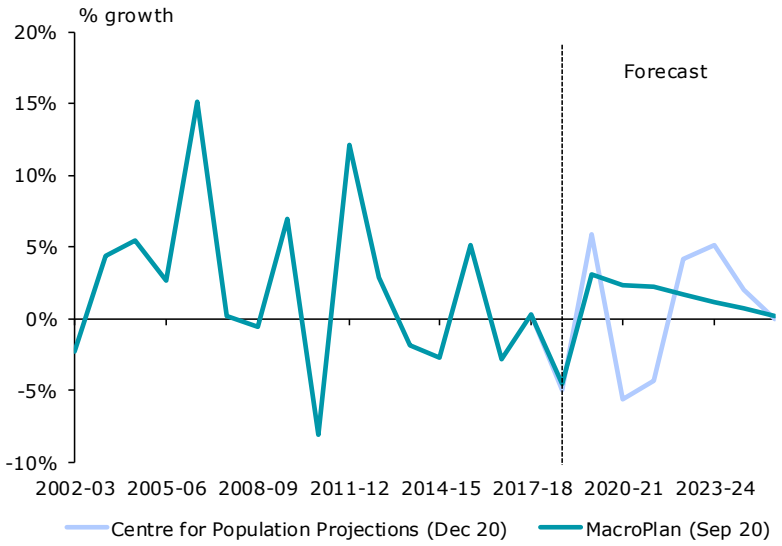
Natural increase

The difference between the number of new births and deaths is referred to as the natural increase in the population. The Centre for Population Projections forecast the rate of natural increase to fall by 5.6% in 2020-21 and 4.3% in 2021-22 before returning to positive growth from 2022-23.

MacroPlan forecast continued positive growth in natural increase in 2020-21 (3.1%) and 2021-22 (2.3%). According to MacroPlan, the COVID-19 lockdown led to a decline in the death rate (for example through a lower road death toll and fewer influenza deaths) and that some of this reduction in the death rate will continue over the forecast period. MacroPlan expect that changes to health standards and workplace culture will result in growth in births outpacing growth in deaths, leading to a significant improvement in natural increase. This finding is not supported by forecasters such as Victorian Treasury, the Centre for Population Projections and Deloitte Access Economics.

Over the period from 2019-20 to 2025-26, MacroPlan forecast that natural increase will add 284,200 persons to the Victorian population, compared to a 267,900 gain forecast by the Centre for Population Projections (a difference of 16,300 persons).

Chart A.3 Natural increase comparison, Victoria



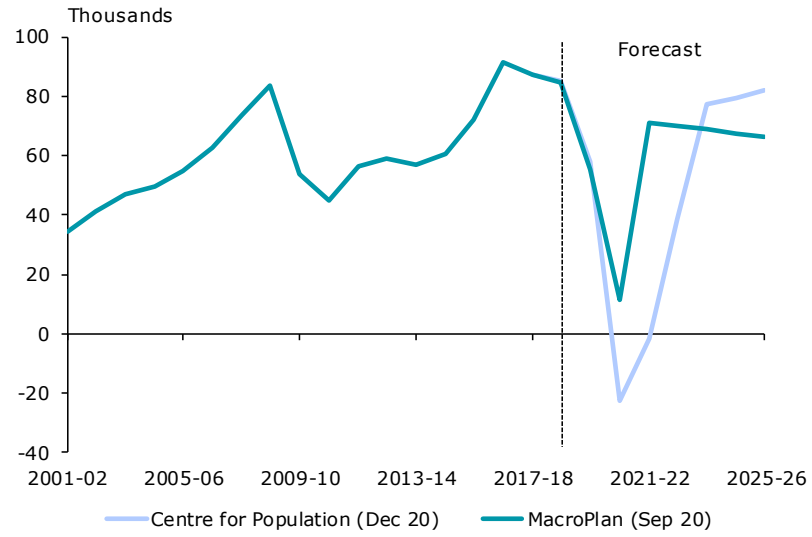
Source: MacroPlan, the Centre for Population Projections.

Net overseas migration

Net overseas migration (NOM) refers to the gap between inward and outward migration. Victorian Treasury and the Centre for Population Projections forecast negative NOM in both 2020-21 and 2021-22. By comparison, MacroPlan expect positive NOM to Victoria of 11,200 in 2020-21 and 71,100 in 2021-22.

Over the period from 2019-20 to 2025-26, MacroPlan forecast that NOM will add 410,100 persons to the Victorian population, compared to a 311,300 gain forecast by the Centre for Population (a difference of 98,800 persons).

Chart A.4 Net overseas migration comparison, Victoria



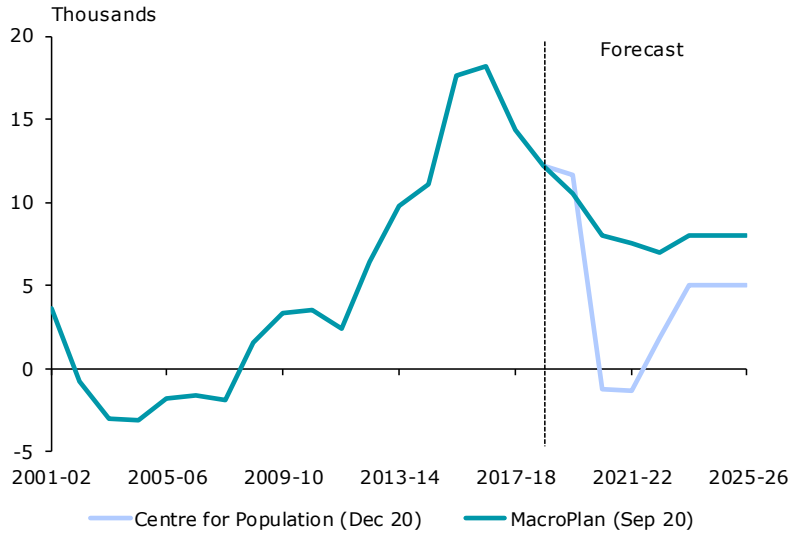
Source: MacroPlan, the Centre for Population Projections.

Net interstate migration

Net interstate migration (NIM) is a measure of the number of interstate arrivals into a state from elsewhere in Australia, less the number of departures. The Centre for Population Projections forecast negative NOM in both 2020-21 and 2021-22, while Victorian Treasury noted that NIM will be lower than levels seen in recent years. By comparison, MacroPlan expect positive NIM to Victoria of 8,000 in 2020-21 and 7,500 in 2021-22.

Over the period from 2019-20 to 2025-26, MacroPlan forecast that NIM will add 57,000 persons to the Victorian population, compared to a 25,900 gain forecast by the Centre for Population Projections (a difference of 31,100 persons).

Chart A.5 Net interstate migration comparison, Victoria



Source: MacroPlan, the Centre for Population Projections.

Analysis of MacroPlan assumptions and forecasts against historical trends and recent actuals

MacroPlan demographic forecast assumptions are included in the table below. MacroPlan forecast a modest reduction in the fertility rate, a relatively large reduction in the mortality rate, as well as a reduction in the number of overseas and interstate arrivals to Victoria.

Table A.5: Assumptions: Victoria and Melbourne

	2018-19 (history)	2025-26 (forecast)	2018-19 (history)	2025-26 (forecast)	2018-19 (history)	2025-26 (forecast)
Fertility (births per woman)	1.66	1.65	2.01	1.99	1.72	1.71
Mortality (deaths per 1,000 persons)	5.1	4.8	6.0	5.7	5.2	5.0
Net Overseas Migration	77,369	60,697	7,110	5,544	84,479	66,240
Net Interstate Migration	2,252	2,520	9,946	5,480	12,198	8,000

Note: Fertility refers to the Total Fertility Rate, mortality refers to the Standardised Death Rate. Data refers to year-end population.

Source: MacroPlan

The following section examines the appropriateness of these forecasts with respect to historical trends and data released following the finalisation of MacroPlan forecasts in September 2020.

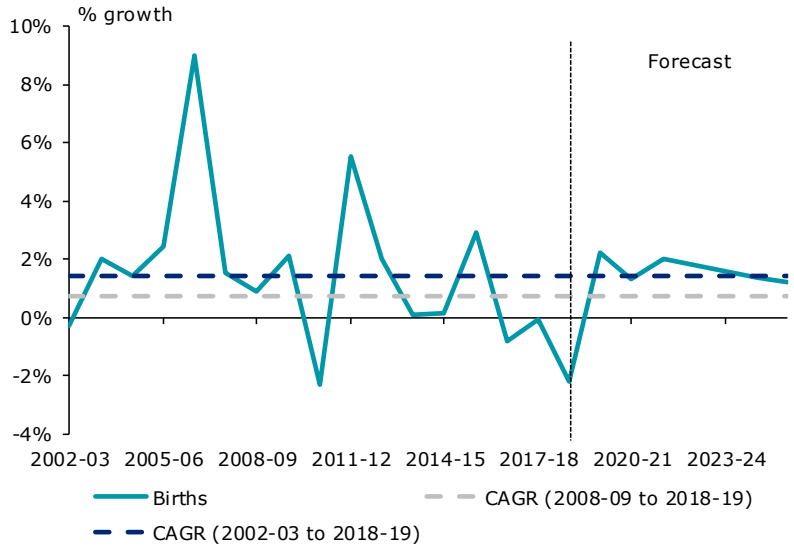
Natural increase - fertility

Fertility is a general term that covers the relationship between the current population (and typically the current female population) and current numbers of births. Fertility assumptions are an important element of a population projection model as they determine to what extent the population is replacing itself (excluding migration). The number of births expected in a population is forecast using an assumption around the Total Fertility Rate (TFR), which measures the number of children a woman would expect to have over her lifetime if she experienced the current age-specific fertility rates at each age.

