OXFORD ECONOMICS

PARKES TOWN WATER SECURITY PROGRAM

LACHLAN PIPELINE DUPLICATION PROJECT – OPTIONS ASSESSMENT REPORT – FINAL

MARCH 2021

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

1. BACKGROUND AND OBJECTIVES

In July 2020, Parkes Shire Council (PSC) engaged BIS Oxford Economics Pty Ltd, in association with Anna Chau Enterprises (ACE) and George Stanley Consulting (GSC) Pty Ltd, to provide business case development and economic and financial appraisal services for the Parkes Town Water Security Program (PTWSP). Specifically, BIS Oxford Economics is required to develop a detailed business case for co-funding under the Safe and Secure Water Program (SSWP).

As described in the Request for Tender, the PTWSP is a series of strategic water infrastructure renewal initiatives intended to 'future proof' the Parkes Shire water supply to meet significant industrial and residential growth and a changing climate, whilst ensuring water extraction is sustainable and spread across a number of available sources.

Specifically, the PTWSP comprises three main components:

- The **Lachlan to Parkes Water Supply Duplication** will more than double the transfer capacity of the pipeline from the Lachlan River Pump Station (PS) to Parkes Water Treatment Plant (WTP)
- The **Lachlan Borefield Expansion** will expand the existing borefield to reduce the local concentration of the raw bore water draw from the existing aquifer
- The **CENTROC Water Grid Connection** will provide a new pipeline and supporting infrastructure linking three water utilities: Forbes Shire Council, PSC and Central Water Tablelands.

The subject of the current business case and this report is the **Lachlan Pipeline Duplication (LPD) Project**, which is a further refinement of the Lachlan to Parkes Water Supply Duplication project.

The SSWP is a $1 billion regional infrastructure co-funding program established in 2017 under the NSW Government's Restart NSW Fund. The SSWP will co-fund eligible water and sewerage projects in regional NSW through improvements to public health, water security, environmental outcomes and/or social benefits[1].

There are three phases of application for funding under the SSWP. On 21 May 2018, PSC was advised by the Department of Industry – Water[1] that its application for co-funding for the PTWSP (Phase 1) through the SSWP had been successful. Phase 2 of the SSWP application by PSC subsequently secured funding for the Phase 3 application which is the current business case for the LPD project. PSC's Phase 3 application is for funding design and

[1] NSW Government (Department of Planning, Industry and Environment) (2021), *Safe and Secure Water Program*, Retrieved from: *https://www.industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program* on 14 January.

construction, which requires a detailed business case in accordance with NSW Treasury guidelines.

The development of the business case involves the identification and assessment of options before the conduct of a cost-benefit analysis (CBA) to determine the preferred investment option(s). The process is commonly referred to as the 'shortlisting' of options for the CBA.

This document constitutes the final options identification and assessment report on the LPD project. It describes the process and results of options identification and assessment using multi-criteria analysis (MCA). This report forms an attachment to the business case submission and should be read in conjunction with the final business case report, which will utilise the Regional NSW business template.

2. THE PROBLEM, PROJECT OBJECTIVES AND PROJECT OVERVIEW

Problem Identification

As described in the brief, the project is driven by four key inter-related problems:

- Increasing demand
- Lower rainfall, including drought and climate change
- Supply restrictions
- Limited storage.

Project Objectives

At the outset, the PTWSP sought to address two key objectives:

- Enabling economic growth for the Parkes region
- Achieving drought security.

Both program objectives can be clearly linked to strategic goals at the state and local government levels, as well as regional goals based on plans for the CENTROC and Central West and Orana regions.

Given that the enabling of economic growth is directly linked to the availability and quality, more importantly, the reliability of water supply, the economic growth objective is effectively reflected in increasing water reliability. Therefore, the key objectives for the project have been refined to:

- **Water reliability** – This includes water availability and water quality, as well as allowing higher flows from the borefields and treatment of river water for use by the mine.
- **Drought security** – This reflects the need to increase water resilience and continuously improve water management to ongoing climatic changes and droughts.

Project Overview

The original scope for the Lachlan to Parkes Water Supply Duplication project was defined in the service brief as follows:

- Augmentation of the Eugowra Road and Back Yamma pump stations through additional reservoirs and pump stations
- Possible construction of a pre-treatment plant which enables reliable extraction of variable quality water from the Lachlan River
- Augmentation of the existing Lachlan River PS intake structure
- Duplication of the pipeline from the Lachlan River to Parkes WTP.

However, as the process of the option identification and assessment proceeded, it became clear that some elements of the above definition should be in the 'do-minimum' base case, hence the subject of the business case is the duplication of the pipeline from the Lachlan River to Parkes WTP and augmentation of pump stations through additional reservoirs and pumps.

3. MULTI-CRITERIA ANALYSIS

Approach

As required by the brief, project options were identified and assessed using MCA for this project. It is also worth noting that, given the very tight timeframes, it was not possible to conduct an initial or rapid CBA of the options to short list them. A quantitative MCA is a structured evidence-based assessment process commonly used to systematically short list a long list of options to be taken forward to the CBA.

A MCA entails identifying pre-defined criteria, assigning weights to them, and then scoring the options, programs or projects on how well they perform against each weighted criterion.[2] In the case of a project such as the LPD, the sum of weighted scores can be used to rank the alternative options.

Project Objectives and Assessment Criteria

The identification of assessment criteria is driven by the objectives of the project. At the outset, the objectives of the project were identified as follows:

- Enabling economic growth (via water reliability)
- Achieving drought security.

In order to develop a set of relevant assessment criteria, we considered the impacts covered in a full social cost-benefit analysis, which is the economic analysis undertaken of the options. These are typically categorised as:

- Economic
- Social

[2] NSW Government (Treasury) (2017), p.67.

- Environmental.

By the end of the pre-MCA workshop, six criteria were identified to be relevant assessment criteria for the LPD project:

- Water reliability
- Drought security
- Financial considerations
- Environmental sustainability
- Stakeholder needs
- Delivery and safety.

At the end of the pre-MCA workshop, the above list of criteria was discussed for confirmation. The majority of the identified criteria were accepted for assessment in the MCA.

However, the attendees asked for the following changes:

- The Financial criterion be renamed “Affordability” to better reflect the constraints on the capital and operating costs of the options
- The Environmental Sustainability criterion be renamed “Ecological Footprint” to better reflect the broader aspects of the expected and potential ecological impacts of the LPD project (e.g. on creek crossings and box gum communities).

The weightings for the assessment criteria were derived using pairwise comparison by the attendees at Workshop No.2.

- The final six assessment criteria and their weightings were as follows:Water reliability – 25%
- Drought security – 25%
- Affordability – 3%
- Ecological footprint – 39%
- Stakeholder needs -0%
- Delivery and safety – 8%.

Together, water reliability and drought mitigation make up 50% of the weightings, while ecological footprint constitutes almost 40% of the weightings. On the whole, the derived weightings in the above table were unsurprising, given the joint importance of water reliability and drought mitigation to Parkes and the surrounding area, and the impact of water supply on the environment in terms of the infrastructure’s overall ecological footprint.

Interestingly, the criterion for meeting stakeholder needs was assigned a zero weighting by the forum, which suggests that stakeholders had already been accounting for their needs through the other criteria, particularly given that the

objectives for the project - water reliability and drought mitigation - make up half of the weightings. This was explicitly discussed at the MCA workshop and attendees in the forum confirmed that they thought all the other assessment criteria, but in particular, water reliability, drought security and ecological footprint, sufficiently addressed the criterion of stakeholder needs. In fact, the workshop attendees were asked to vote on this issue to get a clear agreement on the weighting for the stakeholder needs criterion. Therefore, it was unanimously agreed that the weightings derived should be accepted. Furthermore, the forum was confident that the equal weighting of 16.67% in the equally weighted scenario sufficiently tested the outcomes of the MCA if stakeholder needs were assigned a non-zero weighting.

4. LONG LIST OF OPTIONS

Definition of the Base Case

INSW confirmed that the do-minimum base case should assume the future demand from the Parkes SAP as it is a state-funded commitment. Therefore, options to increase water availability and reliability and to increase the pump and pipeline transfer infrastructure without a full duplication were considered.

The “do-minimum” base case for the LPD project is defined as follows:

- The existing network and budgeted maintenance and repairs
- The Lachlan River pre-treatment plant
- The increase in the Lachlan River offtake
- Additional pumps to increase the transfer capacity of the DICL pipeline.

Long List of Options

GHD, in conjunction with PSC, developed a number of route alignment options for the LPD project based on the following key requirements and constraints:

- A central case demand scenario of 500l/s
- An affordability constraint of $55 million in capital costs for the LPD project.

Based on the existing information and the preliminary analysis undertaken by GHD (2020), the long list of options was identified as follows:

- Option 1 – the Purple route – parallel to the existing alignment
- Option 2 – the Yellow route – via private property / Akuna Road / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street
- Option 3 – the Orange route – via Nash Street / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street
- Option 4 – the Blue route – Ashburnham Road / Road Reserve / Akuna Road / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street.

All of the pipeline options have been designed to supply water at a rate of 200-330l/s in addition to the current 240l/s and were considered to sufficiently meet the criterion of drought security. The pipeline in all four options will be using HDD for trenching. Furthermore, all options will have a delivery timescale of 12-18 months. Finally, all the stakeholders in the MCA workshop agreed that the other criteria had already captured their stakeholder needs (particularly the water reliability and drought security criteria).

Results of the MCA

The following figure shows the raw scores of the options against each criterion and the aggregated raw scores and the aggregated weighted scores for each option.

Fig 0-1: Summary of the MCA scores

Criteria	Equal Weightings	Preferred Weightings	Option 1 - Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
1. Water Reliability	17%	25%	7	8	10	7
2. Drought Security	17%	25%	8	8	8	8
3. Affordability	17%	3%	4	7	8	5
4. Ecological Footprint	17%	39%	5	7	8	4
5. Stakeholder Needs	17%	0%	7	8	7	7
6. Delivery & Safety	17%	8%	2	7	8	5
Total Raw Scores (out of 60)			33	45	49	36
Unweighted/Equally Weighted Scenario (out of 10)			5.5	7.5	8.2	6.0
Ranking			4	2	1	3
Weighted Scenario (out of 10)			6.0	7.5	8.5	5.9
Ranking			3	2	1	4

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Lachlan [Pipeline] Duplication Project – Options Identification and Assessment Workshop No.3 (Amended)*, 09 December, p.20.'

In a MCA, the results for an unweighted criteria scenario are estimated by totalling the raw scores. In this MCA, the sum of the raw scores is out of 60, as shown above.

However, when the unweighted score is then compared with a weighted criteria scenario, the raw scores for each criterion are applied an equal weighting. With six criteria, the equal weighting for each criterion is 16.67% (based on 100 divided by 6). The following sub-sections present the weighted calculations for both the assessment scenarios.

Unweighted/Equally weighted Scenario

The following table shows the raw and weighted scores by criteria and total scores for each option in the equally weighted scenario.

Table 0-1: Results of the MCA – Equally Weighted Criteria Scenario

Criteria	Weights	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
		Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score
1. Water reliability	16.67%	7	1.17	8	1.33	10	1.67	7	1.17
2. Drought security	16.67%	8	1.33	8	1.33	8	1.33	8	1.33
3. Affordability	16.67%	4	0.67	7	1.17	8	1.33	5	0.83
4. Ecological footprint	16.67%	5	0.83	7	1.17	8	1.33	4	0.67
5. Stakeholder needs	16.67%	7	1.17	8	1.33	7	1.17	7	1.17
6. Delivery & safety	16.67%	2	0.33	7	1.17	8	1.33	5	0.83
Total	100.00%	**33**	**5.50**	**45**	**7.50**	**49**	**8.17**	**36**	**6.00**
Ranking		**4**	**4**	**2**	**2**	**1**	**1**	**3**	**3**

The raw scores given by the workshop participants were applied the equal weightings of 16.67% to generate the following total weighted scores for the options:

- Option 1 – the Purple route – 5.5
- Option 2 – the Yellow route – 7.5
- Option 3 – the Orange route – 8.2
- Option 4 – the Blue route – 6.0.

Based on the equally weighted scores, Option 3 (the Orange route) is clearly the first ranked option with a total score of 8.2 out of 10, followed by Option 2 (the Yellow route) with a score of 7.5.

There is some margin separating the first and second ranked options from the last two ranked options, with Option 1 (the Purple route) being the lowest ranked option with a score of 5.5 out of 10.