In 2018-19, MacroPlan estimate that the TFR was 1.72 births per woman for Victoria, 1.66 for Melbourne and 2.01 for the rest of Victoria. Data released by the Australian Bureau of Statistics (ABS) on 9 December 2020 indicates that the TFR for Victoria fell to 1.63 births per woman – the lowest TFR of any Australian state or territory. The TFR for Melbourne was 1.55 births per woman in 2019 and 1.94 for the rest of Victoria. MacroPlan forecast the TFR to be 1.71 births per woman for Victoria in 2025-26, 1.65 for Melbourne and 1.99 for the rest of Victoria.

The forecast number of births in a population is a function of both the assumed TFR and the number of women of child-bearing age in a given period. MacroPlan forecast total births in Victoria to grow from 76,500 in 2018-19 to 85,800 in 2025-26, a CAGR of 1.6%. This compares to a CAGR of 0.9% over the period from 2008-09 to 2018-19. Much of this gain is led by births in Melbourne which are forecast to grow from 60,100 in 2018-19 to 68,900 in 2025-26, a CAGR of 2.0%. Births in the rest of Victoria are forecast to grow from 16,400 to 16,700, a CAGR of 0.3%. This is driven by the fact that in 2018-19 approximately 52% of the Melbourne population was aged between 15 and 49, compared to 41% of the population in the rest of Victoria.

Chart A.6 Births, Victoria



Source: Australian Bureau of Statistics, MacroPlan.

Natural increase - mortality

Mortality is a measure of the likelihood of dying, which varies significantly due to people's age and sex. The Standardised Death Rate (SDR) is the death rate of a population after adjusting for the age distribution.

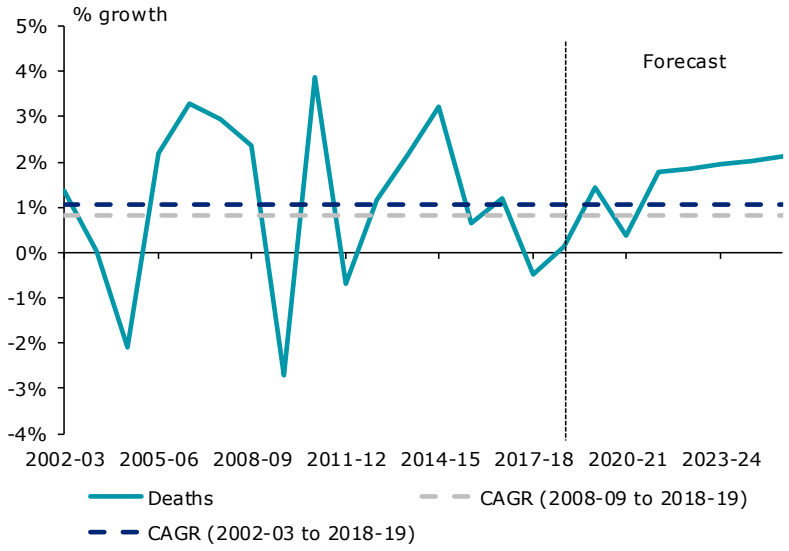
In 2018-19, MacroPlan estimate that the SDR was 5.2 deaths per 1,000 population for Victoria, 5.1 for Melbourne and 6.0 for the rest of Victoria. The SDR is forecast to fall to 5.0 deaths per 1,000 population for Victoria in 2025-26, 4.8 in Melbourne and 5.7 for the rest of Victoria.

The forecast number of deaths in a population is the function of both the assumed SDR and the number of people in each age group. Victoria is typical of most Western societies in that the fall in the SDR is not enough to offset the number of people moving into the older age groups (where the rate of mortality is typically higher), resulting in an increasing number of deaths each year.

MacroPlan expect a sharp fall in the growth rate of deaths in Victoria in 2020-21 due to the COVID-19 lockdown (via a lower road death toll and influenza death toll). According to the Transport Accident Commission, 213 people were killed on Victorian roads in 2020, 53 fewer than in 2019. Provisional data from the ABS indicates that there have been 1,846 deaths in Australia from influenza and pneumonia over the calendar year to 27 October 2020, 1,039 fewer than compared to the average over the same period from 2015 to 2019. However, there have been an additional 824 COVID-19 deaths over the calendar year to 27 October 2020. In total there have been 28,301 deaths in Victoria over the calendar year to 27 October 2020, 125 additional deaths compared to the Victorian average from 2015 to 2019. This does not support the conclusion that Victorian deaths are set to fall sharply due to the impact of the COVID-19 lockdown (beyond reducing deaths from COVID-19).

MacroPlan forecast total deaths in Victoria to grow from 39,200 in 2018-19 to 43,900 in 2025-26, a CAGR of 1.6%. This compares to a CAGR of 1.2% over the period from 2008-09 to 2018-19. Deaths are forecast to grow at a slower pace in Melbourne (a CAGR of 1.6% from 2018-19 to 2025-26) compared to the rest of Victoria (1.8%).

Chart A.7 Deaths, Victoria

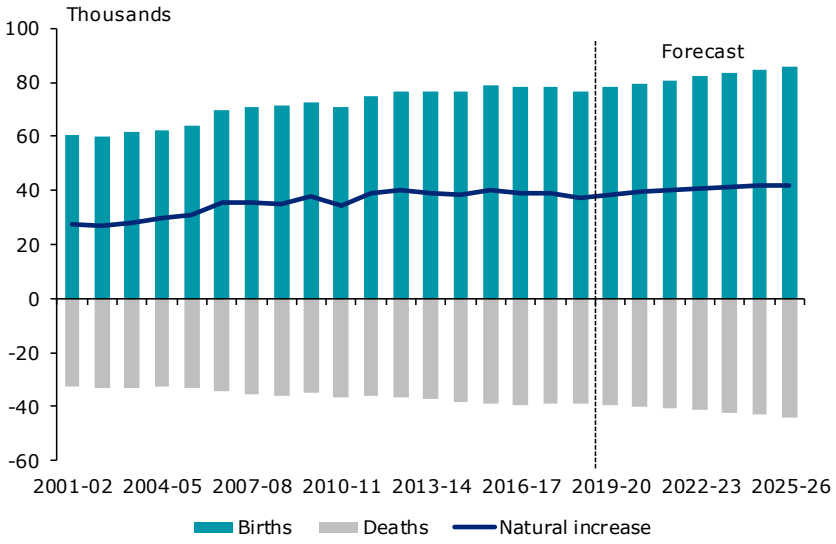


Source: Australian Bureau of Statistics, MacroPlan.

Natural increase - total

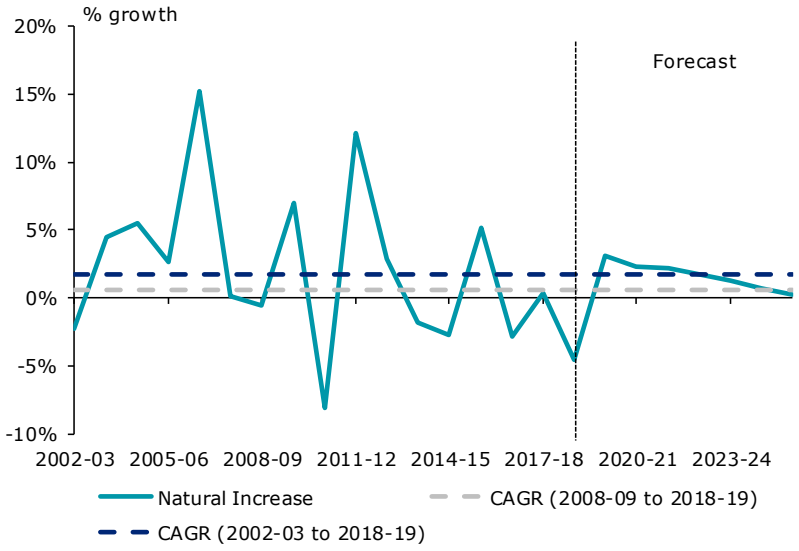
According to MacroPlan, the natural increase in the Victorian population is forecast to grow from 37,300 in 2018-19 to 41,900 in 2025-26. This represents a CAGR of 1.6% over the period from 2019 to 2026, above the 0.5% CAGR over the period from 2008-09 to 2018-19.

Chart A.8 Births and deaths (persons), Victoria



Source: Australian Bureau of Statistics, MacroPlan.

Chart A.9 Natural increase (persons), Victoria



Source: Australian Bureau of Statistics, MacroPlan.

The natural increase in the Melbourne population is forecast to grow from 33,900 in 2018-19 to 39,600, a CAGR of 2.3%. By comparison the natural increase in the rest of Victoria population is forecast to fall from 3,500 in 2018-19 to 2,000 in 2025-26, a CAGR of -7.4%.

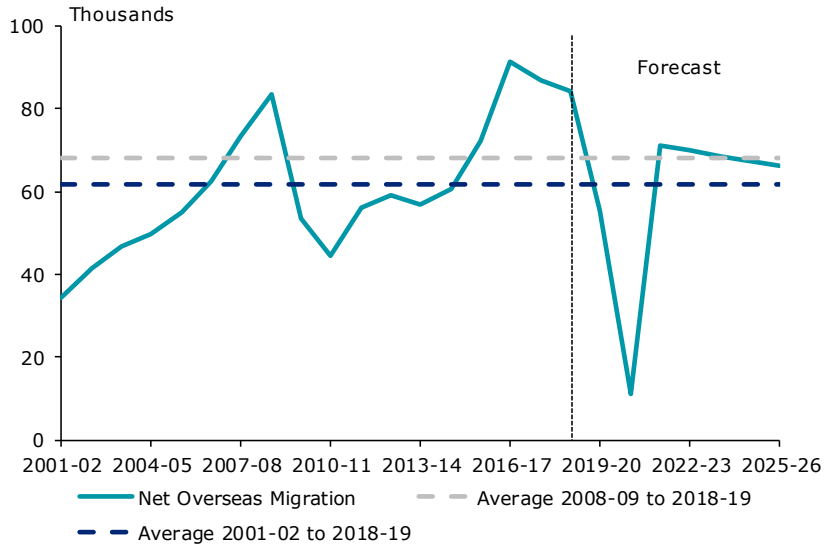
Net overseas migration

Population forecasts also depend on the level of NOM – the gap between inward and outward migration. Unlike fertility and mortality, which to some extent are driven by the demographic characteristics of the existing population, levels of NOM are largely independent of the current residents. Instead, NOM is driven by a range of external factors; social, economic and political.

Victorian NOM grew strongly from 2010-11 to a peak in 2017-18. Over this period NOM increased from 44,600 to 87,000, a CAGR of 10.0%. NOM fell to 84,500 in 2018-19 and is expected to fall sharply in 2019-20 amid the impact of COVID-19. The introduction of border restrictions has seen fewer students, migrants and tourists visit Victoria. According to the Department of Home Affairs, the number of Visas granted for international migrants intending to stay in Victoria fell by 19.8% in 2019-20. Victoria's share of the total Australian migration program also fell to its lowest level since 2014-15.

According to MacroPlan, NOM to Victoria is forecast to fall from 84,500 in 2018-19 to a trough of 11,200 in 2020-21 before recovering to 66,200 in 2025-26. By the end of the forecast period the rate of NOM returns to levels in-line with recent historical trends.

Chart A.10 Victorian net overseas migration (annual)



Source: Australian Bureau of Statistics, MacroPlan.

Melbourne accounted for 91.6% of total Victorian NOM in 2018-19 and this share is expected to remain unchanged by the end of the forecast period in 2025-26. Melbourne NOM is forecast to fall from 77,400 in 2018-19 to 60,700 in 2025-26, while rest of Victoria NOM is forecast to fall from 7,100 to 5,500.

Net interstate migration

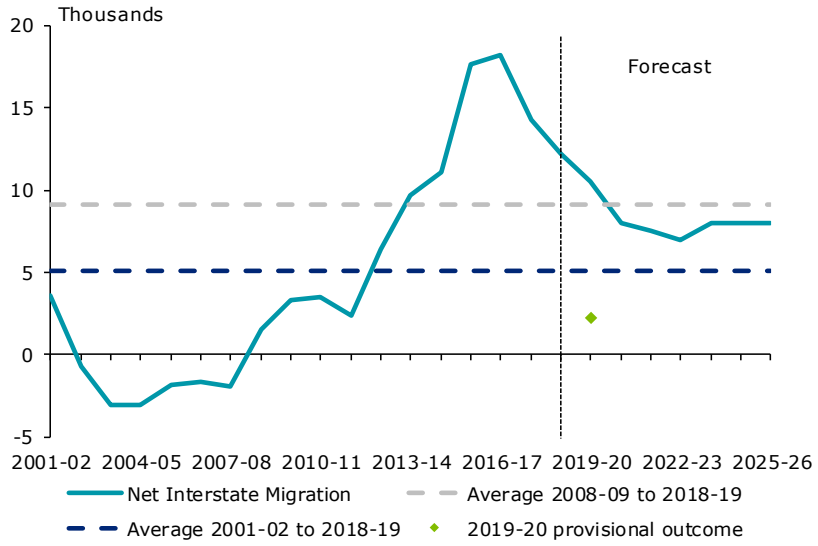
Over the past decade, NIM has added to Victoria's population growth, particularly as younger cohorts move to the state for its education and job opportunities.

NIM grew from a trough of -3,100 in 2003-04 to a peak of 18,200 in 2016-17, before slowing to 12,200 in 2018-19. The presence of state border restrictions from March 2020 has weighed heavily on Victorian NIM.

Provisional data from ABS indicates that NIM to Victoria fell from 2,665 in the December quarter of 2019 to 590 in the March quarter of 2020 and -3,042 in the June quarter of 2020. Departures from Victoria to other states fell by 3.7% over 2019-20, but this was more than offset by a 14.3% decline in persons migrating from other states to Victoria.

MacroPlan forecast NIM of 10,500 in 2019-20, above the 2,243 provisional outcome released by the ABS. According to MacroPlan, NIM is forecast to fall to a trough of 7,000 in 2022-23 before recovering to 8,000 in 2025-26.

Chart A.11 Victorian net interstate migration (annual)



Source: Australian Bureau of Statistics, MacroPlan.

NIM to Melbourne is forecast to grow from 2,300 in 2018-19 to 2,500 in 2025-26, while NIM to the rest of Victoria is forecast to fall from 9,900 in 2018-19 to 5,500 in 2025-26.

Waterways and drainage

MW's waterways and drainage services include the management of linear assets (e.g. drainage assets and waterways), catchment and flood risk areas, as well as emergency response activities. These services are provided for households and businesses and it is the stock of properties that drives the level of activity performed.

Findings

Reasonableness and application of growth factors

Demand for waterways and drainage is driven by combining property and developer contribution forecasts. Residential property forecasts are underpinned by appropriate growth factors such as house prices, macroprudential regulations, interest rates and measures of under or over supply of housing. Non-residential property forecasts are driven by demographic factors such as population growth and government projects, however factors such as employment growth and output growth by industry may be more appropriate drivers of construction activity.

Developer contribution forecasts do not use the property market outlook as an input. The resulting developer opex and capex forecasts are much weaker than the property market forecasts. However limited detail is provided on the results of industry consultation and key assumptions underpinning these forecasts. As such, it is not possible to confirm that developer contribution forecasts are reasonable.

Consistency of assumptions across forecasts

Property contribution forecasts, produced by BIS Oxford Economics, are underpinned by an in-house macroeconomic and demographic model. MW has extended these forecasts from 2026-27 to 2030-31 using household growth projections from VIF (2019). BIS Oxford Economics note there is minimal difference between their population outlook and that of VIF (2019), but this does represent an inconsistency in underlying assumptions.

The property market outlook underpinning connections is not used when forecasting developer contributions. Instead, assumptions regarding land development and capacity to deliver were developed through consultation with industry. This means there are differences between the property market outlook and the developer growth outlook, however this is not unreasonable, particularly in the short term with Melbourne Water assets typically needing to be put in place before property sales occur, but connections not occurring until after land sales.

Comparison of assumptions and growth factors to other available forecasts
The growth outlook for the property market is weaker than history. This is driven by the cyclical nature of the market, with activity slowing heading into 2020. Initial data from the ABS indicates that the property cycle has likely changed due to COVID-19, with lower interest rates and government stimulus providing near-term support for approvals. Other forecasts are not available for comparison.

Consideration and implementation of COVID-19 impacts
Potential COVID-19 impacts have not been directly included in forecasts for waterways and drainage services demand. MW has determined that pre-COVID-19 forecasts for property growth and developer contributions are still applicable, however in our view this is unlikely given the material change in key growth factors such as interest rates, house prices and stimulus measures.

The forecasts provided by MW include a downturn in property construction in both 2019-20 and 2020-21 and are therefore likely to indirectly capture some of the potential negative effects of COVID-19 on demand for waterways and drainage services.

Overview of approach
Demand for waterways and drainage services are forecast by combining property and developer contribution forecasts. Residential, non-residential and rural demand are examined separately.

Property growth forecasts
BIS Oxford Economics produced forecasts for residential and non-residential building commencements out to 2025-26. These building forecasts were converted into forecasts of new customer connections using data provided by MW.

Data on dwelling commencements is sourced from the ABS Building Activity series. Residential dwelling commencement forecasts are driven by BIS Oxford Economics forecasts of population growth and are informed by other factors such as house prices, macroprudential regulations, interest rates and measures of under or over supply of housing. Non-residential dwelling commencement forecasts are driven by demographic factors such as population growth and government projects. BIS Oxford Economics did not consider rural customer growth in its analysis.

New residential customer connections are expected to follow building commencements with a lag, determined by analysis of data provided by MW. For residential commencements this lag was estimated to be 3-6 months.

The forecasts developed by BIS Oxford Economics were finalised prior to the outbreak of COVID-19.

Developer contribution forecasts
Developer contribution forecasts are informed by engagement with the land development industry, taking into account factors such as recent levels of lot production and assumptions around future rates of land development for growth areas and the delivery capacity of the land development industry.

Review of growth factors and assumptions
The following section examines BIS Oxford Economics forecasts for residential and non-residential building commencements, MW's subsequent forecasts for residential, non-residential and rural waterways and drainage customers, as well as the developer forecasts.

Property growth forecasts
BIS Oxford Economics forecasts for building commencements over the period from 2019-20 to 2025-26 are included in Table A.5.

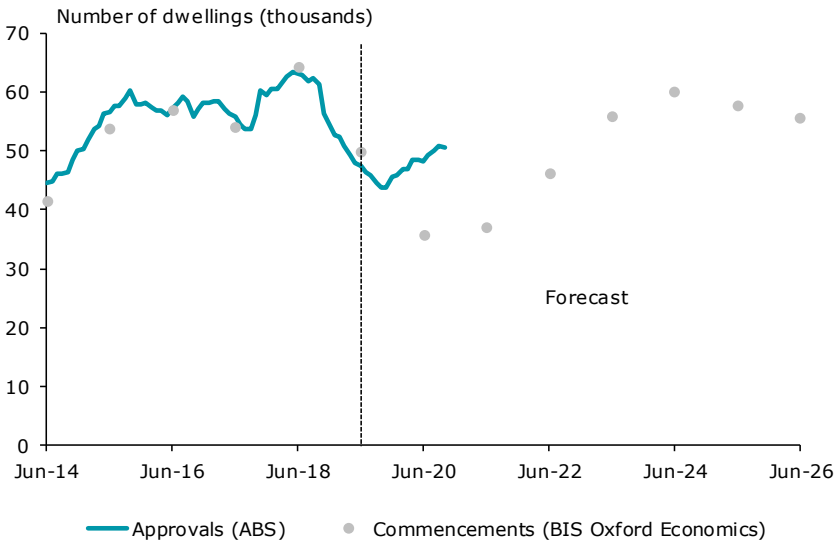
Table A.6: BIS Oxford Economics annual building commencements, Greater Melbourne

	Levels		CAGR	
	History	**Forecast**	**History**	**Forecast**
	2018-19	**2025-26**	**2013-14 to 2018-19**	**2018-19 to 2025-26**
Residential (number)	49,965	55,682	3.7%	1.6%
Non-residential (value, $m)	10,128	9,942	8.1%	-0.3%

Note: BIS Oxford Economics forecasts for residential refer to the number of residential dwelling commencements, non-residential refers to the value of non-residential building commencements.
Source: BIS Oxford Economics.