Weighted Scenario

The following table shows the raw and weighted scores by criteria and total scores for each option in the weighted scenario.

Table 0-2: Results of the MCA – Weighted Criteria Scenario

Criteria	Weights	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
		Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score
1. Water reliability	25.00%	7	1.75	8	2.00	10	2.50	7	1.75
2. Drought security	25.00%	8	2.00	8	2.00	8	2.00	8	2.00
3. Affordability	2.68%	4	0.11	7	0.19	8	0.21	5	0.13
4. Ecological footprint	39.29%	5	1.96	7	2.75	8	3.14	4	1.57
5. Stakeholder needs	0.00%	7	0.00	8	0.00	7	0.00	7	0.00
6. Delivery & safety	8.04%	2	0.16	7	0.56	8	0.64	5	0.40
Total	100.00%	**33**	**5.98**	**45**	**7.50**	**49**	**8.50**	**36**	**5.86**
Ranking		**3**	**3**	**2**	**2**	**1**	**1**	**4**	**4**

The raw scores given by the workshop participants were applied the specific weightings derived jointly by the workshop forum to generate the following total weighted scores for the options:

- Option 1 – the Purple route – 6.0
- Option 2 – the Yellow route – 7.5
- Option 3 – the Orange route – 8.5
- Option 4 – the Blue route – 5.9.

Based on the weighted scores, Option 3 (the Orange route) is clearly the first ranked option with a total score of 8.5 out of 10, followed by Option 2 (the Yellow route) with a score of 7.5.

Again, there is some margin separating the first and second ranked options from the last two ranked options. However, under a weighted criteria scenario, the last two options were much closer in scores, with Option 1 (the Purple route) and Option 4 (the Blue route) scoring 6.0 and 5.9 respectively. Option 1 performs marginally better than Option 4, and hence the 3rd and 4th rankings are switched from those in the equally weighted criteria scenario.

Comparison of assessment scenarios

The following table directly compares the equally weighted scores with the weighted scores by option.

Table 0-3: Results of the MCA – Comparison of assessment scenarios

Criteria	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score
1. Water reliability	1.17	1.75	1.33	2.00	1.67	2.50	1.17	1.75
2. Drought security	1.33	2.00	1.33	2.00	1.33	2.00	1.33	2.00
3. Affordability	0.67	0.11	1.17	0.19	1.33	0.21	0.83	0.13
4. Ecological footprint	0.83	1.96	1.17	2.75	1.33	3.14	0.67	1.57
5. Stakeholder needs	1.17	0.00	1.33	0.00	1.17	0.00	1.17	0.00
6. Delivery & safety	0.33	0.16	1.17	0.56	1.33	0.64	0.83	0.40
Total	**5.50**	**5.98**	**7.50**	**7.50**	**8.17**	**8.50**	**6.00**	**5.86**
Ranking	**4**	**3**	**2**	**2**	**1**	**1**	**3**	**4**

The following points emerged from the above table:

- In both the equally weighted and weighted criteria scenarios, Option 3 (the Orange route) is clearly the best performing option amongst the four options. It returned the highest score for every criterion in the MCA. The option performed particularly well against the criteria of water reliability, drought security and ecological footprint. The scores in both assessment

scenarios were high and were close to each other. In the weighted scenario, Option 3 recorded a strong total score of 8.5 out of 10.

- The second best performing option in both assessment scenarios was Option 2 (the Yellow route). It also consistently performed well against the criteria of water reliability, drought security and ecological footprint. Option 2 recorded the second highest score for every criterion. The total scores for Options 2 under both scenarios were the same at 7.5.
- It is clear that Options 3 and 2 consistently performed better than Options 1 and 4 in both assessment scenarios and by a reasonably clear margin. The consistent performance of Options 3 and 2 was sufficient to eliminate the need for further sensitivity testing of the weights.
- The scores for Option 1 (the Purple route) were very close under both assessment scenarios: 5.5 for the equally weighted scenario and 6.0 for the weighted scenario.
- Similarly, the scores for Option 4 (the Blue route) were very close under both assessment scenarios: 6.0 for the equally weighted scenario and 5.9 for the weighted scenario.
- However, despite the similar scores for Options 1 and Option 4 in both assessment scenarios, the weightings did lead to a slightly different ranking of Options 1 and Option 4. In the weighted scenario, Option 1 moved marginally ahead of Option 4, which became the lowest ranking option.
- The range of scores in both scenarios was around 2.7 out of 10, which allowed sufficient differentiation between the options. The scores were slightly higher for the weighted criteria scenario, where the total scores were increased by 0.5 for Option 3, the preferred option. Option 1 also saw its score increase by around 0.5 but was still only ranked the third best option.

The results of the MCA indicate that the highest-ranking options in both assessment scenarios are as follows:

1. Option 3 – the Orange route
2. Option 2 – the Yellow route.

5. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

A long list of four options for the LPD project was subject to a quantitative MCA.

Despite significant differences in weightings between the unweighted/equally weighted criteria scenario and the weighted criteria scenario, the options were ranked very similarly under both assessment scenarios.

Under the weighted scenario, which should be accorded precedence, the options were ranked as follows:

1. Option 3 – the Orange route

2. Option 2 – the Yellow route

3. Option 1 – the Purple route

4. Option 4 – the Blue route.

On the other hand, under the unweighted or equally weighted scenario, the options were ranked as follows:

1. Option 3 – the Orange route

2. Option 2 – the Yellow route

3. Option 4 – the Blue route

4. Option 1 – the Purple route.

On the basis of the MCA conducted, Option 3 (the Orange route) was the highest ranking option. A final review of compliance considerations by the workshop participants validated Option 3 as the preferred option for the CBA.

In summary, Option 3 has a number of significant advantages in its design, subject to the completion of discussions with landowners of private properties.

Recommendations

It is recommended that PSC take forward Option 3 (the Orange route) to be compared against the do-minimum base case in the CBA as part of the FBC of the LPD project.

1. INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

In July 2020, Parkes Shire Council (PSC) engaged BIS Oxford Economics Pty Ltd, in association with Anna Chau Enterprises (ACE) and George Stanley Consulting (GSC) Pty Ltd, to provide business case development and economic and financial appraisal services for the Parkes Town Water Security Program (PTWSP). Specifically, BIS Oxford Economics is required to develop a detailed business case for co-funding under the Safe and Secure Water Program (SSWP).

As described in the Request for Tender, the PTWSP is a series of strategic water infrastructure renewal initiatives intended to 'future proof' the Parkes Shire water supply to meet significant industrial and residential growth and a changing climate, whilst ensuring water extraction is sustainable and spread across a number of available sources.

Specifically, the PTWSP comprises three main components:

- The **Lachlan to Parkes Water Supply Duplication** will more than double the transfer capacity of the pipeline from the Lachlan River Pump Station (PS) to Parkes Water Treatment Plant (WTP)
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[3] NSW Government (Department of Planning, Industry and Environment) (2021), *Safe and Secure Water Program*, Retrieved from: *https://www.industry.nsw.gov.au/water/plans-programs/infrastructure-programs/safe-and-secure-water-program* on 14 January.

construction, which requires a detailed business case in accordance with NSW Treasury guidelines.

The development of the business case involves the identification and assessment of options before the conduct of a cost-benefit analysis (CBA) to determine the preferred investment option(s). The process is commonly referred to as the 'shortlisting' of options for the CBA.

This document constitutes the final options identification and assessment report on the LPD project. It describes the process and results of options identification and assessment using multi-criteria analysis (MCA). This report forms an attachment to the business case submission and should be read in conjunction with the final business case report, which will utilise the Regional NSW business template.

1.2 METHOD OF APPROACH AND DATA SOURCES

In accordance with NSW Treasury guidelines[4], the development of a business case needs to consider a range of alternative approaches to achieve the business case objectives.

As required by the brief, project options were identified and assessed using MCA for this project. It is also worth noting that, given the very tight timeframes, it was not possible to conduct an initial or rapid CBA of the options to short list them. A quantitative MCA is a structured evidence-based assessment process commonly used to systematically short list a long list of options to be taken forward to the CBA.

A MCA entails identifying pre-defined criteria, assigning weights to them, and then scoring the options, programs or projects on how well they perform against each weighted criterion.[5] In the case of a project such as the LPD, the sum of weighted scores can be used to rank the alternative options.

The data sources consulted for this options report included the following:

- GHD for Parkes Shire Council (2020), *Lachlan Pipeline Duplication Engineering Design Preliminary Constraints*, 16 November
- PSC (2020), *Parkes Town Water Security Program Business Case Development Technical Support Services, Request for Tender #PSC2020/015*
- PSC (2020), *Information from the Water and Sewerage Operations Team*, 17 December
- BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Parkes Town Water Security Program - Workshop No.1*, 24 September.
- BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Parkes Town Water Security Program – Options Identification & Assessment Workshop No.2*, 7 October.

[4] NSW Government (Treasury) (2018), *Business Case Guidelines (TPP18-06)*, August, p.18.
[5] NSW Government (Treasury) (2017), p.67.

- BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Lachlan [Pipeline] Duplication Project – Options Identification and Assessment Workshop No.3*, 9 December.
- Eco Logical Australia for Parkes Shire Council (2021), *Lachlan to Parkes Water Duplication – Scoping Study: Preliminary Environmental Assessment*, 16 March.

1.3 STRUCTURE OF THE REPORT

The remainder of the report is structured as follows:

- Chapter 2 identifies the problem and the project objectives, outlines the policy framework and provides an overview of the project
- Chapter 3 describes the approach to the options identification and assessment process using MCA, including the relationship between project objectives and assessment criteria and the derivation of weights for the assessment criteria
- Chapter 4 describes the long list of options (including the base case) and the MCA of those options, and provides the results of the MCA under different scenarios
- Chapter 5 presents the conclusions drawn and makes recommendations for next steps in the business case
- Appendices A and B contain the MCA workshop attendees lists and the workshop slides respectively.

2. THE PROBLEM, PROJECT OBJECTIVES, POLICY FRAMEWORK AND PROJECT OVERVIEW

2.1 INTRODUCTION

This chapter identifies the problem(s) that the proposed project will solve or overcome and hence identifies the need for the project. It will also identify the stated objectives of the project and summarise the policy framework guiding the development of the project. Finally, this chapter will provide an overview of the project in terms of a high level scope.

2.2 PROBLEM IDENTIFICATION

Parkes Shire is located in Central West NSW, 360km west of Sydney and covers a total area of 5,919km^2. The Shire's four largest towns are Parkes (population 12,096), Peak Hill (1,150), Trundle (666) and Tullamore (373). The urban centre of Parkes is located on the Newell Highway linking Melbourne and Brisbane, and the transcontinental railway connecting Sydney to Perth.[6]

Furthermore, the Shire sits within the catchments of two main river systems, the Bogan and the Lachlan rivers, which are tributaries of the Murray-Darling System. PSC is responsible for the Parkes/Peak Hill Water Supply System, which supplies the towns of Parkes and Peak Hill, as well as the villages of Alectown and Cookamidgera.[7]

As described in the brief, the project is driven by four key inter-related problems:

- Increasing demand
- Lower rainfall, including drought and climate change
- Supply restrictions
- Limited storage.

2.2.1 Increasing demand

The main sources of current and future demand in Parkes[8] are as follows:

- **The townships of Parkes and Peak Hill** – The towns are currently supplied by the Parkes WTP, which can supply up to 16ML/day. Even

[6] PSC (2020), p6.
[7] PSC (2020), p.6.
[8] PSC (2020), p.14.

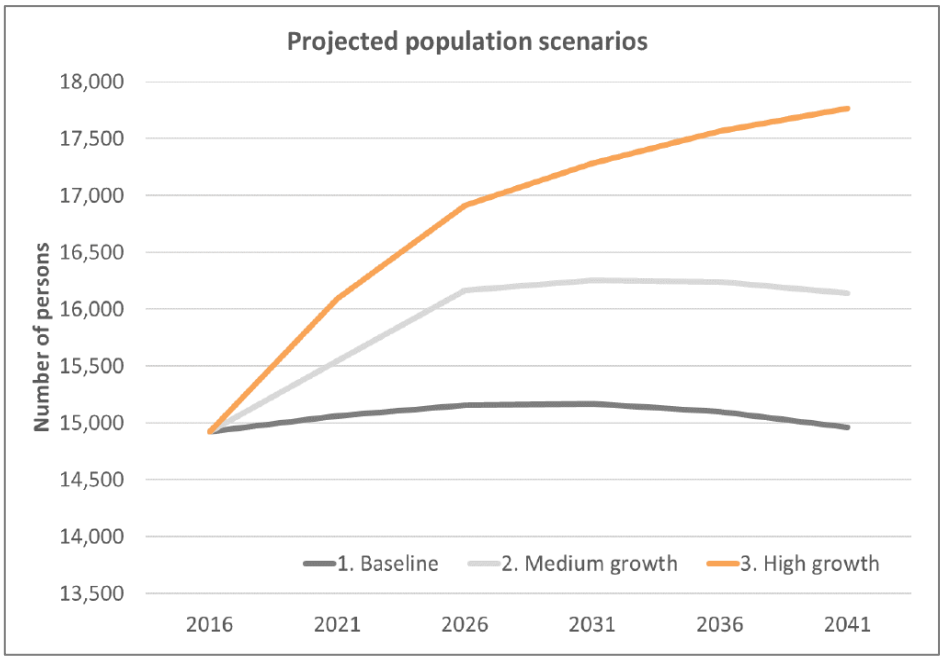
though the typical urban water demand averages 7ML/day, the WTP has reached capacity during peak water demand.

- **Northparkes Mine (NPM)** – The mine currently draws 6.5ML/day. However, planned expansion will increase water demand to 10ML/day for the life of the mine (up to 2050). PSC has metered bulk supply contracts for raw water to NPM.
- **Parkes Special Activation Precinct (SAP)** – The Precinct includes the National Logistics Hub and seeks to take advantage of Parkes position at the junction of the Inland Rail and the east-west rail routes, as well as good access to the Newell Highway. The SAP is expected to increase demand by up to 16ML/day by 2040, with additional increased demand from site workers and support industries in the Parkes township expected to increase the Parkes urban peak water demand to around 20ML/day.
- **Additional mining exploration** – New mining activity in the region has the potential to further increase demand for water, but specific requirements are not yet known.

Reflecting the development of the SAP, the Parkes region is expected to experience fairly high population and employment growth over the next 20 years. Using 2016 as a base, the Local Strategic Planning Statement (LSPS) released in 2020 assumes a population growth of 0.25% for a low development scenario, 8% for a medium scenario and 19% for a high scenario.

The following figure illustrates the population growth under the three scenarios identified.

Fig. 1. Projected population scenarios



Source: Astrolabe for PSC (2020)

The wide variation in the projected growth scenarios reflects the uncertainty around the scale and timeframe for development of the SAP and how this will impact on employment and population growth in the Parkes LGA, both directly and indirectly through multiplier impacts.

Technical studies used to provide an evidence base for the Parkes SAP Structure Plan similarly considered low, medium and high development scenarios:

- An infrastructure analysis undertaken by Aurecon[9] projected water demand under a low, medium and high development scenario, with total potable water demand ranging from 13.5ML/day to 71ML/day. It was assumed some water supply was generated within the SAP, including rainwater, harvested stormwater and recycled water, with the residual supply requirements estimated at between 0ML/day and 42ML/day. All three scenarios assumed population growth in Parkes and surrounding townships of just 0.4% between 2016 and 2046 and therefore did not consider multiplier impacts.
- The Structure Plan for the SAP includes a final design for 4,840ha comprising a mix of freight and logistics, resources and recycling, and agribusiness uses. Aurecon estimated that the ultimate potable water demand for the final design (i.e. with all 4,840ha developed as per the defined uses) would be 19ML/day (excluding green infrastructure), with potential for up to 22ML/day of supply onsite.
- SGS Economics[10] prepared an employment assessment for the final design which considered low, medium, and high development growth scenarios. The associated number of jobs, by 2041, ranged from around 1,000 to 3,000 created directly at the SAP, with a similar range for jobs created indirectly, either through supporting activity at the SAP or supporting an associated increase in the residential population of Parkes LGA. (For comparison, at Census 2016 there were approximately 5,400 jobs in the Parkes LGA).

Since these technical studies were produced, PSC has held discussions with the Department of Regional NSW which has indicated that the planned transfer capacity onsite for water accessed from PSC would be 200L/s. This has therefore been taken as an upper bound for the SAP's requirements.

PSC is currently in the process of updating its IWCM Strategy, which will include projections for future demand. Given the uncertainty around demand related to the SAP, total demand for water by the mid-2050s is assumed to range from a low scenario of 400l/s to a high of 600l/s, with a central case demand scenario assumed to be **500l/s** based on the following flow rate requirements:

[9] Aurecon for NSW Department of Planning and Environment (June 2019), Parkes Special Activation Precinct: Infrastructure and Transport Evaluation Report, Revision: 4

[10] SGS Economics for NSW Department of Planning and Environment (August 2019), Parkes Special Activation Precinct: Economic and industry analysis, Final report

- PSC – 225l/s (peak demand)
- SAP – 125l/s
- NPM – 150l/s (peak demand, average demand estimated at 120l/s)

These demand assumptions underpin the options assessment process, with the capacity to supply 500l/s being considered a minimum requirement for a project option.

The following table provides a more detailed breakdown of the assumptions for total demand over a 30 year horizon.

Fig. 2. Projected water demand

Daily ML/day	2016	2020	2030	2040	2050
Town (high scenario)	6.85	6.93	8.28	9.53	10.41
Town (medium scenario)	6.85	6.92	7.11	7.25	7.40
Town (low scenario)	6.85	6.86	6.99	7.13	7.26
SAP demand	0	0.82	4.11	16.59	16.59
NPM	5.48	10.96	10.96	10.96	10.96

L/s	2016	2020	2030	2040	2050
Town (high scenario)	79	80	96	110	120
Town (medium scenario)	79	80	82	84	86
Town (low scenario)	79	79	81	83	84
SAP demand	0	10	48	192	192
NPM	63	127	127	127	127
Total (high)	**143**	**217**	**270**	**429**	**439**
Total (high, peak)	**180**	**262**	**343**	**537**	**563**

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Parkes Town Water Security Program - Workshop No.1*, 24 September, p.9.

2.2.2 Lower rainfall

Parkes has recently emerged from a period of intense drought, spanning over 24 months.[11] In 2019, rainfall in Parkes was 229.8mm, which was well below the yearly average of 610.3mm. During the peak of the drought, the capacity of the Lake Endeavour Dam dropped to 17% with continued water losses due to evaporation and seepage.[12]

In a worst case scenario where the raw water supply is interrupted, Parkes' existing capacity to store water can only meet demand for 48 hours.

2.2.3 Supply restrictions

According to the brief, PSC currently provides water supply services through two separate schemes[13]:

[11] PSC (2020), p.14.
[12] PSC (2020), p.14.
[13] PSC (2020), p7.

- The Parkes/Peak Hill/Northparkes Mine Water Supply Scheme
- The Forbes to Tottenham Water Supply Scheme.

The raw water for the Parkes/Peak Hill water supply is drawn from three sources but all have some form of supply restriction:

- Lake Endeavour and Beargamil dams – Raw water from Lake Endeavour and Beargamil dams provides a gravity feed to the Parkes WTP at a maximum flow rate of 7ML/day. However, with 70% of the lake capacity reserved for recreational use and as a contingency for firefighting and emergency use, this source is not reliable.
- Lachlan River intake – Extraction from the Lachlan River can be reduced or unavailable due to poor water quality or low flows, and by reductions to the general security allowance during drought. In addition, occasional blue-green algae blooms can also restrict the ability to source water.
- Lachlan River borefield – This can be affected by falling water levels during times of inadequate natural recharge coupled with increased drawdowns, resulting in access limitations if the bores are not sunk deep enough to access the water.

It should be noted that NPM owns three of the existing eight bores, including associated water allocations. PSC supplies raw water to NPM. Water pumped from the river is supplied directly to NPM. Together, the Lachlan River and Lachlan Borefield can supply up to 17ML/day.

PSC operates two raw water pipelines from the Lachlan River and borefield to the WTP, with one conveying bore water and the other conveying river water. Each pipe has a capacity of 10ML/day. The WTP was designed to treat mixed water (i.e. dam water, bore water and river water), ensuring capacity could be reached by diversifying supply.

2.2.4 Storage limitations

PSC has limited water storage for contingency provision if supply is interrupted. The availability of raw water supply may be impacted by[14]:

- Prolonged drought affecting river flow – restricting the Parkes offtake
- Increased aquifer demand – affecting the available drawdown
- Pump/power failure – disrupting raw water transfer

2.2.5 Summary

As outlined above, the infrastructure problem has root causes in both supply and demand factors, which requires government intervention such as capital investment. The symptoms of the infrastructure problem are clearly evident during peak usage times and are likely to continue given constraints in supply and storage.

[14] PSC (2020), p.8.

At this stage, the cost of the problem has not yet been quantified but the qualitative analysis above clearly indicates that the scale of the problem cannot be ignored given the expected growth in demand in the region and the ongoing threat to supply from climate change and projected periods of drought[15].

2.3 PROJECT OBJECTIVES

The development of objectives for the project has been an iterative process.

At the outset, the PTWSP sought to address two key objectives:

- Enabling economic growth for the Parkes region
- Achieving drought security.

Both program objectives can be clearly linked to strategic goals at the state and local government levels, as well as regional goals based on plans for the CENTROC and Central West and Orana regions.

Given that the enabling of economic growth is directly linked to the availability and quality, more importantly, the reliability of water supply, the economic growth objective is effectively reflected in increasing water reliability. Therefore, the key objectives for the project have been refined to:

- **Water reliability** – This includes water availability and water quality, as well as allowing higher flows from the borefields and treatment of river water for use by the mine.
- **Drought security** – This reflects the need to increase water resilience and continuously improve water management to ongoing climatic changes and droughts.

Other relevant project objectives identified during the development of the business case reflect the economic, social and environmental impacts of the project. These are discussed in Section 4.

2.4 STRATEGIC ALIGNMENT OF THE PROJECT

The development of the PTWSP and the LPD project is guided by a broad policy framework operating at all three levels of government.

The following table summarises the current policy framework of key relevant policies, strategies, and funding programs by their respective government agencies.

[15] https://www.climatechangeinaustralia.gov.au/en/climate-projections

Fig. 3. Policy Framework for the LPD project

Level of Government	Government Agency	Relevant policies, strategies and funding programs
Federal	Infrastructure Australia	Australian Infrastructure Plan (2016)
	Infrastructure Australia	Australian Infrastructure Audit (2019)
	Department of Infrastructure, Transport, Regional Development and Communications (DITRDC), **and** Department of Industry, Science, Energy and Resources (DISER)	Building Better Regions Fund (Round 5)
	Department of Agriculture	National Water Policy (2012)
State (NSW)	Premier of NSW	Premier's Priorities
	Infrastructure NSW	NSW State Infrastructure Strategy 2018–2038.
	Department of Premier & Cabinet	Snowy Hydro Legacy Fund
		NSW Regional Growth Framework; and Regional Growth Fund: Growing Local Economies
		20 Year Economic Vision for Regional NSW (July 2018)
	Department of Industry	Making it Happen in the Regions: Regional Development Frameworks
	Department of Planning and Environment	Safe & Secure Water Program
		Regional Plan for the Central West and Orana 2036
State and Local (Regions)	Department of Premier and Cabinet, Parkes Shire Council, Lachlan Shire Council and Forbes Shire Council	Mid-Lachlan Regional Economic Development Strategies (REDs) 2018-2022
Local (Regions)	CENTROC Water Utilities Alliance (CWUA)	CENTROC Water Security Study
		CENTROC Regional IWCM (2009)
Local	Parkes Shire Council	Integrated Water Management Strategy (IWCM) (2004, 2017)
		Parkes Community Strategic Plan (CSP)
		Parkes Economic Development Plan

Sources: Based on Parkes Shire Council (2020), *Strategic Alignment Document,* Parkes Shire Council website and NSW Government website.

As can be seen, the LPD project demonstrates strong strategic alignment to federal, state, and local government policies and strategies, as well as regional plans. Descriptions of the relevant policy documents and further analysis of strategic alignment are presented in the main business case.

2.5 PROJECT OVERVIEW

As described in the Request for Tender, the PTWSP includes many components, including up to 90km of new raw water transfer pipelines, expansion of the Lachlan River borefield, construction of a river pre-treatment facility and augmentation of pump stations.

While the original brief included the CENTROC Water Grid Connection, the analysis undertaken during the progress of this business case identified that the CENTROC project should constitute a project in its own right and hence be the subject of its own business case.