A key leading indicator of building commencements is building approvals. Chart A.12 compares the number of residential dwellings approved in Greater Melbourne to forecasts for commencements prepared by BIS Oxford Economics. Residential dwelling commencements are expected to reach a trough in 2019-20 before returning to positive growth in 2020-21. This is supported by the growth in residential building approvals through 2020 to date (up to October 2020). However, recent data suggests that the trough in residential dwelling commencements may not be as low as initially forecast by BIS Oxford Economics. This may be due to large falls in interest rates in early 2020 and government stimulus measures (including HomeBuilder and stamp duty concessions), which occurred after BIS Oxford Economics finalised their forecasts.

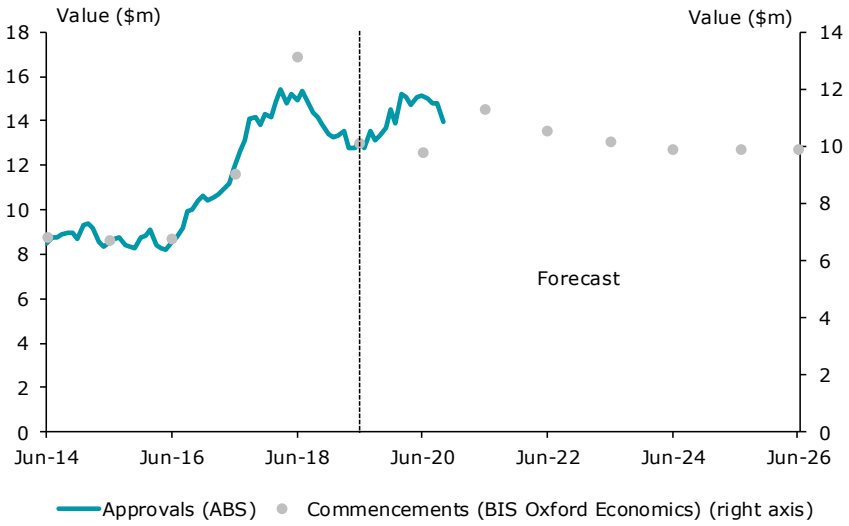
Chart A.12 Residential dwelling commencements and approvals, Greater Melbourne



Source: Australian Bureau of Statistics, BIS Oxford Economics.

BIS Oxford Economics forecast the value of non-residential building activity to fall by 3.2% in 2019-20 before growing by 15.7% in 2020-21. By contrast, the value of non-residential building approvals has been weak since early 2020 amid the impact of COVID-19. This suggests that the value of non-residential building activity will remain weak through 2020-21. BIS Oxford Economics forecast zero growth in non-residential building activity in both 2024-25 and 2025-26.

Chart A.13 Non-residential dwelling commencements and approvals, Greater Melbourne



Source: Australian Bureau of Statistics, BIS Oxford Economics.

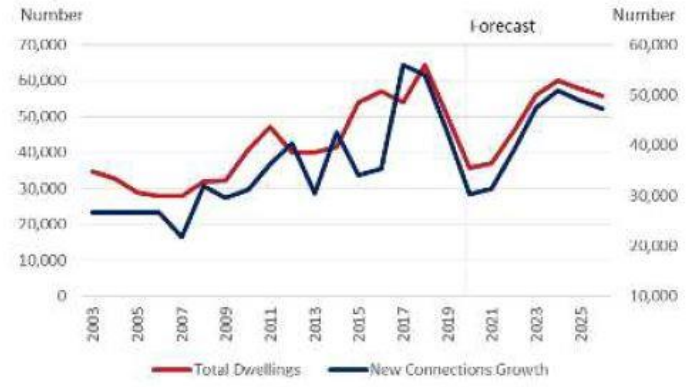
BIS Oxford Economics have used their own population forecasts in developing forecasts for building commencements. These population forecasts have not been provided, but BIS Oxford Economics have noted that they are broadly similar to those produced by VIF (2019) (a pre-COVID-19 forecast). As such, the forecasts of population and building activity used by MW do not include the negative impact of COVID-19.

Waterways and drainage customer forecasts

Forecasts for building commencements have been used to drive growth in the number of waterways and drainage customers. MW state that demand for residential waterways and drainage services is driven by forecast growth in the number of residential dwelling commencements. Demand for non-residential waterways and drainage services is driven by growth in the value of non-residential building commencements. Demand for rural properties is based on BIS Oxford Economics forecasts for development in adjoining metro areas.

Data was not available to econometrically test the historical fit of building commencements to customer growth. Visual inspection of charts presented by BIS Oxford Economics shows a strong correlation between historical residential dwelling commencements and growth in residential customers, while the correlation appears weaker between non-residential building commencements and non-residential customers.

Chart A.14 Forecast residential connections growth



Source: BIS Oxford Economics, MW.

Chart A.15 Forecast non-residential connections growth

Source: BIS Oxford Economics, MW.

MW has extended customer forecasts numbers from 2026-27 to 2030-31 using household growth projections for Greater Melbourne Capital City Statistical Area from VIF (2019).

MW forecasts that the number of residential customers will grow at a CAGR of 2.2% from 2018-19 to 2025-26, above the 1.6% CAGR in residential building approvals over the same period. The number of non-residential customers is forecast to grow at a CAGR of 1.8% from 2018-19 to 2025-26, above the -0.3% CAGR in non-residential building activity forecast by BIS Oxford Economics.

Table A.7: Waterways and drainage customer forecasts by property type

	BIS Oxford Economics building commencements (CAGR)			MW customers (CAGR)		
	History 2013-14 to 2018-19	**Forecast 2018-19 to 2025-26**	**Forecast 2018-19 to 2030-31**	**History 2013-14 to 2018-19**	**Forecast 2018-19 to 2025-26**	**Forecast 2018-19 to 2030-31**
Residential	3.7%	1.6%	-	-	2.2%	2.1%
Non-residential	8.1%	-0.3%	-	-	1.8%	1.8%
Rural	-	-	-	-	2.0%	2.0%
Total	-	-	-	-	2.2%	2.1%

Note: BIS Oxford Economics forecasts for residential refer to the number of residential dwelling commencements, non-residential refers to the value of non-residential building commencements.

Source: MW PS21 – Submission including supplement.

Developer contribution forecasts

Total developer contributions are forecast to fall from $166 million in 2018-19 to $133 million in 2025-26, a CAGR of -3.1%. MW has not explicitly identified a driver of this reduction in developer contributions, but have noted that COVID-19 may have a negative impact on demand.

The developer forecasts do not use the BIS Oxford Economics property market outlook as an input to growth. The developer forecasts of capex and opex are much weaker than the property market forecasts.

Table A.8: Developer contributions

	$ million		CAGR	
	History	**Forecast**	**History**	**Forecast**
	2018-19	**2025-26**	**2016-17 to 2018-19**	**2018-19 to 2025-26**
Capex component (offset to RAB)	166	133	6.2%	-3.1%
Opex component (other revenue)	11	9	6.2%	-3.2%
Total	178	142	6.2%	-3.1%

Note: gifted assets are not included.

Source: MW PS21 – Submission including supplement.

Sewage demand

This section of the report examines sewage demand forecasts for the Eastern Treatment Plant (ETP) and the Western Treatment Plant (WTP).

Forecasting demand for sewage services is inherently more challenging than water demand or demand for waterways and drainage services. Sewage demand requires the measurement of five parameters (flow, inorganic total dissolved solids (iTDS), total suspended solids (TSS), biological oxygen demand (BOD) and total Kjeldahl nitrogen (TKN)). There are over one million connections, a lack of comprehensive metering, and a transfer network that is more open to inflow of stormwater and groundwater than the water network.

MW has adopted an updated forecasting methodology from 2017-18 in response to the Demand Forecasting & Capital Planning Improvement Project – which was originally scoped in 2014-15 in response to unexpected growth in organic loads at ETP and WTP.

Findings

Reasonableness and application of growth factors

One of the main assumptions underpinning the sewage demand outlook is population growth, with MW forecasts using VIF (2019) projections to drive the demand outlook. As noted above, this population outlook is unreasonably high when compared to recent population projections as it does not account for COVID-19 impacts.

The link between residential sewage demand and population growth is appropriate given the clear relationship between the two factors. It also appears reasonable to use population growth to drive non-residential sewage demand, however employment growth is likely to be a more applicable growth factor. While the decision to assume no growth for some industries may be appropriate, this cannot be assessed without further information on the industries that have been excluded.

Demand from larger non-residential customers is derived using customer-level insights. While this is good practice it is recommended that these are revised to incorporate potential changes in planned investments following the impact of COVID-19.

Consistency of assumptions across forecasts

Assumptions relating to residential demand (population growth and flow), non-residential demand (customer-level insights, employment forecasts, population forecasts), infiltration and the balancing item are applied consistently. Differences in forecasts for sewage demand across retailers are driven by variation in the growth factors (i.e. the rate of population growth) rather than variation in the approach.