From an economic perspective, the CENTROC project is a discrete project and its costs and benefits are sufficiently mutually exclusive to be considered as a standalone project. Furthermore, following discussions with NSW Department of Planning, Industry and Environment (DPIE), the need to prioritise the LPD project over the CENTROC project was identified by both PSC and NSW Government (as represented by DPIE). This reflects the water requirements for the State Government's SAP. INSW and DPIE advised PSC that the SAP should be considered committed funding. Therefore, the CENTROC project has been excluded from the scope of the current business case.

The original scope for the Lachlan to Parkes Water Supply Duplication project was defined in the service brief as follows:

- Augmentation of the Eugowra Road and Back Yamma pump stations through additional reservoirs and pump stations
- Possible construction of a pre-treatment plant which enables reliable extraction of variable quality water from the Lachlan River
- Augmentation of the existing Lachlan River PS intake structure
- Duplication of the pipeline from the Lachlan River to Parkes WTP.

However, as the process of the option identification and assessment proceeded, it became clear that some elements of the above definition should be in the 'do-minimum' base case, hence the subject of the business case is the duplication of the pipeline from the Lachlan River to Parkes WTP and augmentation of pump stations through additional reservoirs and pumps. This is discussed in greater detail in Sections 4.2 and 4.3.

3. APPROACH TO OPTIONS IDENTIFICATION AND ASSESSMENT

3.1 INTRODUCTION

This chapter describes the approach to options identification and assessment using MCA. It also identifies the appropriate assessment criteria for the MCA by examining the relationship between potential assessment criteria and the project objectives. It also outlines the process by which the weights for the assessment criteria are derived. Finally, this chapter presents the assessment scenarios in the MCA.

To ensure a rigorous options identification and assessment process, two MCA workshops were held:

- A Pre-MCA workshop (aka “Workshop No.2”) – 7 October 2020, 8.30am to 10.30am – to brief on the process of the MCA, agree on the project objectives and their related assessment criteria and derive the weights for the criteria
- A MCA workshop (aka “Workshop No.3”) – Wednesday 9 December 2020, 9am to 12.30pm – to conduct the MCA of the options as an integrated project team and to agree on the MCA results and outcomes.

The above workshops were attended by PSC officers and relevant stakeholders such as NPM and NSW Government (in respect of the SAP). Appendix A contains information about the attendees at the two workshops.

3.2 PROJECT OBJECTIVES AND ASSESSMENT CRITERIA

Project options were assessed quantitatively and qualitatively using a range of assessment criteria. The process measures how well each option performs against each criterion to determine which option(s) best meet the project objectives and hence should be shortlisted to the next stage of the investment appraisal (i.e. the CBA).

The identification of assessment criteria is driven by the objectives of the project. At the outset, the objectives of the project were identified as follows:

- Enabling economic growth (via water reliability)
- Achieving drought security.

In order to develop a set of relevant assessment criteria, we considered the impacts covered in a full social cost-benefit analysis, which is the economic analysis undertaken of the options. These are typically categorised as:

- Economic
- Social
- Environmental.

At the beginning of the pre-MCA workshop, the participants discussed the project objectives and the costs and benefits which would be captured by a full social CBA to identify a number of criteria which would be appropriate for assessing the long list of options.

The following table summarises the derivation of the potential assessment criteria driven by the project objectives and the three types of impacts covered by a CBA.

Fig. 4. Derivation of Assessment Criteria

	Project Objectives / CBA impacts	Examples of specific impacts in the CBA	Possible Criteria
Defined project Objectives	Water reliability	Water availability Water quality Water flow rates	Water reliability
	Drought security	Security of water sources New water sources Future-proofing (having future water supply options)	Drought security
Categories of costs and benefits in a CBA	Economic impacts	Economic growth Supply of water Capital and operating costs	Water reliability Drought security Financial costs/affordability Deliverability
	Social impacts	The social costs and benefits to other beneficiaries and stakeholders (e.g. the council, the region, the mine, the community)	Water reliability Drought security Stakeholder needs Safety
	Environmental impacts	Energy use Impact on flora and fauna Sustainability Impacts to aquatic ecosystems Soil and waterway health Impact on indigenous communities	Drought security Environmental sustainability or ecological footprint

By the end of the pre-MCA workshop, six criteria were identified to be relevant assessment criteria for the LPD project:

- Water reliability
- Drought security
- Financial considerations

- Environmental sustainability
- Stakeholder needs
- Delivery and safety.

Of note, the workshop participants felt that it was important that the goal of water supply was reflected in two separate objectives - water reliability and drought security - as they achieve different economic, social and environmental outcomes. For example, achieving drought security would deliver economic and social benefits, but also environmental benefits.

3.3 ASSESSMENT CRITERIA

At the end of the pre-MCA workshop, the above list of criteria was discussed for confirmation. The majority of the identified criteria were accepted for assessment in the MCA.

However, the attendees asked for the following changes:

- The Financial criterion be renamed “Affordability” to better reflect the constraints on the capital and operating costs of the options
- The Environmental Sustainability criterion be renamed “Ecological Footprint” to better reflect the broader aspects of the expected and potential ecological impacts of the LPD project (e.g. on creek crossings and box gum communities).

The following figure illustrates the development of the criteria over time.

Fig. 5. Development of Assessment Criteria

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Lachlan [Pipeline] Duplication Project – Options Identification and Assessment Workshop No.3*, 09 December, p.7.

The following table summarises the key sub-criteria making up the six criteria.

Fig. 6. Assessment Criteria and sub-criteria

Criteria	Sub-criteria	Basis for assessment and scoring	Other considerations
Water reliability		An option which supports growth in Parkes' economy and population will score higher than an option with limited potential to support higher flow volumes into the future.	This includes water availability and water quality, as well as allowing higher flows from the borefields and treatment of river water for use by the mine.
Drought mitigation		An option which increases resilience to climatic variability will score higher than an option which only increases the demand on an existing source.	In essence, this is reflected in new sources of water for PSC.
Affordability	Capital Cost / Cost of Delivery ($m to deliver the option)	An option with a lower capital investment will score higher than an option with a higher capital investment.	
	Operating costs ($m per annum. to operate the option)	An option which is cheaper to operate will score higher than an option which is more expensive to operate.	
	Approvals, Design, Procurement & Construction	An option with a shorter delivery timeframe will score higher than an option with a longer delivery timeframe.	
Ecological footprint	Overall environmental impacts	An option which has fewer environmental constraints and limitations (as determined by a REF) will score higher than an option with more identified constraints.	
	Ease of Approvals (Time/Complexity of approvals process)	An option which requires a higher number of approvals, or involves more sensitive approvals, will score lower than an option which has a simpler approval pathway.	
	Land Area Impacted (Option footprint)	An option which requires less land, and that is easily accessible, will score higher than an option which uses a large amount of land or land that is of a higher quality or difficult to access.	This includes ecological systems along the route alignment option such as box gum communities.
	GHG Production (Energy intensity)	An option which uses a small amount of electricity or has a smaller carbon footprint will score higher than an energy intensive option.	
Stakeholder needs	Parkes Shire Council	An option that provides the opportunity for PSC to meet its eight strategic objectives, while minimising the cost impost to ratepayers.	
	North Parkes Mine	An option which secures future demand requirements for the life of the mine at lowest cost to CMOC investors and shareholders, while meeting CMOC's sustainability commitments.	
	Special Activation Precinct	An option which allows the flexibility to meet the long-term vision of the SAP while meeting other state strategic objectives on water sustainability.	
	CENTROC	An option which provides the opportunity to enhance drought resilience within the broader Lachlan Valley.	

Criteria	Sub-criteria	Basis for assessment and scoring	Other considerations
	Community	An option which delivers sustained economic benefits to users and non-users.	
Delivery & safety	Risk associated with delivery	An option which is well-understood will score higher than an option where there are potential roadblocks or risks which are not yet fully understood.	This also includes the difficulty of geotechnical services, waterway crossings, etc.
	Risk associated with operation	An option which is easy to operate with few risks will score higher than an option which has operational uncertainty.	

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Parkes Town Water Security Program – Options Identification & Assessment Workshop No.2*, 7 October, pp.9-13.

3.4 ASSESSMENT SCENARIOS

For the purpose of this MCA, a scoring scale of 0 to 10 was applied, where:

- 0 = the option does not meet the criterion
- 5 = the option partially meets the criterion
- 10 = the option fully meets the criterion.

3.5 ASSESSMENT SCENARIO AND WEIGHTING OF ASSESSMENT CRITERIA

MCA is generally performed under two scoring scenarios:

- An unweighted (or equally weighted) score scenario, i.e. all the assessment criteria have the same weight in the analysis
- A weighted criteria scenario where certain criteria are prioritised (generally according to stakeholder needs) and are weighted differently.

With six criteria, the unweighted/equally weighted scenario would apply weights of **16.67%** for each criterion.

For the weighted scenario, the weightings of the assessment criteria in the MCA were derived using pairwise comparison of the criteria. This is the standard method to derive weights amongst a set of specified criteria.

The following figure illustrates the structure of the pairwise comparisons undertaken.

Fig. 7. Pairwise Comparison of Criteria

		A	B	C	D	E	F
		Water reliability	**Drought mitigation**	**Affordability**	**Ecological Footprint**	**Stakeholder Needs**	**Delivery & Safety**
A	**Water reliability**		To be compared	To be compared	To be compared	To be compared	To be compared
B	**Drought mitigation**			To be compared	To be compared	To be compared	To be compared
C	**Affordability**				To be compared	To be compared	To be compared
D	**Ecological Footprint**					To be compared	To be compared
E	**Stakeholder Needs**						To be compared
F	**Delivery & Safety**						

The process involved systematically comparing two criteria at a time to drive differential between the two criteria being compared and then to derive preference of one criterion over another. The following questions were asked of the forum to assist this process:

(i) Do you prefer satisfying the objective of water reliability over the objective of drought mitigation?

(ii) Do you prefer satisfying the objective of water reliability over the objective of affordability?

(iii) Do you prefer satisfying the objective of water reliability over the objective of ecological footprint?

(iv) Do you prefer satisfying the objective of water reliability over the objective of stakeholder needs?

(v) Do you prefer satisfying the objective of water reliability over the objective of delivery and safety?

(vi) Do you prefer satisfying the objectives of drought mitigation over the objective of affordability?

(vii) Do you prefer satisfying the objectives of drought mitigation over the objective of ecological footprint?

(viii) Do you prefer satisfying the objectives of drought mitigation over the objective of stakeholders?

(ix) Do you prefer satisfying the objectives of drought mitigation over the objective of delivery & safety?

(x) Do you prefer satisfying the objectives of affordability over the objective of ecological footprint?

(xi) Do you prefer satisfying the objectives of affordability over the objective of stakeholder needs?

(xii) Do you prefer satisfying the objectives of affordability over the objective of delivery & safety?

(xiii) Do you prefer satisfying the objectives of ecological footprint over the objective of stakeholder needs?

(xiv) Do you prefer satisfying the objectives of ecological footprint over the objective of delivery and safety?

(xv) Do you prefer satisfying the objectives of stakeholder needs over the objective of delivery and safety?

In total, nine workshop attendees contributed to the process, representing different stakeholders (e.g. PSC, NPM) and a range of functional and industry experts (e.g. water engineers and water operation specialists, project managers, finance specialists, and environmental and ecological specialists). The pairwise preferences were then tallied to derive the overall preferences in weighting among all the criteria. The following figure illustrates the process and presents results of the pairwise comparison between criteria.

Fig. 8. Process and results of the pairwise comparison between criteria

			A	B	C	D	E	F		
			Water reliability	Drought mitigation	Affordability	Ecological footprint	Stakeholder needs	Delivery & safety	Preferences	Weights
1	A	Water reliability		3A	15A	8D	10A	5F	28	25%
2	B	Drought mitigation			20B	5D	8B	B=F	28	25%
3	C	Affordability				6D	3C	1F	3	3%
4	D	Ecological footprint					16D	9D	44	39%
5	E	Stakeholder needs						3F	0	0%
6	F	Delivery & safety							9	8%
									112	100%

The following figure summarises the weights derived for the six criteria to be used in the weighted scenario of the MCA.

Fig. 9. Derived Weightings for Assessment Criteria

Criteria	Weightings [(1)]
Water reliability	25%
Drought mitigation	25%
Affordability	3%
Ecological footprint	39%
Stakeholder needs	0%
Delivery & safety	8%
TOTAL	**100%**

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Lachlan [Pipeline] Duplication Project – Options Identification and Assessment Workshop No.3*, 09 December, p.7.

Note: (1) Derived from pairwise comparison undertaken by the workshop attendees.

Together, water reliability and drought mitigation make up 50% of the weightings, while ecological footprint constitutes almost 40% of the weightings. On the whole, the derived weightings in the above table were unsurprising, given the joint importance of water reliability and drought mitigation to Parkes and the surrounding area, and the impact of water supply on the environment in terms of the infrastructure's overall ecological footprint.

Interestingly, the criterion for meeting stakeholder needs was assigned a zero weighting by the forum, which suggests that stakeholders had already been accounting for their needs through the other criteria, particularly given that the objectives for the project - water reliability and drought mitigation - make up half of the weightings. This was explicitly discussed at the MCA workshop and attendees in the forum confirmed that they thought all the other assessment criteria, but in particular, water reliability, drought security and ecological footprint, sufficiently addressed the criterion of stakeholder needs. In fact, the workshop attendees were asked to vote on this issue to get a clear agreement on the weighting for the stakeholder needs criterion. Therefore, it was unanimously agreed that the weightings derived should be accepted. Furthermore, the forum was confident that the equal weighting of 16.67% in the equally weighted scenario sufficiently tested the outcomes of the MCA if stakeholder needs were assigned a non-zero weighting.

4. MULTI-CRITERIA ANALYSIS OF OPTIONS

4.1 INTRODUCTION

This chapter contains the multi-criteria analysis of the options. First, it defines the base case option against which the project options are compared. Second, it identifies the long list of options considered to solve the identified problem. Third, the raw criteria scores for each option and the resultant weighted and unweighted/equally weighted scores are presented, along with key findings emerging from the MCA.

4.2 DEFINITION OF THE BASE CASE

The CBA of the project option(s) compares the costs and benefits of the project option(s) against a 'base case' option. The base case is defined as a "do-nothing" option or a "do-minimum" option. In reality, the base case is rarely a "do-nothing" option because it is not a realistic option when external factors are changing, e.g. increasing demand. Therefore, it is often considered to be the "do minimum" actions you would undertake if the project did not proceed.

INSW confirmed that the do-minimum base case should assume the future demand from the Parkes SAP as it is a state-funded commitment. Therefore, options to increase water availability and reliability and to increase the pump and pipeline transfer infrastructure without a full duplication were considered.

The "do-minimum" base case for the LPD project is defined as follows:

- The existing network and budgeted maintenance and repairs
- The Lachlan River pre-treatment plant
- The increase in the Lachlan River offtake
- Additional pumps to increase the transfer capacity of the DICL pipeline.

It should be noted that the river pre-treatment plant and the river offtake were previously included in the project option under the Stage 2 funding application.

The existing pump and pipeline infrastructure can deliver 240l/s (excludes Lake Endeavour Dam). The "do-minimum" base case is expected to deliver 280l/s but will fall well short of the central case demand scenario of 500l/s by the mid 2050s.

The raw water extraction capacity for the borefield and Lachlan River is expected to increase from 340l/s to 430l/s as a result of a combination of the base case investment and the Lachlan Borefield Expansion work being funded by the Critical Drought Initiative.

Fig. 10. Demand and supply requirements under the base case

Measures of water	Sources of demand/supply	Flow rate (litres per second) (l/s)		Notes
		2021[1)]	2026[(2)]	
Peak raw water demands from Parkes/Peak Hill and NPM	Parkes WTP	200	200	The current maximum design flow of the WTP is 200l/s which has been reached during times of hot weather peak demand and will not be sufficient to meet the SAP peak demand of 12l/s at the end of 2021.
	NPM	>80	150	The current flow rate is not sufficient for the mine to expand to a peak demand of 150l/s
	SAP	-	50	
	Total	**280**	**400**	
Raw water extraction capacity of the system	Borefield	120	150	Assumes borefield upgrades (sunk costs of Critical Drought Initiative Project currently under construction) and one new bore (new capex)
	Lachlan River	120	280	This is subject to availability and can be unusable due to water quality issues. For example, this source of extraction was not available from February 2020 to July 2020.
	Sub-total	240	430	This is the typical annual extraction.
	Lake Endeavour Dam	60	60	Only available when dam levels exceed a reserve requirement.
	Total	300	490	
Pump and pipeline capacity	MSCL[(3)] (bore water)	120	120	
	DICL[(4)] (river water)	120	180	Assumes 50% flow rate can be achieved by replacement of existing pumps and motors.
	Sub-total	**240**	**300**	This is the typical annual capacity.
	Lake Endeavour Dam	60	60	Only available when dam levels exceed a reserve requirement.
	Total	300	360	
Shortfall between typical peak demand and pump and pipeline capacity		**40**	**100**	Lower if Lake Endeavour Dam is online.

Source: Based on PSC (2021), *Information from the Water and Sewerage Operations Team*, 17 December.

Notes: (1) The 2021 peak demand can be met with existing pipelines but requires the construction of a river pre-treatment plant and off-take augmentation to ensure river water availability and an investment in the DICL pipeline to increase its flow rate by 50%. It also requires the availability of water from the Lake Endeavour Dam.

(2) The 2026 peak demand cannot be met with existing pipelines, even with the river water pre-treatment plant and off-take, investment in the DICL pipeline and availability of Lake Endeavour Dam.

(3) Mild Steel Cement Lined (MSCL) pipeline, 375 mm diameter and approximately 55 years old. The pipeline has had several corrosion related failures in recent years. Its probable remaining life is 20 years. Due to maintenance issues, it is not considered to be suitable for augmented flow rates.

(4) Ductile Iron Cement Lined (DICL) pipeline, 375 mm diameter and approximately 25 years old. The pipeline is in good condition. Its probable remaining life is over 50 years and is considered to be suitable for augmented flow rates.

4.3 LONG LIST OF OPTIONS

4.3.1 The options

As noted in Section 2.5, the definition of the project itself has evolved since the issue of the service brief. For the purposes of developing a long list of options for the business case, the project was assumed to be the Lachlan Pipeline Duplication project.

GHD, in conjunction with PSC, developed a number of route alignment options for the LPD project based on the following key requirements and constraints:

- A central case demand scenario of 500l/s
- An affordability constraint of $55 million in capital costs for the LPD project.

Based on the existing information and the preliminary analysis undertaken by GHD (2020), the long list of options was identified as follows:

- Option 1 – the Purple route – parallel to the existing alignment
- Option 2 – the Yellow route – via private property / Akuna Road / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street
- Option 3 – the Orange route – via Nash Street / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street
- Option 4 – the Blue route – Ashburnham Road / Road Reserve / Akuna Road / Eugowra Road / Renshaw McGirr / Noonan Reserve / Danilenko Street

The following figure illustrates the four alternative route alignment options for the LPD project.

Fig. 11. Duplicate pipeline route options

Source: GHD (2020)

The MCA workshop attendees agreed that the above long list was appropriate for the MCA and proceeded to score the options against each criterion. Policy and operational options were discussed at earlier workshops and meetings but were found to be insufficient to meet the significant growth in demand expected for Parkes over the long term.

(a) Common assumptions

The four options identified above assumed the following pre-conditions and characteristics in their scope:

- Any option will work with the existing infrastructure which has a design capacity or flow rate of 240l/s
- The duplicated pipeline will be DN500 mm in size
- The minimum flow rate will be 200l/s but the infrastructure will be designed to be upgraded to 300l/s

- The existing Mild Steel Cement Lined (MSCL) pipeline remains operable
- The new Eugowra Road PS will be in operation
- The existing infrastructure and proposed infrastructure can be separated to have their respective supplies for the new Eugowra Road PS
- The duplicated pipeline will bypass Back Yamma PS and be directed to the new PS proposed to be located 4km upstream of the WTP
- The capital and operating expenditure estimates for the new infrastructure under all four options are broadly aligned.

(b) Sources of differences

The four route alignment options differ with respect to the following:

- Geotechnical design
- Asset maintenance
- Cost of power
- Environmental impacts
- Energy optimisation.

These will be explored in more detailed below.

4.4 MULTI-CRITERIA ANALYSIS OF OPTIONS

4.4.1 Assessment of options against criteria

During the MCA workshop, the MCA involved each option being compared against one individual criterion at a time, to ensure focus on how well each option met a criterion and enable comparison between options. This helps to avoid and minimise selection bias which could occur when an option is assessed against all the criteria at the same time.

Appendix B contains the workings of the MCA.

The following is a summary of how the options performed in terms of meeting the criteria:

(a) Water reliability

In terms of water capacity, all the route options have been designed to have the same task in supplying water at a rate between 200L/s and 300L/s. The evaporative losses for all four of the proposed pipeline routes are comparable as they will be similar in length and will be built underground.

To accommodate the new duplicate pipeline, it is proposed that a new PS be installed within the boundaries of existing PSC owned land along the identified route(s). For Options 3 and 4 (the Orange and Blue routes respectively) the PS will be located at the new STP site, while for Option 2 (the Yellow route) it will be located at the old STP site. Compared to Option 1 (the Purple route), Options 2, 3 and 4 all provide an easier opportunity to install and maintain a

new generator. Option 1 will have to utilise constrained land at Back Yamma PS for a booster pump station.

Similarly, Options 3 and 4 (the Orange and Blue routes respectively) have the advantage of being the easiest sites to access. In contrast, Options 1 and 2 (the Purple and Yellow routes respectively) are more difficult sites to access, with Option 1 also being the furthest from town.

Options 3 and 4 are considered to be better for future-proofing water reliability because of their ability to augment recycled water supply at the Advanced Water Recycling Facility (AWRF) which is co-located with the new STP.

In terms of servicing the SAP, Option 1(the Purple route) provides the best opportunities for diverting water, either where Back Yamma crosses Goobang Creek or at the middle of town at low ground around the railway line. Diversions for the other three options would likely involve traversing high ground directly west of the old or new STP.

Option 1 is expected to be less reliable due to an expected increase in power surges and outages. In general, the construction of Option 2 in a more urbanised area will likely lead to a higher risk of conflict and hence lower levels of reliability. Furthermore, Option 1 has less space for solar energy at Back Yamma PS, so it is potentially less flexible operationally and hence may not improve water security to the same extent as the other options.

On the basis of the above, Option 3 (the Orange route) fully meets the water security criterion and scores a maximum of 10 points in the raw score, followed by Option 2 (the Yellow route). Options 1 and 4 are joint third when assessed against this criterion.

(b) Drought security

In terms of drought security, all four options were expected to have the same level and type of water source connectivity, hence all the options were expected to deliver approximately the same level of drought security.

Marginal differences in future-proofing and the ability to augment recycled water did not drive discernible differences in the raw scores. Options 1 and 2 (the Purple and the Yellow routes respectively) were expected to be the easiest options to upgrade, while Options 3 and 4 (the Orange and Blue routes respectively) had the capability to augment recycled water supply.

In the final analysis, there was very little differentiation between the options in regard to drought security and hence all options recorded a raw score of 8 out of 10.

(c) Affordability

Affordability is typically measured on the basis of the total financial costs of capital and operating expenditure. In a single quantitative measure, this is best reflected in the present value of total costs (otherwise known as discounted total costs). However, since the discounted cashflow analysis in the CBA has not yet been performed, we have focused the analysis primarily on capital costs and operating costs. Other project considerations such as the construction period may also impact on the total costs of the project.

(i) Capital costs

In terms of affordability, all four options were designed to have similar capital costs of around $50m in P50 costs due to investment affordability constraints specified by PSC. It should be noted that the final capital expenditure estimates were not available at the time of the MCA as they will be detailed at the concept design phase[16].