Comparison of assumptions and growth factors to other available forecasts

Sewage demand forecasts are broadly stronger than history. However, the forecast has only been compared to the CAGR between 2010-11 and 2018-19 due to limited data provided. The 2010-11 year experienced a particularly high level of wet weather which resulted in strong sewage inflow infiltration levels. This may be distorting the historic growth figures for the ETP.

Forecast growth in BOD for the WTP appears unreasonably high relative to historical trends. Forecast non-residential demand for South East Water at the ETP also appears high when compared to South East Water's residential demand forecasts and Yarra Valley Water's non-residential demand forecasts.

MW identified that climate change is likely to reduce wet weather flows moving forward, lowering infiltration inflows which are a large driver of the iTDS forecast. However, the outlook for iTDS is much stronger than history, driven by higher residential demand across major retailers.

Consideration and implementation of COVID-19 impacts
The underlying drivers of sewage demand have not taken into account COVID-19 impacts. In particular, the use of VIF (2019) population forecasts has likely overestimated future sewage demand.

Non-residential category A (top) sewage demand forecasts were developed through consultation with the larger commercial users. This may take into account some of the COVID-19 impact on sewage demand, but this has not been explicitly stated.

Overview of approach
The forecast methodology applies a baseline-plus-growth approach.

Table A.9: Sewage demand forecast assumptions

Category	Method	Assumptions
Residential		
Residential	• Calculated using VIF (2019) and mapped to catchment areas.	• Population assumed to grow in-line with VIF (2019) forecasts (1.94% CAGR from 2020-21 to 2025-26 in Melbourne, 1.96% CAGR for WTP catchment and 1.33% CAGR for ETP catchment) • L/person per day (flow) taken from a 2017-18 residential end-use study. Forecast to decline from 140L/p/day in 2018-19 to 129L/p/day in 2030-31. Driven by an increasing share of multi-unit dwellings relative to detached houses, as well as appliance efficiencies. • Assumptions have also been made to capture the effect of the transient population (working in the city, living elsewhere). Primarily affects the WTP catchment.
Non-residential		
Category A (top)	• Single industrial customers that will contribute more than 1% of a particular water treatment plant's load for a parameter. • Forecasts provided by retail water companies and based on customer engagement activities (incorporating expected increases and decreases at a customer level).	• Assumptions made at the customer level. For example, 2020-21 forecasts adjusted to account for a customer's plan to install on-site pre-treatment to reduce strength of their waste (mostly impacting BOD and TKN). • All forecast growth to plateau within the forecast period to 2030-31.
Category A (group)	• Major non-residential flows excluding Category A (top). • Forecasts provided by retail water companies.	• Zero growth is assumed – based on recent historical data.
Category B	• Represents the smallest industrial and commercial contributors. • Estimated using calculated flows and load by industry.	• For the period from 2016-17 to 2020-21 a combination of employment forecasts by industry (25 industry groupings) and population growth was applied (for all other industry groups). • For the period from 2021-22 to 2025-26 population growth forecasts were applied to all industry groups. • Eight industries were assigned zero growth on the basis that their growth was unrelated to population.
Sludge	• Yarra Valley Water's treatment plants discharge waste sludge back into the network. • Baseline is determined by retailers.	• Forecast growth is based on increases in flows at local treatment plants up to their capacity. • Beyond local treatment plant capacity, the whole volume of sewage will be transferred to MW (captured in catchment-based forecast for each treatment plant).
Western Water	• Western Water is expected to become a City West Water customer in 2021	• The Mutual Sewage Transfer Agreement between City West Water and Western Water is currently being finalised. The forecasts for sewage volumes reflect this work-in-progress agreement (further details not available).
Inflow and infiltration		
Groundwater infiltration	• The degree to which groundwater enters the network via sewers that are at or below the water table. • Estimated via the Melbourne Sewage Model 2014.	• Loads are estimated using representative concentrations from a literature review. • Zero growth is assumed – on the basis of most sewers joining the network are reticulation (i.e. not susceptible to groundwater infiltration). • A renewal program is expected to offset the deterioration of old sewers.

Rainfall derived inflow and infiltration	• The degree to which stormwater enters the network via illegal connections, manholes and other apertures. • Estimated using 20-years of historical rainfall data and total treatment plant flows for three scenarios (dry, average and wet). A percentage of total treatment flows was determined for each scenario and split by ETP and WTP.	• Growth is based on "A review of inflow and infiltration study methodologies for flow and concentration". • Assume a 12% uplift in rainfall derived inflow and infiltration between 2016 and 2051.
Balancing item		
Balancing item	• Comprises the remaining contributions to the sewer that have not been captured in the segments above.	• The balancing item is assumed to grow in-line with growth in the population.

Source: MW PS21 – Submission including supplement.

Review of growth factors and assumptions

MW's sewage forecasts for the period to 2030-31 are included in A.10 and A.11:

Table A.10: Sewage forecasts by parameter

	Volume			CAGR		
	History	**Forecast**	**Forecast**	**History**	**Forecast**	**Forecast**
	2018-19	**2025-26**	**2030-31**	**2010-11 to 2018-19**	**2018-19 to 2025-26**	**2018-19 to 2030-31**
Western Treatment Plant						
Flow (GL)	189.6	203.7	212.9	0.6%	1.0%	1.0%
TSS (kt)	71.1	81.4	86.7	0.7%	1.9%	1.7%
BOD (kt)	81.6	90.4	95.5	-1.3%	1.5%	1.3%
TKN (kt)	12.6	14.4	15.4	1.7%	1.9%	1.7%
iTDS (kt)	133.0	143.9	149.6	-0.6%	1.1%	1.0%
Eastern Treatment Plant						
Flow (GL)	128.0	132.6	137.6	-1.5%	0.5%	0.6%
TSS (kt)	57.9	63.3	67.1	3.5%	1.3%	1.2%
BOD (kt)	47.6	51.0	53.7	-0.3%	1.0%	1.0%
TKN (kt)	8.4	9.1	9.6	0.8%	1.1%	1.2%
iTDS (kt)	-	-	-	-	-	-

Source: MW PS21 – Submission including supplement.

Table A.11: Sewage forecasts by parameter by retail water company, CAGR 2018-19 to 2025-26

	Western Treatment Plant				Eastern Treatment Plant			
	City West Water	**South East Water**	**Yarra Valley Water**	**Total**	**City West Water**	**South East Water**	**Yarra Valley Water**	**Total**
Flow (GL)								
Residential	1.5%	1.2%	0.9%	1.2%	-	0.4%	0.5%	0.5%
Non-residential	0.6%	1.6%	2.3%	1.3%	-	1.0%	0.8%	0.9%
Inflow-infiltration	0.1%	0.0%	0.1%	0.1%	-	0.3%	0.3%	0.3%
Balancing	-	-	-	-	-	1.3%	1.4%	1.3%
Total	**1.2%**	**0.8%**	**0.9%**	**1.0%**	**-**	**0.5%**	**0.5%**	**0.5%**
BOD (kt)								
Residential	2.4%	2.1%	1.7%	2.1%	-	1.3%	1.4%	1.3%
Non-residential	0.5%	1.3%	0.3%	0.5%	-	0.4%	0.8%	0.4%
Inflow-infiltration	0.2%	0.2%	0.2%	0.2%	-	0.6%	0.6%	0.6%
Balancing	2.4%	2.1%	1.7%	2.1%	-	1.3%	1.4%	1.3%
Total	**1.6%**	**1.8%**	**1.2%**	**1.5%**	**-**	**0.9%**	**1.2%**	**1.0%**
TSS (kt)								
Residential	2.4%	2.1%	1.7%	2.1%	-	1.3%	1.4%	1.3%
Non-residential	1.0%	1.8%	1.9%	1.6%	-	1.6%	0.8%	1.3%
Inflow-infiltration	0.2%	0.2%	0.2%	0.2%	-	0.6%	0.6%	0.6%
Balancing	2.4%	2.1%	1.7%	2.1%	-	1.3%	1.4%	1.3%
Total	**2.1%**	**2.0%**	**1.7%**	**1.9%**	**-**	**1.3%**	**1.3%**	**1.3%**
TKN (kt)								
Residential	2.4%	2.1%	1.7%	2.1%	-	1.3%	1.4%	1.3%
Non-residential	0.6%	1.2%	1.4%	0.9%	-	-1.0%	0.9%	-0.5%
Inflow-infiltration	0.2%	0.2%	0.2%	0.2%	-	0.6%	0.6%	0.6%
Balancing	-	-	-	-	-	-	-	-
Total	**2.0%**	**2.0%**	**1.7%**	**1.9%**	**-**	**1.0%**	**1.3%**	**1.1%**
iTDS (kt)								
Residential	2.4%	2.1%	1.7%	2.1%	-	-	-	-
Non-residential	0.5%	1.5%	0.4%	0.5%	-	-	-	-
Inflow-infiltration	0.0%	0.0%	0.0%	0.0%	-	-	-	-
Balancing	2.4%	2.1%	1.7%	2.1%	-	-	-	-
Total	1.3%	0.8%	1.1%	1.1%	-	-	-	-

Source: MW PS21 – Submission including supplement.

Total Sewage Flow

Total sewage flow forecasts differ across retailers due to two underlying assumptions; the population growth rate for that catchment area and expected flows from category A (top) non-residential customers. Population drives forecast flows for residential customers (adjusted for a consistent reduction in volume per day over time), category B non-residential customers (adjusted for industry make-up), and the balancing item. All retailers used the same inflow infiltration assumption, albeit this differs across the two treatment plants.

The total volume of sewage flowing to the WTP is forecast to grow at a CAGR of 1.0% from 2018-19 to 2025-26, above the 0.6% CAGR from 2010-11 to 2018-19. The total volume of sewage flowing to the ETP is forecast to grow at a CAGR of 0.5% from 2018-19 to 2025-26, above the -1.5% CAGR from 2010-11 to 2018-19.

The faster rate of forecast growth for the WTP relative to the ETP is driven by different population growth. The population in the WTP catchment is forecast to grow at a CAGR of 2.0% from 2020-21 to 2025-26, compared to a 1.3% CAGR for the ETP over the same period.

MW and retail water companies have noted that they do not believe that the historical trend for the ETP represents a reasonable expectation for future sewage flows. In part this is due to heavy rainfall in 2011 that contributed to high levels of inflow and infiltration in 2010-11, thereby distorting the CAGR from 2010-11 to 2018-19.

Forecasts for the total volume of sewage through the ETP are consistent among each of the retail water companies. City West Water forecast a 1.2% CAGR in sewage through the WTP, compared to a 0.9% CAGR for Yarra Valley Water and a 0.8% CAGR for South East Water. This appears to be driven primarily by residential demand (underpinned by VIF (2019) population growth).

There is significant variation in the forecast CAGR for the volume of non-residential sewage through the WTP. This is driven predominantly by Category A (top) forecasts, which rely on input from key industry participants. Category A (group) forecasts are consistently zero across retailers, and Category B (group) forecasts differ slightly due to different population forecasts underpinning the retailers. In addition, Yarra Valley Water non-residential growth is impacted by a 7.7% forecast CAGR in sludge discharged to the WTP (over the period from 2018-19 to 2025-26).

MW has noted that sewage demand habits for the population as a whole have remained relatively constant from July 2020 to December 2020. Water retailers have reported to MW that waste flows and loads have not significantly changed in response to COVID-19 lockdowns, and remain within normal variability.

Total Suspended Solids

Similar to BOD and TKN, differences in TSS forecasts across retailers are due to different population forecasts and expected flows from category A (top) non-residential customers. All retailers used the same category A (group) assumption and inflow infiltration assumption, albeit the latter differs across the two treatment plants.

TSS loads are forecast to grow at a faster rate for the WTP (CAGR of 1.9% from 2018-19 to 2025-26) compared to the ETP (1.3%). This reflects faster forecast growth in population and residential demand for the WTP relative to the ETP.

Strong growth in South East Water's residential category for the ETP is driven by a one off 20% correction to category A (top) over 2018-19 to 2019-20. This is an observed figure and is an appropriate assumption to make.

The balancing item accounts for a relatively high proportion of TSS load. In 2018-19 the balancing item accounted for 31% of TSS load for the ETP and 18% for the WTP, with these shares forecast to remain relatively unchanged over the forecast period to 2025-26 and driven by population growth.

Biological Oxygen Demand

Similar to TSS and KN, differences in BOD forecasts across retailers are due different population forecasts and expected flows from category A (top) non-residential customers. All retailers used the same category A (group) assumption and inflow infiltration assumption, albeit the latter differs across the two treatment plants.

BOD loads are forecast to grow at a faster rate for the WTP (CAGR of 1.5% from 2018-19 to 2025-26) compared to the ETP (1.0%). This reflects faster forecast growth in population and residential demand for the WTP relative to the ETP.

Forecast of BOD loads is stronger than in history for both WTP (historical CAGR of -1.3% from 2010-11 to 2018-19) and ETP (historical CAGR of -0.3% from 2010-11 to 2018-19). While non-residential category A (top) loads are expected to fall across South East Water, City West Water and Yarra Valley Water, all other non-residential and residential loads are expected to grow substantially. This is driven by ongoing population growth across the catchment area. Without

further information on historical BOD loads by category, it is unclear if this assumption is appropriate.

Total Kjeldahl Nitrogen

Similar to BOD and TSS, differences in TKN forecasts across retailers are due different population forecasts and expected flows from category A (top) non-residential customers. All retailers used the same category A (group) assumption and inflow infiltration assumption, albeit the latter differs across the two treatment plants.

TKN loads are forecast to grow at a faster rate for the WTP (CAGR of 1.9% from 2018-19 to 2025-26) compared to the ETP (1.1%). This reflects faster forecast growth in population and residential demand for the WTP relative to the ETP, as well as more modest declines in non-residential demand.

The weak growth outlook for non-residential TKN at the ETP is driven by negative growth for South East Water's category A (top) loads (CAGR of -3.4% from 2018-19 to 2025-26). All three water retailers forecast declines in category A (top) loads at the WTP, but City West Water – which accounts for 82% of total load at the WTP – forecasts a -0.9% CAGR between 2018-19 and 2024-25. These assumptions have been made from customer level data.

Inorganic Total Dissolved Solids

iTDS loads are only forecast through WTP as no charges are levied for iTDS loads through ETP. These forecasts are driven predominantly by population forecasts for the catchment area and expected flows from category A (top) non-residential customers.

iTDS loads are forecast to grow at a faster rate than history, with a CAGR of 1.1% between 2018-19 to 2025-26 compared to a historic CAGR of -0.6% between 2010-11 and 2018-19. iTDS loads are driven by wet weather events, and the historical decline in loads may be due to a period of drought in Australia which has reduced wet weather events. Looking forward, the strong population growth rates for City West Water and Yarra Valley Water are driving the outlook for iTDS.

South East Water's relatively slower forecast growth rate is driven by its higher share of inflow infiltration, which is forecast to remain steady over the outlook.

Sewage demand queries identified by the ESC

The ESC has identified a number of sewage demand assumptions which might not be appropriate for use in demand forecasting given the impact of COVID-19. The ESC has also identified several growth rates which appear high. The table below includes Deloitte Access Economics' assessment on whether these assumptions and growth rates are considered reasonable.

Table A.12: Sewage demand queries identified by the ESC

ESC query	Deloitte Access Economics assessment	Reasonable / Unreasonable / Uncertain
Assumptions		
• **Non-residential - Category A - retail water companies assigned a zero-growth factor for both treatment plant catchments based on recent past actuals.**	• Category A is split into two cohorts. Category A (top) refers to single industrial customers that contribute more than 1% of a particular treatment plant's load for a parameter, while Category A (group) refers to all remaining customers. • Forecasts for category A (top) are informed by customer-level insights (e.g. one customer plans to install pre-treatment facilities that will reduce BOD and TKN), with overall growth to plateau over the forecast period to 2030-31. It is possible that plans, to the extent that they are costly to implement, may be delayed or cancelled following the impact of COVID-19 on industrial customers. It is suggested that these assumptions are re-visited by MW in this context. • Forecasts for category A (group) are assigned a zero-growth factor. MW has noted that this is due to recent historical data, but MW has not specified over what period this historical data refers to. As such, it is difficult to establish whether this is a long-running trend or whether forecast demand will more likely grow in-line with variables such as population growth.	• Uncertain
• **Non-residential – Category B – for 2016-17 to 2020-21 a mix of employment forecasts (25 industry groups) and population growth (all other industry groups) were applied. For 2021-22 to 2025-26 population growth forecasts were applied to all industry groups. A small number of industry groups (eight) were assigned zero growth because their growth was unrelated to population. Is it appropriate to use population growth, particularly for 2019-20 to 2021-22 considering the impacts of the coronavirus pandemic?**	• Sewage demand from category B – which represents the smallest industrial and commercial contributors– is most likely to be driven by employment in the respective industries rather than overall population growth in the relevant catchment region. For some industries, as identified by MW, sewage demand is likely to be unrelated to population growth. As such, it would be desirable to use employment forecasts rather than population as a driver. Further, as discussed above, the forecasts of population growth used are high and in need of revision.	• Unreasonable
• **Rainfall derived inflow and infiltration – growth is based on 'a review of inflow and infiltration study methodologies for flow and concentration' which concluded a 12% uplift in rainfall derived inflow and infiltration between 2016 and 2051.**	• MW has not provided further details on which studies were included in the review of inflow and infiltration methodologies.	• Uncertain
Growth rates		
• **Yarra Valley's non-residential compound annual growth rate of 2.3% in flow at WTP is driven by 7.7% annualised growth (2018-19 to 2025-26) in sludge discharged to WTP.**	• Yarra Valley Water's treatment plants discharge waste sludge back into the Melbourne network. The quantity (ML per year) of sludge at the WTP is forecast to grow by a CAGR of 7.7% from 2018-19 to 2025-26 at the WTP and 0.8% at the ETP. Forecasts are based on increases in flows at local treatment plants up to their capacity, with the	• Uncertain

	remaining sludge transferred to MW. Further details on the forecast capacity utilisation of Yarra Valley Water's local plants is not specified by MW.[76]	
• **Non-residential total suspended solids compound annual growth rate is 1.9% for Yarra Valley Water and 1.7% for South East Water at WTP.**	• Non-residential TSS at the WTP are forecast to grow at a CAGR of 1.9% for Yarra Valley Water, 1.8% for South East Water and 1.0% for City West Water. Growth in sludge load (7.7% CAGR from 2018-19 to 2025-26) is a key driver of non-residential growth for Yarra Valley Water. Yarra Valley Water forecasts a 0.3% CAGR in non-residential demand from category A (top) from 2018-19 to 2025-26, compared to a -0.4% CAGR for City West Water and a -0.5% CAGR for South East Water. This may be due to differences in customer-level insights, but MW has not explicitly noted this. • Each of the three retail water companies forecast zero growth in category A (group) from 2018-19 to 2024-25, while there are only minor differences in forecasts for category B (group).	• Uncertain
• **For total suspended solids and BOD at both ETP and WTP, no categories (residential, non-residential, balancing item, inflow) for each water business have negative compound annual growth rates.**	• MW forecast BOD to grow by a CAGR of 1.5% over the period from 2018-19 to 2025-26 at the WTP and 1.0% at the ETP. This is above the -1.3% CAGR from 2010-11 to 2018-19 at the WTP and -0.3% CAGR at the ETP. While historic figures using 2010-11 as the base year can be misleading for the purposes of making forecasts (due to very high inflows caused by rain in 2010, particularly at ETP, see Chart A.16), the forecast growth still appears unreasonably high particularly given likely population changes. Chart A.16 Comparison of historical sewage flow (ML) and forecast  Source: MW PS21 – Submission including supplement.	• Unreasonable

[76] Around 7% of the sewage that Yarra Valley Water collects is treated in one of nine small treatment plants that Yarra Valley Water owns and operates (located in outer areas where it is typically not economically feasible to transfer to the MW system).