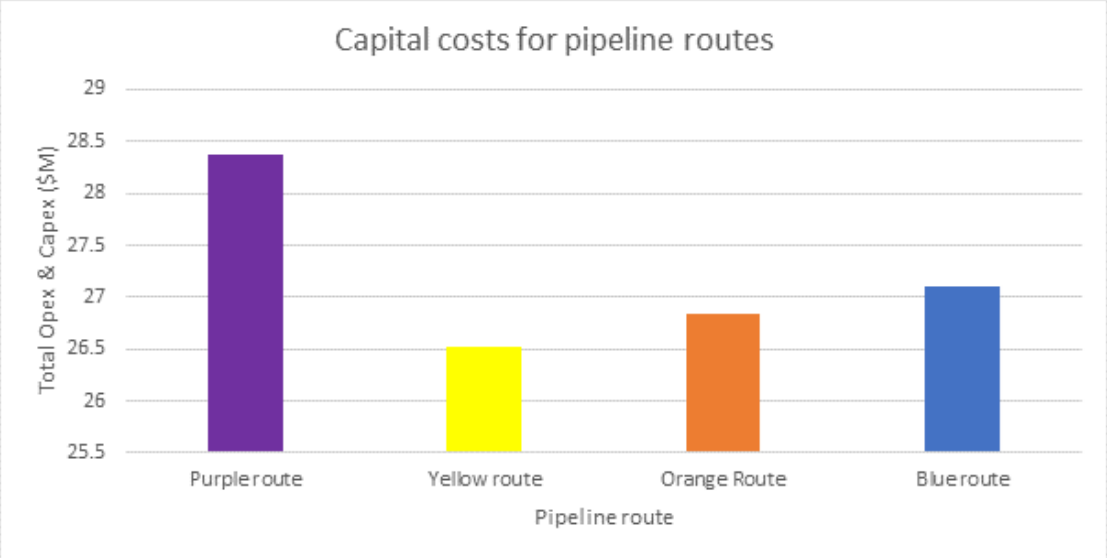
The following table summarises the differential preliminary capital costs for each option (with the common costs for all the options excluded to facilitate comparison), while the following figure focuses solely on the capital costs for pipeline routes.

Fig. 12. Differential preliminary capital costs by option (2020 prices)

Components	Option 1 (the Purple option)	Option 2 (the Yellow option)	Option 3 (the Orange option)	Option 4 (the Blue option)
New PS	5.00	5.00	5.00	5.00
Pipeline (including easement acquisition)	28.57	27.03	26.72	27.30
Total	**33.57**	**32.03**	**31.71**	**32.30**

Sources: Based on GHD for Parkes Shire Council (2020), *Lachlan Pipeline Duplication Engineering Design Preliminary Constraints*, 16 November, Section 8.1: Tables 8-11 and 13, and Figure 10-1.

Figure X: Capital costs for pipeline routes by option



Sources: Based on GHD for Parkes Shire Council (2020), *Lachlan Pipeline Duplication Engineering Design Preliminary Constraints*, 16 November, Section 8.1: Figure 10-1.

[16] GHD (2020), s8.1.

The following points emerge from the above table and figure:

- A very small range of $1.86 million exists between the highest-cost and lowest-cost options
- The main difference in the costs between the options is the duplication of the pipeline itself since the new pumping station is $5 million for all the options. Furthermore, only the last 6kms differ for Options 1, 2 and 3
- In terms of the pipeline construction costs, which were the main focus of the MCA:
    - Option 2 (the Yellow route) has the lowest cost of constructing the pipeline because it is the second shortest route and is not required to traverse town and services
    - It is followed by Option 3 (the Orange route), which is slightly more expensive than Option 2 because of its additional length
    - Option 4 (the Blue route) has the second highest construction cost for the pipeline as it is the longest pipeline and there are sections of bedrock along the route, even though it also has large greenfield areas which are associated with lower unit construction costs
    - Option 1 is the most expensive route to construct due to multiple services and population interfaces, despite being the shortest route.

(ii) Operating costs

Recurrent operating expenditure relates to day-to-day operating costs and ongoing and periodic maintenance costs.

The operational costs associated with the four options will all be relative to one another with respect to pump station maintenance and the cost of pipeline maintenance. The main divergence in operating costs will be the cost of pumping due to the pressure and flow from the pump station. The pumping costs for each option are summarised in the following table.

Fig. 13. Differential preliminary operating costs by option (2020 prices)

Unit costs and Total costs (undiscounted)	Option 1 (the Purple option)	Option 2 (the Yellow option)	Option 3 (the Orange option)	Option 4 (the Blue option)
Current pump power cost ($/hour)	96.90	96.90	98.04	95.76
Pump power cost over 20-year operating horizon (1)	16.98	16.98	17.18	16.78
Pump power cost over 50-year operating horizon (1)	42.44	42.44	42.94	41.94

Source: GHD for Parkes Shire Council (2020), Lachlan Pipeline Duplication Engineering Design Preliminary Constraints, 16 November, Section 8.1, Table 12.

Note: (1) assuming 24 hour operation.

It is clear that all options are very close in terms of operating costs and there is only a small range of $0.4 million over 20 years between the highest-cost

option and the lowest-cost option. Option 4 would be the cheapest option to run over 20 years, while Option 3 would be the most expensive option to run over 20 years.

Savings through solar power for each option have not been included in the above table but were considered in the MCA. GHD notes that:[17]

- Options 3 and 4 (the Orange and Blue routes respectively) are able to have a large solar array installed near the new STP for the new PS
- Option 1 (the Purple route) has no room at the Back Yamma site
- Option 2 (the Yellow route) has limited space at the old STP site.

All options have the Lachlan River PS site used where additional solar can be constructed.

Much of the differential in pumping power costs relates to head pressure as a result of the different route elevations. Option 4 (the Blue route) has the lowest operating cost but its setup will reduce operational flexibility as there is no buffer to enable maintenance activities to be isolated to sections of the route. Option 2 (the Yellow route) will have slightly more head pressure and is a longer route than the Option 1. Option 3 (the Orange route) has similar pumping costs to Option 1 when solar savings are factored in, but not as low as Option 4.

Operating expenditure also needs to consider the ease of maintenance access which is driven by the location of the booster PS. Options 3 and 4 (the Orange and Blue routes respectively) have the best booster PS sites for maintenance followed by Option 2 (the Yellow route). Option 1 (the Purple route) will have the worst location for maintaining the PS.

Maintenance costs are also affected by the length of the pipeline and the number of valves. Options 1 and 2 (the Purple and Yellow routes respectively) performed best under these criteria given the shortness of their routes, while Option 4 performed the worst given the length of the route.

(iii) Other Cost Considerations

The present values of total costs were not available for all the options and the construction timescales were estimated to be the same for all options at 12-18 months.

In the final analysis, Option 3 scored the best against the affordability criterion with 8 out of 10, followed by Option 2 at 7 out of 10, while Option 1 just passed at 4 out of 10. Option 3 is able to minimise pipeline construction costs (2nd lowest) while avoiding urban interfaces and bedrock sections. Due to its high capital cost and its worst location for pump station maintenance, Option 1 was not considered to meet the affordability criterion with a raw score of 4.

[17] GHD (2020), Section 8.3.

(d) Ecological Footprint

The assessment of options against this criterion examined a number of issues such as water/road/railway crossings, the impact of trenching, heritage issues, and the likelihood of impacting threatened species.

For crossings, waterway crossings were identified as the most critical issue in terms of differentiating between the routes:

- Option 1 (the Purple route) has the most creek crossings and the second highest number of critical issues, including a likelihood of heritage issues correlated with the number of creek crossings
- Option 2 (the Yellow route) has the second highest number of creek crossings and was ranked as having the third most critical issues
- Option 3 (the Orange route) has the third highest number of creek crossings and the least number of critical issues. Compared to all the other options, it performed most favourably in terms of having the lowest impacts on waterway crossings.
- Option 4 (the Blue route) has the least number of waterway crossings but has the highest number of critical issues due to the need to clear some of the Box Gum Woodland on Birthday Lane, which requires Commonwealth approval and will be a cost burden under biodiversity offset scheme requirements.

In terms of road crossings, Option 1 (the Purple route) was the most notable as there will be road reserves with mature trees, while the remaining three options were comparable with no major issues.

All four options were considered to be broadly comparable when measured against railway crossing with no distinct differences drawn.

In terms of trenching, all crossing will be undertaken using horizontal directional drilling (HDD). Therefore, the options were considered to have a similar impact on the environment from trenching (nil, if HDD is used).

As flagged above, Option 4 (the Blue route) is most likely to have issues with threatened species given the location of the Box Gum Woodland and their associated ecological communities, compared with the other three options.

In the final analysis, Option 3 (the Orange route) was rated first with 8 out of 10, closely followed by Option 2 (the Yellow route) with 7 out of 10. Not surprisingly, Options 1 and 4 (the Purple and Blue routes respectively) did not perform as well given that Option 1 had the most creek crossings and Option 4 was most likely to threaten some species. In fact, Option 4 was considered not to meet the criterion with a raw score of 4 out of 10.

(e) Stakeholder Needs

In terms of stakeholder needs, all four options would meet the central demand requirement of 500l/s by the mid-2050s. GHD were given the minimum requirement for the new pipeline's flow capacity at 200l/s with the ability to ramp up to 330l/s in the future through pump upgrades. In combination with the existing transfer capacity of 240l/s, this would provide a transfer capacity of up

to 570l/s. (If Lake Endeavour Dam was also online, raw water capacity could reach 600l/s).

All four options would therefore be able to meet the mine requirements for 150l/s, PSC's for 225l/s and have the potential to provide up to 200l/s to the SAP.

Regarding connectivity with a proposed CENTROC pipeline grid, all the options are expected to have the same network effects.

In the final analysis, Option 2 was marginally ahead with a raw score of 8 out of 10 for stakeholder needs, compared to a score of 7 for the other three options. One of the critical drivers of Option 2's higher score was that it was the second easiest in dealing with land ownership issues. While Option 1 was the easiest amongst the option in terms of land ownership issues, it also presented the most potential for cultural and heritage issues and this pulled its overall score down.

(f) Delivery & Safety

This criterion was considered in detail according to delivery risks and operational risks.

(i) Delivery risks

A critical consideration is geotechnical risks and the amount of bedrock likely to be encountered during construction. Option 3 (the Orange route) has the lowest geotechnical risk as the route alignment has alluvial soil for the length of the route. The remaining three options encounter bedrock at different locations and to varying degrees. Option 2 (the Yellow route) crosses bedrock on Nash Hill for 470 metres, while Option 3 (the Blue route) hits bedrock about 1.8 km north of Ernie Hodges Road and is close to the Birthday Mine. Option 1 (the Purple route) also encounters bedrock and is close to the Birthday Mine.

All of the options require land acquisition or land remediation costs of some sort. Option 2 (the Yellow route) does not require land acquisition for the PS but might require land remediation for solar power at the old STP site. On the other hand, Option 1 (the Purple route) requires land acquisition for both the PS and for the solar power. Options 3 and 4 (the Orange and Blue routes respectively) require land acquisition for the pipeline but not for the PS or solar power.

Interface risk is another critical consideration in deliverability. In terms of interface risk, Option 1 (the Purple route) was assessed as having the most difficulty in paralleling the existing pipeline given the number of interfaces with services and populations. Option 4 (the Blue route) also presents challenges, with 1.2 km of easements required and the Box Gum Woodland interface near Birthday Lane. Option 3 (the Orange route) was assessed as having good access but it will cross an existing private gravel access to two properties before entering Council-owned ground south of the STP site. Although it has the least interface with services, Option 3 will have up to 3km of easements, depending on the alignment with paper roads.

Option 3 (the Orange route) will have the advantage that the route across the private land was chosen by landowners, hence mitigating stakeholder management issues.

Other issues in delivering Option 1 (the Purple route) include the need to increase the size of the pump due to its proximity to the river. The route generally lacks Council-owned land and constraints on development density may impact on delivery.

In terms of safety, the largely greenfield alignment of Option 4 (the Blue route) makes it the safest option to deliver. In contrast, the lack of Council-owned land and the high number of interfaces with services makes Option 1 (the Purple route) the least safe to deliver. Options 2 and 3 (the Orange and Yellow routes) were assessed to be the second and third safest routes to deliver a new pipeline.

(ii) Operational risks

As flagged earlier in the Affordability criterion, the head pressure for three of the options – Options 1, 2 and 3 (the Purple, Yellow and Orange routes respectively) – was broadly comparable. It was noted that Option 4 (the Blue route) will have the highest pressure throughout the pipeline. This is because the pipeline will be under significant pressure as PSC cannot use a break tank arrangement.

(iii) Summary of delivery and safety risks

In the final analysis, Options 3 and 2 (the Orange and Yellow routes) are likely to result in superior outcomes on the criterion of Delivery & Safety. Option 3, in particular, scored a high score of 8 out of 10, followed closely by Option 2 which recorded a raw score of 7, reflecting their relative ease of deliverability due to fewer easements and interfaces with services.

The remaining two options performed relatively poorly against this criterion, with Option 4 (the Blue route) scoring 3 out 10 and Option 1 (the Purple route) recording 2 out of 10. Neither Options 4 nor 1 were considered suitable for delivery.