	• MW forecasts TSS to grow by a CAGR of 1.9% over the period from 2018-19 to 2025-26 at the WTP and 1.3% at the ETP. This is above the 0.8% CAGR from 2010-11 to 2018-19 at the WTP and below the 3.5% CAGR at the ETP. Although forecast growth for both systems is lower than overall population growth, there is unreasonably strong growth in TSS balancing items for the WTP (all retailers). Forecast non-residential demand for South East Water at the ETP also appears high when compared to South East Water's residential demand forecasts and Yarra Valley Water's non-residential demand forecasts.	
• **For BOD, forecasts for both systems are higher than 2010-11 to 2017-18. 'Significant growth in the west is reflected in a relative increase in City West Water's BOD forecast' (price submission supplement, section 5.4.3). Between 2010-11 to 2018-19 BOD had a negative compound annual growth rate, but now a positive compound annual growth rate is forecast, why?**	• As noted above, historic growth rates which use 2010-11 as a base are distorted due to high rainfall in 2010. trends.	
• **For TKN, MW states 'higher forecasts for City West Water and South East Water mainly reflect a significant pick up in population growth which dominates this measure' (price submission supplement, section 5.4.3).**	• Residential sewage flows contribute the vast majority of TKN at both the WTP and ETP. As such, the faster rate of population growth in the western catchment regions for City West Water and South East Water (relative to Yarra Valley Water) is driving stronger growth in TKN at the WTP. This appears reasonable.	• Reasonable

Source: MW PS21 – Submission including supplement.

Water demand

Water demand refers to the volume of water supplied to households and businesses. MW's water demand forecasts underpin both expenditure (opex and capex) forecasts and tariff levels. Water demand forecasts are a function of the number of connections (residential, non-residential and non-revenue) as well as water usage per connection.

Forecasts for total water demand therefore depend on variables such as population growth and changes in water use patterns (such as the use of more efficient appliances, behavioural changes and trends in residential building types).

MW's forecasts of water demand are based on an aggregation of forecasts developed by retail water companies - City West Water, South East Water, Yarra Valley Water, Western Water and the four adjacent regional retail water companies.

Findings

Reasonableness and application of growth factors

Water demand forecasts produced by water retailers are driven by growth in the number of connections (based on forecast population growth) and water usage per connection. The population forecasts used were finalised prior to the outbreak of COVID-19 and are likely to overstate forecast water demand. As such, water demand forecasts are considered in need of revision.

The water demand forecasts also take into consideration other factors such as water efficiency, population density, and water loss in the system. Broadly, these assumptions are reasonable but there are inconsistencies in the application of growth factors across water retailers.

The residential usage per connection is forecast to decline at a much faster rate than history, in part driven by behaviour change campaigns in City West Water, Western Water and Yarra Valley Water. There is limited evidence to assess the reasonableness of this assumption in driving such high rates of decline in residential usage per connection.

Consistency of assumptions across forecasts

All retail water companies prepared their forecasts independently using integrated-supply demand planning (iSDP) models. While most water retailers' forecasts are underpinned by VIF (2019) forecasts, Western Water use VIF 2016, several providers use third-party forecasts for greater regional data, and smaller providers appear to make flat assumptions based on historical rates of population growth. This approach is likely to create internal inconsistencies for MW's total water demand forecast.

Each of the four main retail water companies forecast non-residential connections using a different approach. This creates further inconsistency in the approach used to forecast total water demand.

Water demand is also materially affected by variation in assumptions related to efficiency improvements. While it may be appropriate for usage per connection to vary based on region-specific factors such as behaviour change campaigns or metering, it is difficult to verify the appropriateness of said assumptions.

Comparison of assumptions and growth factors to other available forecasts

Water connection growth aligns with historical trends across the retailers and is in line with the population outlook underpinning the forecasts. The only exception is Western Water which is expecting much stronger connection growth going forward compared to other retailers. Currently Western Water only draws a portion of its water supply from the Melbourne system, but this may change with the merger of Western Water and City West Water in 2021.

The non-residential connection growth for Western Water is much stronger than both other retailers and history. This may be related to the expected recovery of Rosslynne Reservoir via seasonal transfers, but there is limited information on the details of the proposed plan.

Usage per residential connection is expected to fall at a faster rate than history across all retailers, except for South East Water In addition, South East Water usage per residential connection falls a

much slower rate than the other retailers. This appears at odds with historic patterns, which show South East Water usage per residential connection declining faster than other retailers.

Consideration and implementation of COVID-19 impacts
The water demand forecasts have not included any consideration for COVID-19 impacts. The slowdown in the rate of population growth due to COVID-19 is likely to have significant implications for the number of new connections and therefore water demand over coming years. It means that the water demand forecasts will be overstated, as will expenditure required to meet demand.

Overview of approach
MW's forecasts of water demand are based on an aggregation of forecasts developed by retail water companies - City West Water, South East Water, Yarra Valley Water, Western Water and the four adjacent regional retail water companies. Each retail water company's forecasts was prepared independently in December 2019, with Western Water providing revised forecasts in May 2020 to ensure consistency with assumptions used in its 2020 Price Submission and Corporate Plan.

City West Water, South East Water, Yarra Valley Water and Western Water all use an integrated-supply demand planning (iSDP) model with inputs taken from end use studies. Water demand forecasts are produced for residential, non-residential and non-revenue water. Residential water demand forecasts are driven by bottom-up models of water use as well as population and household numbers. This allows for the incorporation of assumptions around water use (e.g. showering frequency and duration) as well as efficiencies (e.g. adoption of more efficient appliances).

Non-residential and non-revenue water demand forecasts are driven using observed trends or relationships to factors such as residential demand or population. Non-revenue water demand is also adjusted for any future non-revenue water management activities.

The assumptions adopted by a particular retail water company in their iSDP model may vary from the assumptions adopted by another retail water company.

MW conducted a review of retail water companies forecasts in January 2020. This involved using a top-down linear regression model maintained by MW to forecast water demand based on expected population, household numbers and climate. These forecasts were then compared to retailer forecasts provided in December 2019. All retailer forecasts were higher than the median trend analysis projection estimated by MW, with both City West Water and South East Water forecasts sitting above the maximum trend projections estimated by MW.

The key assumptions for the four main retail water companies are outlined in the tables below.

Table A.13: Water demand forecast assumptions and approaches adopted by retailers

Category	Nature of key variables	Assumptions
Residential		
Number of connections	Existing number of connections	• Taken from retail billing system. Varies from the forecasts provided by retail water companies in their 2018 price submissions.
	Connection growth	• VIF (2019) data for population growth by region is mapped to the relevant area for retail water companies. • Internal retail water company data sources relating to construction and dwelling mix are considered in the finalisation of connection growth forecasts. • Western Water data is based on VIF2016/idPlacemaker 17 forecasts. Data has been adjusted for recent changes in customer numbers.
Usage per connection	Persons per connection	• Assumptions are made around the number of persons per household. This is based on VIF (2019) data. Retail water companies have made adjustments to this measure of population density based on insights on development activity within their regions.
	Water efficiency/behavioural change	• All retail water companies include an assumed increase in water efficiency over the forecast period. • City West Water and Yarra Valley Water assume 1% annual reduction in water use arising from behaviour change programs, while South East Water has not applied an efficiency factor. • Forecasts adopted exclude efficiencies relating to digital metering.
	Recycled water	• All retail water companies assume there is a substitution of potable water demand through the provision of recycled water. • The forecasts for water demand include assumptions on the growth in recycled water uptake by region.
	Outdoor water use	• The forecasts are based on an average of climate-related scenarios developed by retail water companies.
Non-residential		
Number of connections	Existing number of connections	• Taken from retail billing system. Varies from the forecasts provided by retail water companies in their 2018 price submissions.
	Connection growth	• Based on historical data or aligned with residential growth.
Usage per connection	Water efficiency/behavioural change	• Based on historical data or pegged to residential growth.
	Recycled water	• Same approach as residential.
	Outdoor water use	• Same approach as residential.
Non-revenue water		
Non-revenue water	-	• Rolling average percentages of the total residential and non-residential potable demands.

Source: MW PS21 – Submission including supplement.

Table A.14: Water demand forecast assumptions by water retailer

	City West Water	South East Water	Yarra Valley Water	Western Water	Barwon Water	South Gippsland Water	Westernport Water	Gippsland Water
Residential								
Connections (population / household growth)	VIF (2019)	VIF (2019) / Spatial Economics (for regional detail)	VIF (2019)	VIF 2016 / idPlacemaker 17 (for regional detail)	.idPlacemaker18 (Oct 2018)	VIF (2019). Assume a 1.5% annual increase in population.	VIF 2016. Assume a 1.2% annual increase in residential connections based on avg. from 2008-09 to 2015-16	Unknown
Persons per connection	As above (unclear if additional adjustments made)							
Water efficiency / behavioural change	Annual efficiency gains. Assume a fall in shower volumes due to behaviour change campaign and lower leakage from digital metering	Annual efficiency gains (toilets, showers and washing machines).	Efficiency trends in Urban Water Strategy assumed to continue. Assume a reduction in per capita usage due to behaviour change campaign.	Efficiency gains over time. Assume a reduction in per capita usage amid changing customer base (smaller blocks with lower consumption), appliance upgrades and behaviour change campaigns.	Efficiency gains over time.	Unknown	Unknown	No specific assumption of efficiency gains
Recycled water	Expected to increase (internal model based on historical data, end use studies and lot forecast on recycled water areas)	Forecasts based on asset planning data	Forecast based on historical usage and expected growth in mandated recycled water areas	Recycled water approx. 29% of total water usage with adjustments based on historical data. New growth areas limited to certain developments. No potable substitution.	Class A recycled water consumption assumed to be 6.85 ML/d (plant capacity)	None	Unknown	None
Outdoor water use	Derived in iSDP model. Exact assumptions unknown.	Unknown	Derived in iSDP model. Exact assumptions unknown.	Unknown	Unknown	Unknown	Unknown	Unknown
Non-residential								
Connections	Formula based on historical data	Growth is based on an avg. from 2012-13 to 2018-19	Pegged to residential growth forecast	Driven by growth in residential connections	Non-residential usage considered as a percentage of residential water use.	1.5% annual growth in non-residential demand	1.0% annual growth in non-residential demand	Unknown
Usage per connection		Growth is based on an avg. from 2012-13 to 2018-19 with a 0.25% annual efficiency gain						Unknown
Non-revenue water	Based on 10-year historical average	Rolling average of a percentage of total residential and non-residential demand	Method unknown. Assumed to fall due to impact of district meters	Percentage of bulk water demand and derived using historical data	Percentage of bulk water demand and derived using a 10-year historical avg.	Percentage of bulk water demand and derived using historical data	Percentage of bulk water demand	Unknown

Source: MW PS21 Water Sewage Demands – FINAL.

Review of growth factors and assumptions

The following section analyses the retail water companies' forecasts for the number of new connections as well as water usage per connection. The four largest retail water companies – City West Water, South East Water, Yarra Water and Western Water – account for the vast majority of water demand. As such, the analysis is limited to these providers.

Number of connections

Compared to 2015-16 to 2018-19, City West Water, South East Water and Yarra Valley Water forecast a decline in the rate of growth of residential and non-residential connections over the next two regulatory periods (to 2025-26 and 2030-31). Western Water forecasts a rise in the rate of growth of new connections from 2018-19 to 2025-26 compared to 2015-16 to 2018-19.

Table A.15: Number of connections

	% share of connections			CAGR		
	History 2018-19	**Forecast 2025-26**	**Forecast 2030-31**	**History 2015-16 to 2018-19**	**Forecast 2018-19 to 2025-26**	**Forecast 2018-19 to 2030-31**
Residential						
City West Water	20.2%	21.5%	21.9%	3.5%	2.9%	2.7%
South East Water	33.5%	32.2%	31.9%	2.3%	1.5%	1.5%
Yarra Valley Water	35.7%	35.3%	34.8%	2.4%	1.8%	1.7%
Western Water	3.0%	3.7%	4.2%	4.3%	5.0%	4.8%
Total residential	***92.4%***	***92.7%***	***92.8%***	***2.7%***	***2.1%***	***2.0%***
Non-residential						
City West Water	1.9%	1.8%	1.8%	1.6%	1.3%	1.3%
South East Water	2.8%	2.7%	2.6%	1.7%	1.0%	1.1%
Yarra Valley Water	2.7%	2.6%	2.6%	2.6%	1.8%	1.7%
Western Water	0.2%	0.2%	0.2%	1.6%	4.1%	4.3%
Total non-residential	***7.6%***	***7.3%***	***7.2%***	***2.0%***	***1.4%***	***1.4%***

Source: MW PS21 – Submission including supplement.

Among the large retail water companies City West Water forecasts the fastest growth in new residential connections at a CAGR of 2.9%, compared to more modest gains of 1.8% for Yarra Valley Water and 1.5% for South East Water.

Table A.16: Residential connections and population growth (CAGR)

	Connections			Population		
	History 2018-19	**Forecast 2025-26**	**Forecast 2030-31**	**History 2015-16 to 2018-19**	**Forecast 2018-19 to 2025-26**	**Forecast 2018-19 to 2030-31**
Residential						
City West Water	3.5%	2.9%	2.7%	3.5%	2.6%	2.4%
South East Water	2.3%	1.5%	1.5%	-	-	-
Yarra Valley Water	2.4%	1.8%	1.7%	2.0%	1.7%	1.6%
Western Water	4.3%	5.0%	4.8%	-	-	-
Total residential*	**2.7%**	**2.1%**	**2.0%**	**2.5%**	**2.0%**	**1.9%**

*total residential population growth refers to VIF (2019) forecast growth for Greater Melbourne.

Source: MW PS21 – Submission including supplement.

Each of the four main retail water companies forecast non-residential connections using a different approach. City West Water use historical data, South East Water use historical data from 2012-13 to 2018-19, Yarra Valley Water have pegged growth in non-residential connections to growth in

residential connections, and Western Water have used growth in residential connections as a driver of non-residential connections. There is some risk that this approach excludes changes in demand from large customers such as manufacturers, which is likely to be more correlated with economic activity than population growth (the key driver of residential demand).

Western Water has noted that the 10.5% CAGR in overall water demand (ML) from 2020-21 to 2024-25 is driven by upgraded transfer infrastructure enabling a greater volume of water supplied from the Melbourne system to northern towns and recovery of Rosslynne Reservoir. Once Rosslynne Reservoir has recovered to an acceptable level it is assumed that these transfers will reduce.

Usage per connection

Water usage per connection is measured as kilolitres per connection per year (kL/connection). Usage per residential connection has fallen for each of the four retail water companies, but the magnitude of these reductions has varied. Over the period from 2015-16 to 2018-19, there was a 1.3% CAGR fall in usage per connection among South East Water residential customers and a 0.5% CAGR fall among Yarra Valley Water residential customers. Similar trends are seen in non-residential usage per connection.

Table A.17: Usage per connection

	Usage (kL/connection)			CAGR		
	History	**Forecast**	**Forecast**	**History**	**Forecast**	**Forecast**
	2018-19	**2025-26**	**2030-31**	**2015-16 to 2018-19**	**2018-19 to 2025-26**	**2018-19 to 2030-31**
Residential						
City West Water	145.3	126.9	124.3	-1.0%	-1.9%	-1.3%
South East Water	148.5	143.5	138.3	-1.3%	-0.5%	-0.6%
Yarra Valley Water	154.8	140.4	135.0	-0.5%	-1.4%	-1.1%
Western Water	189.2	169.7	145.3	-0.7%	-1.5%	-2.2%
Total residential	151.6	139.5	134.1	-0.9%	-1.2%	-1.0%
Non-residential						
City West Water	1,030.4	935.9	886.3	-1.5%	-1.4%	-1.2%
South East Water	558.3	539.1	522.1	-0.8%	-0.5%	-0.6%
Yarra Valley Water	555.4	499.6	483.9	-0.6%	-1.5%	-1.1%
Western Water	759.0	682.4	551.4	5.0%	-1.5%	-2.6%
Total non-residential	681.7	628.3	600.1	-1.0%	-1.2%	-1.1%

Source: MW PS21 – Submission including supplement.

City West Water, Yarra Valley Water and Western Water all forecast an acceleration in the annual reduction in water usage per residential connection. City West Water assumes annual efficiency gains partly from a fall in shower volumes due to a behaviour change campaign and lower leakage from digital metering. Yarra Valley Water assumes the efficiency trends noted in the Urban Water Strategy to continue as well as a reduction in per capita use due to behaviour change campaigns. Western Water also assume efficiency gains over the forecast period and a reduction in per capital usage amid a changing customer base (smaller residential lots with lower consumption), appliance upgrades, and behaviour change campaigns. These rates of decline are very high when compared to history. While behaviour change campaigns have been cited across all three retailers, it is not clear that the campaigns can drive such high rates of decline in residential usage per connection.

South East Water forecasts a decline in the annual reduction in water usage per residential connection. South East Water has included efficiency gains related to toilets, showers and washing machines in its modelling. There is no specific mention of behaviour changes in reduced usage per residential connection. Overall, water usage per residential connection is set to fall at a CAGR of 0.6% from 2018-19 to 2030-31, only half the rate forecast by City West Water (-1.3%) and Yarra Valley Water (-1.1%).

This trend is mirrored in non-residential water usage per connection. City West Water forecasts non-residential usage per connection using a formula based on historical data, South East Water uses an average of historical data from 2012-13 to 2018-19 and include a 0.25% annual efficiency gain, Yarra Valley Water pegs growth in non-residential usage to growth in residential usage, and Western Water drives forecast non-residential usage per capita using forecast residential usage per connection.

Non-revenue water

Non-revenue water (NRW) is water that is lost before it reaches customers. Forecasts for NRW are driven by historical data or as a proportion of total bulk water demand.

Table A.18: Non-revenue water

	CAGR (ML)			Average (NRW as a share of total water)		
	History	**Forecast**	**Forecast**	**History**	**Forecast**	**Forecast**
	2015-16 to 2018-19	**2018-19 to 2025-26**	**2018-19 to 2030-31**	**2015-16 to 2018-19**	**2018-19 to 2025-26**	**2018-19 to 2030-31**
City West Water	-3.3%	-0.4%	-0.4%	10.6%	9.4%	8.9%
South East Water	3.8%	0.2%	0.5%	14.5%	14.7%	14.7%
Yarra Valley Water	-7.7%	1.7%	1.2%	11.4%	11.4%	11.1%
Total	*-1.9%*	*0.6%*	*0.6%*	*12.3%*	*12.1%*	*11.8%*

Source: MW PS21 – Submission including supplement.

Yarra Valley Water expects a modest improvement in NRW as a share of total water in the forecast period. This assumption is based on lower NRW due to district metering. The impact of metering is not expected to occur until the post 2025-26.

Neither City West Water nor South East Water have identified metering as a key driver for changes to NRW as a share of total water. But while South East Water expects NRW to remain at a relatively stable share of total water, City West Water expects a substantial decline. City West Water's forecast is based on a 10-year historical average growth in NRW, which at -0.4% is much weaker than other retailer outlooks.

Limitation of our work

General use restriction

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