4.4.2 Summary of MCA by option

All of the pipeline options have been designed to supply water at a rate of 200-330l/s in addition to the current 240l/s and were considered to sufficiently meet the criterion of drought security. The pipeline in all four options will be using HDD for trenching. Furthermore, all options will have a delivery timescale of 12-18 months. Finally, all the stakeholders in the MCA workshop agreed that the other criteria had already captured their stakeholder needs (particularly the water reliability and drought security criteria).

The following sub-section summarises the key differential points emerging for each option during the MCA, with their strengths and weaknesses identified.

(a) Option 1 – the Purple route

Option 1 consistently performed the worst against all criteria.

The main advantages of Option 1 include the following:

- It has the shortest route for construction and maintenance, but this is offset by the presence of bedrock, difficult access to the PS site and the PS's distance from town

- It could utilise the land at the Back Yamma PS for the booster pump station
- The route alignment is probably best located to serve the SAP
- It will have lower head pressure and hence lower operational costs
- The least difficult land ownership issues.

The main limitations and risks of Option 1 include the following:

- Locational disadvantages along the alignment as indicated above
- Difficulty in paralleling the new pipeline with the existing pipeline
- It will be more difficult to install and maintain a new generator than for the other options
- Power surges and outages are more likely
- It will have the highest number of waterway crossings and associated critical issues such as cultural and heritage issues
- The high number of interfaces with services and population will have the greatest impact on safety risks
- No ability to augment recycled water.

(b) Option 2 – the Yellow route

Option 2 generally performed well against all criteria.

The main advantages of Option 2 include the following:

- The availability of land at the old STP site to put in a new generator rather than the constrained site at the Back Yamma PS
- No land acquisition required for the PS and no easements required as the alignment follows a public road
- The lowest pipeline construction costs due to having the second shortest route and not traversing through towns and services
- The second best location to maintain a booster pump station
- The second least difficult land ownership issues
- Having the second shortest route is likely to lead to the second lowest pipeline and valve maintenance costs
- The second most ecologically sustainable option with the second lowest number of waterway crossings.

The main limitations and risks of Option 2 include the following:

- The route alignment is along a more urbanised area and hence presents greater risk of future conflicts
- It is likely to have the highest operating costs due to the additional power required for pumping water

- No ability to augment recycled water.

(c) Option 3 – the Orange route

Option 3 consistently performed the best against all criteria.

The main advantages of Option 3 include the following:

- Alluvial soil along the length of the route makes the pipeline relatively easy to construct
- The route across the private land was chosen by landowners, hence mitigating stakeholder management issues
- The availability of space at the new STP site for a new generator
- The option to augment recycled water
- It will have the best location (new STP site) for maintaining a booster pump station
- It has the second least water crossings, the lowest number of interfaces with services, and avoids any critical ecological communities.

The main limitations and risks of Option 3 include the following:

- Land acquisition will be required for the pipeline and the land ownership issues along the route were assessed to be the most difficult
- 3km of easements, depending on the alignment with paper roads.

(b) Option 4 – the Blue route

Option 4 performed reasonably well against all criteria but did not perform as strongly as Options 3 and 2.

The main advantages of Option 4 include the following:

- The availability of space at the new STP site for a new generator
- The option to augment recycled water
- It will have the best location (new STP site) for maintaining the booster pump station, which has good potential to boost flow rates with booster pump upgrades
- It is expected to have the lowest operating costs but at the expense of operational flexibility due to its setup
- The alignment will have the fewest waterway crossings, but it will impact on the Box Gum Woodland on Birthday Lane and threaten species.

The main limitations and risks of Option 4 include the following:

- With the longest route alignment, it will result in the highest pipeline and valve maintenance costs
- Ecological issues as identified above

- Land acquisition required for the pipeline with 1.8 km of bedrock along the route
- 1.2km of easements required on otherwise paper roads
- It will be the most difficult option to upgrade in the future and harder to connect a water feed to the SAP.

4.4.3 Results of the MCA

The following figure shows the raw scores of the options against each criterion and the aggregated raw scores and the aggregated weighted scores for each option.

Fig. 14. Summary of the MCA scores

Criteria	Equal Weightings	Preferred Weightings	Option 1 - Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
1. Water Reliability	17%	25%	7	8	10	7
2. Drought Security	17%	25%	8	8	8	8
3. Affordability	17%	3%	4	7	8	5
4. Ecological Footprint	17%	39%	5	7	8	4
5. Stakeholder Needs	17%	0%	7	8	7	7
6. Delivery & Safety	17%	8%	2	7	8	5
Total Raw Scores (out of 60)			33	45	49	36
Unweighted/Equally Weighted Scenario (out of 10)			5.5	7.5	8.2	6.0
Ranking			4	2	1	3
Weighted Scenario (out of 10)			6.0	7.5	8.5	5.9
Ranking			3	2	1	4

Source: BIS Oxford Economics Pty Ltd for Parkes Shire Council (2020), *Lachlan [Pipeline] Duplication Project – Options Identification and Assessment Workshop No.3 (Amended)*, 09 December, p.20.'

In a MCA, the results for an unweighted criteria scenario are estimated by totalling the raw scores. In this MCA, the sum of the raw scores is out of 60, as shown above.

However, when the unweighted score is then compared with a weighted criteria scenario, the raw scores for each criterion are applied an equal weighting. With six criteria, the equal weighting for each criterion is 16.67% (based on 100 divided by 6). The following sub-sections present the weighted calculations for both the assessment scenarios.

(a) Results of the MCA – Equally Weighted Criteria Scenario

The following table shows the raw and weighted scores by criteria and total scores for each option in the equally weighted scenario.

Fig. 15. Results of the MCA – Equally Weighted Criteria Scenario

Criteria	Weights	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
		Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score
1. Water reliability	16.67%	7	1.17	8	1.33	10	1.67	7	1.17
2. Drought security	16.67%	8	1.33	8	1.33	8	1.33	8	1.33
3. Affordability	16.67%	4	0.67	7	1.17	8	1.33	5	0.83
4. Ecological footprint	16.67%	5	0.83	7	1.17	8	1.33	4	0.67
5. Stakeholder needs	16.67%	7	1.17	8	1.33	7	1.17	7	1.17
6. Delivery & safety	16.67%	2	0.33	7	1.17	8	1.33	5	0.83
Total	100.00%	**33**	**5.50**	**45**	**7.50**	**49**	**8.17**	**36**	**6.00**
Ranking		**4**	**4**	**2**	**2**	**1**	**1**	**3**	**3**

As can be seen from above, the raw scores given by the workshop participants were applied the equal weightings of 16.67% to generate the following total weighted scores for the options:

- Option 1 – the Purple route – 5.5
- Option 2 – the Yellow route – 7.5
- Option 3 – the Orange route – 8.2
- Option 4 – the Blue route – 6.0.

Based on the equally weighted scores, Option 3 (the Orange route) is clearly the first ranked option with a total score of 8.2 out of 10, followed by Option 2 (the Yellow route) with a score of 7.5.

There is some margin separating the first and second ranked options from the last two ranked options, with Option 1 (the Purple route) being the lowest ranked option with a score of 5.5 out of 10.

(b) Results of the MCA – weighted criteria scenario

The following table shows the raw and weighted scores by criteria and total scores for each option in the weighted scenario.

Fig. 16. Results of the MCA – Weighted Criteria Scenario

Criteria	Weights	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
		Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score	Raw Score	Weighted Score
1. Water reliability	25.00%	7	1.75	8	2.00	10	2.50	7	1.75
2. Drought security	25.00%	8	2.00	8	2.00	8	2.00	8	2.00
3. Affordability	2.68%	4	0.11	7	0.19	8	0.21	5	0.13
4. Ecological footprint	39.29%	5	1.96	7	2.75	8	3.14	4	1.57
5. Stakeholder needs	0.00%	7	0.00	8	0.00	7	0.00	7	0.00
6. Delivery & safety	8.04%	2	0.16	7	0.56	8	0.64	5	0.40
Total	100.00%	**33**	**5.98**	**45**	**7.50**	**49**	**8.50**	**36**	**5.86**
Ranking		**3**	**3**	**2**	**2**	**1**	**1**	**4**	**4**

The raw scores given by the workshop participants were applied the specific weightings derived jointly by the workshop forum to generate the following total weighted scores for the options:

- Option 1 – the Purple route – 6.0
- Option 2 – the Yellow route – 7.5
- Option 3 – the Orange route – 8.5
- Option 4 – the Blue route – 5.9.

Based on the weighted scores, Option 3 (the Orange route) is clearly the first ranked option with a total score of 8.5 out of 10, followed by Option 2 (the Yellow route) with a score of 7.5.

Again, there is some margin separating the first and second ranked options from the last two ranked options. However, under a weighted criteria scenario, the last two options were much closer in scores, with Option 1 (the Purple route) and Option 4 (the Blue route) scoring 6.0 and 5.9 respectively. Option 1 performs marginally better than Option 4, and hence the 3rd and 4th rankings are switched from those in the equally weighted criteria scenario.

(c) Comparison of assessment scenarios

The following table directly compares the equally weighted scores with the weighted scores by option.

Fig. 17. Results of the MCA – Comparison of assessment scenarios

Criteria	1. Purple Route		2. Yellow Route		3. Orange Route		4. Blue Route	
	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score	Equally Weighted Score	Weighted Score
1. Water reliability	1.17	1.75	1.33	2.00	1.67	2.50	1.17	1.75
2. Drought security	1.33	2.00	1.33	2.00	1.33	2.00	1.33	2.00
3. Affordability	0.67	0.11	1.17	0.19	1.33	0.21	0.83	0.13
4. Ecological footprint	0.83	1.96	1.17	2.75	1.33	3.14	0.67	1.57
5. Stakeholder needs	1.17	0.00	1.33	0.00	1.17	0.00	1.17	0.00
6. Delivery & safety	0.33	0.16	1.17	0.56	1.33	0.64	0.83	0.40
Total	**5.50**	**5.98**	**7.50**	**7.50**	**8.17**	**8.50**	**6.00**	**5.86**
Ranking	**4**	**3**	**2**	**2**	**1**	**1**	**3**	**4**

The following points emerged from the above table:

- In both the equally weighted and weighted criteria scenarios, Option 3 (the Orange route) is clearly the best performing option amongst the four options. It returned the highest score for every criterion in the MCA. The

option performed particularly well against the criteria of water reliability, drought security and ecological footprint. The scores in both assessment scenarios were high and were close to each other. In the weighted scenario, Option 3 recorded a strong total score of 8.5 out of 10.

- The second best performing option in both assessment scenarios was Option 2 (the Yellow route). It also consistently performed well against the criteria of water reliability, drought security and ecological footprint. Option 2 recorded the second highest score for every criterion. The total scores for Options 2 under both scenarios were the same at 7.5.
- It is clear that Options 3 and 2 consistently performed better than Options 1 and 4 in both assessment scenarios and by a reasonably clear margin. The consistent performance of Options 3 and 2 was sufficient to eliminate the need for further sensitivity testing of the weights.
- The scores for Option 1 (the Purple route) were very close under both assessment scenarios: 5.5 for the equally weighted scenario and 6.0 for the weighted scenario.
- Similarly, the scores for Option 4 (the Blue route) were very close under both assessment scenarios: 6.0 for the equally weighted scenario and 5.9 for the weighted scenario.
- However, despite the similar scores for Options 1 and Option 4 in both assessment scenarios, the weightings did lead to a slightly different ranking of Options 1 and Option 4. In the weighted scenario, Option 1 moved marginally ahead of Option 4, which became the lowest ranking option.
- The range of scores in both scenarios was around 2.7 out of 10, which allowed sufficient differentiation between the options. The scores were slightly higher for the weighted criteria scenario, where the total scores were increased by 0.5 for Option 3, the preferred option. Option 1 also saw its score increase by around 0.5 but was still only ranked the third best option.

4.5 KEY FINDINGS FROM THE MCA

The results of the MCA indicate that the highest ranking options in both assessment scenarios are as follows:

3. Option 3 – the Orange route
4. Option 2 – the Yellow route.

Further analysis was undertaken to determine the preferred option based on the following considerations:

- An absolute ranking threshold – e.g. the first ranked option
- Sufficient quality is provided by the option – e.g. all shortlisted options should have a score which at least exceeds 7.5 in the equally weighted and weighted scenarios, i.e. an option should be fully meeting the criterion or close to meeting the criterion

- Satisfy the minimum number of shortlisted project options for the CBA, i.e. there should be a minimum of one option, compared with the do-minimum base case.

On the basis of the above considerations, it was further agreed by the forum that **Option 3 (the Orange route)** should proceed to the CBA in the FBC. Given the clear margin of Option 3 over Option 2 and the very tight timeframes for the business case, it was considered appropriate that only Option 3 proceed to the CBA as the current preferred option.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

A long list of four options for the LPD project was subject to a quantitative MCA.

Despite significant differences in weightings between the unweighted/equally weighted criteria scenario and the weighted criteria scenario, the options were ranked very similarly under both assessment scenarios.

Under the weighted scenario, which should be accorded precedence, the options were ranked as follows:

5. Option 3 – the Orange route
6. Option 2 – the Yellow route
7. Option 1 – the Purple route
8. Option 4 – the Blue route.

On the other hand, under the unweighted or equally weighted scenario, the options were ranked as follows:

5. Option 3 – the Orange route
6. Option 2 – the Yellow route
7. Option 4 – the Blue route
8. Option 1 – the Purple route.

On the basis of the MCA conducted, Option 3 (the Orange route) was the highest ranking option. A final review of compliance considerations by the workshop participants validated Option 3 as the preferred option for the CBA.

In summary, Option 3 has a number of significant advantages in its design, subject to the completion of discussions with landowners of private properties.

5.2 RECOMMENDATIONS

It is recommended that PSC take forward Option 3 (the Orange route) to be compared against the do-minimum base case in the CBA as part of the FBC of the LPD project.

APPENDIX A: WORKSHOP ATTENDEES

A1. WORKSHOP NO. 2

The following table summarises the attendees of the pre-MCA workshop (Workshop 2) on Wednesday 7 October 2020 between 8.30am and 10.30am.

Fig. 18. Attendees at the pre-MCA workshop (7 Oct 2020)

Name	Organisation	Position
Andrew Francis	Parkes Shire Council	Director, Infrastructure
Jason Myers	Parkes Shire Council	Project Manager
Justin Yee	Parkes Shire Council	Project Engineer, Major Projects
Graeme Bayliss	Parkes Shire Council	Infrastructure Operations Manager
Geoff Porter	Parkes Shire Council	Water & Sewerage Operations Manager
Ben Willis	KBR	Consulting Engineer
Jacques Labuschagne	CMOC-North Parkes Mine	Finance Director
Stephen Dusseljee	CMOC-North Parkes Mine	Senior Mechanical Project Engineer
Rhys Woods	CMOC-North Parkes Mine	Contracts Advisor
Troy Anderson	Regional Growth NSW Development Corporation	Director, Infrastructure & Delivery
Emily Cotterill	The Environmental Factor	Director & Principal Consultant
Reid Butler	Reid Consulting	Director
Rachael Logie	BIS Oxford Economics Pty Ltd	Associate Director
Anna Chau	Anna Chau Enterprises	Principal

A2. WORKSHOP No.3

The following table summarises the attendees of the pre-MCA workshop (Workshop 2) on Wednesday 9 December 2020 between 9am and 12.30pm.

Fig. 19. Attendees at the MCA workshop (9 Dec 2020)

Name	Organisation	Position
Andrew Francis	Parkes Shire Council	Director, Infrastructure
Jason Myers	Parkes Shire Council	Project Manager
Justin Yee	Parkes Shire Council	Project Engineer, Major Projects
Graeme Bayliss	Parkes Shire Council	Infrastructure Operations Manager
Geoff Porter	Parkes Shire Council	Water & Sewerage Operations Manager
Rebecca Ben-Haim	Eco Logical Australia	Senior Environmental Consultant
Jacques Labuschagne	CMOC-North Parkes Mine	Finance Director
Stephen Dusseljee	CMOC-North Parkes Mine	Senior Mechanical Project Engineer
Rhys Woods	CMOC-North Parkes Mine	Contracts Advisor
David Powell	DPG Water Pty Ltd	Director
Emily Cotterill	The Environmental Factor	Director & Principal Consultant
Nick Ruthenberg	GHD Pty Ltd	Water Engineer
Rachael Logie	BIS Oxford Economics Pty Ltd	Associate Director
Anna Chau	Anna Chau Enterprises	Principal

APPENDIX B: WORKSHOP SLIDES FOR MCA

6(a) MCA – Criterion 1: Water Reliability

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- Minimum flow requirement (L/s)	All routes have same duty and supply the same amount of water (200 L/s – 300L/s)	All routes have same duty and supply the same amount of water (200 L/s – 300L/s)	All routes have same duty and supply the same amount of water (200 L/s – 300L/s)	All routes have same duty and supply the same amount of water (200 L/s – 300L/s)
- Evaporative losses	Comparable – similar length, all underground	Comparable – similar length, all underground	Comparable – similar length, all underground	Comparable – similar length, all underground
- Pump station / booster location	Utilise Back Yamma pump station land for booster pump station Harder to put in new generator and maintain than other options	Existing STP site Easier to put in new generator at new or existing STP than utilise Back Yamma	New STP site Easier to put in new generator at new or existing STP than utilise Back Yamma	New STP site Easier to put in new generator at new or existing STP than utilise Back Yamma
- Maintenance	Hardest site to access / furthest from town	Second easiest site to access	Joint easiest site to access	Easiest site to access No buffer – alterations to duties upstream or downstream will have effect on whole pipeline if cannot take certain parts of the network offline and keep other parts running during maintenance
- Power supply	Power surges and outages slightly more likely	More urbanised area, so more risk of conflict		
- Option for Solar Energy	Space for solar constrained at BY, so potentially less operational flexibility	Room at existing STP site	Room at new STP site	Room at new STP site
- Option for Recycled Water	N/A	N/A	Possibility to augment recycled water	Possibility to augment recycled water
- Impact of SAP	Best place to diverge to SAP is where Back Yamma crosses Goobang Creek. Second best place to diverse is middle of town at low ground around railway line Purple route could be best option (at railway line) but not clear as SAP demands (potable vs raw) not determined	High ground directly west of old / new STP	High ground directly west of old / new STP	High ground directly west of old / new STP
Qualitative				
Raw Scores	7	8	10	7

6(b) MCA – Criterion 2: Drought Security

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- Water source connectivity	No difference	No difference	No difference	No difference
- Future-proofing	Easiest option to upgrade	2nd easiest option to upgrade	3rd easiest to upgrade	Least easy option to upgrade
- Recycle water capability			Can augment recycled water	Can augment recycled water
- Town water security	No difference	No difference	No difference	No difference
- Future Valley security (Forbes / CTW)	No difference	No difference	No difference	No difference
Qualitative				
Raw Scores	8	8	8	8

6(c) MCA – Criterion 3: Affordability

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- Capex	Only last 6km differs for purple, yellow and orange routes	Only last 6km differs for purple, yellow and orange route	Only last 6km differs for purple, yellow and orange routes	
	Highest Capex due to service and population interfaces (higher unit cost assumed for urban areas), despite being shortest route	Lowest Capex as second shortest route and not required to traverse town and services	2nd lowest Capex. More expensive than yellow due to additional length	Large greenfield component offsets some of the costs associated with bedrock section and the longest pipeline length. 2nd highest Capex
- Opex	Lower head pressure, so lower operational costs	Slightly more head pressure than the Purple Route, so higher operational costs	Same pumping costs as Purple Route, but not as low as Blue Route	Lowest Opex costs, but significant reduction in operational flexibility due to setup
	2nd lowest Opex over 20 years as shortest route	Highest Opex - 6kw more for pumping than purple and orange routes for 200L/s comparison due to lay of land. Costs differentials between routes exacerbated at 300L/s.	From an Opex perspective, it's comparable with the Purple route but not as low as the Blue route.	Good potential to boost flow rates with upgrade to booster pumps, but would use more power at higher flow rates due to length
	Worst location for pump station maintenance	Second best boost pump station location for maintenance	Best booster bump station location for maintenance	Best booster bump station location for maintenance
	Shortest route so lowest pipeline and valve maintenance	Second shortest route so lower pipeline and valve maintenance than orange and blue		Highest pipeline and valve maintenance costs
- PV of total costs	Not available	Not available	Not available	Not available
- Construction timescales	12-18 months (potentially broken into separate packages)	12-18 months (potentially broken into separate packages)	12-18 months (potentially broken into separate packages)	12-18 months (potentially broken into separate packages)
Qualitative				
Raw Scores	4	7	8	5

6(d) MCA – Criterion 4: Ecological Footprint

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- Waterway crossings	Primary route (common to all options) has the main environmental constraints	Primary route (common to all options) has the main environmental constraints	Primary route (common to all options) has the main environmental constraints	Primary route (common to all options) has the main environmental constraints
	Most creek crossings. 2nd most critical issues	One more creek crossing than orange. 3rd most critical issues	Least critical issues	Least waterway crossings but most critical issues due to Box Gum Woodland on Birthday Lane ❖ Requires Commonwealth Approval ❖ Cost burden under biodiversity offset scheme Special protection area on section of Birthday Lane running east-west chosen as an alternative to the Blue route to avoid hill Actual alignment goes through timbered area on north-south leg of Birthday Lane and not the special protection area and would not have the same issues. Alternative alignments could avoid removal of Box Gum Woodland
- Impact of trenching	All crossings HDD	All crossings HDD	All crossings HDD	All crossings HDD
- Heritage issues	Likelihood of heritage issues correlated with number of creek crossings.			
- Threatened species				Most likely to have threatened species issues due to interface with Box Gum Woodland
- Road crossings	Road reserves with mature trees	Comparable across options	Comparable across options	Comparable across options
- Railway crossings	Comparable across options	Comparable across options	Comparable across options	Comparable across options
Qualitative				
Raw Scores	5	7	8	4

6(e) MCA – Criterion 5: Stakeholder Needs

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- L/s flow				
- SAP	Up to 200L/s (proposed on site capacity)	Up to 200L/s (proposed on site capacity)	Up to 200L/s (proposed on site capacity)	Up to 200L/s (proposed on site capacity)
- NPM	Minimum 150L/s for mine throughout year	Minimum 150L/s for mine throughout year	Minimum 150L/s for mine throughout year	Minimum 150L/s for mine throughout year
- Connection to SAP	Easier to connect raw water feed to SAP	Easier to connect raw water feed to SAP	Easier to connect raw water feed to SAP	Harder to connect raw water feed to SAP
Qualitative				
- NPM	See above	See above	See above	See above
- SAP	See above	See above	See above	See above
- CENTROC	Same network effects	Same network effects	Same network effects	Same network effects
- Town water	Same drought security	Same drought security	Same drought security	Same drought security
- Community	Most community issues in terms of land interfaces	2nd most community issues in terms of land interfaces	3rd most community issues in terms of land interfaces	Least community issues in terms of land interfaces
	4th most difficult land ownership issues	3rd most difficult land ownership issues	Most difficult land ownership issues	2nd most difficult land ownership issues
	Most potential for cultural/heritage issues			
Raw Scores	7	8	7	7

6(f) MCA – Criterion 6: Delivery & Safety

	Option 1 – Purple Route	Option 2 – Yellow Route	Option 3 – Orange Route	Option 4 – Blue Route
Quantitative				
- Delivery risks	Bedrock	Crosses bedrock on Nash Hill for 470m	Alluvial soil for length of route	Hits bedrock 1.8km north of Ernie Hodges Road
- Geotech	Proximity to Birthday mine			Proximity to Birthday mine
- Land acquisition & easements	Land acquisition for PS and solar energy	No land acquisition required for PS but potential remediation for solar	Land acquisition for pipeline but not for pumping station or solar energy	Land acquisition for pipeline but not for pumping station or solar energy
- Interface risk	Difficulty in paralleling the existing pipeline	No easement required, follows public road	Good access, crosses an existing private gravel access to two properties and then it enters Council owned ground south of new STP	1.2km of easements otherwise paper roads
	Highest interface with services and populations		Up to 3km of easements, depending on alignment with paper roads	Box Gum Woodland issues around Birthday Lane
			Least interface with services	
- Pump station	Need to increase pump size because of proximity to river			
- Solar power	Lack of Council owned land and development density constraint to potential delivery			
- Safety	Least safe to deliver due to interfaces with services and lack of Council owned land	3rd safest to deliver	2nd safest to deliver	Safest to deliver – largely greenfield
- Operational risks				
- Pressure	Purple / Yellow / Orange comparable, getting up to similar head	Purple / Yellow / Orange comparable, getting up to similar head	Purple / Yellow / Orange comparable, getting up to similar head	Higher pressure throughout pipeline than other three routes. Under significant pressure as can't use break tank arrangement.
Qualitative - Delivery risks - Operational risks			Route across private land chosen by landowners	
Raw Scores	2	7	8	3

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