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Water Sensitive Cities Australia

Beaufort Linear Park Project: Rapid BCA

Md Sayed Iftekhar, Nirodha Imali Jayawardana, Jamie Ewert, Ray Davies, Fitalew Taye and Pilana Vithana Sajith Harshana

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Authors
Md Sayed Iftekhar, Nirodha Imali Jayawardana, Jamie Ewert, Ray Davies, Fitalew Taye and Pilana Vithana Sajith Harshana

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Water Sensitive Cities Australia
Level 1, 8 Scenic Blvd, Clayton Campus
Monash University
Clayton, VIC 3800

e. admin@crcwsc.org.au
w. www.watersensitivecities.org.au

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Introduction

The Department of Environment, Land, Water and Planning (DELWP) manages regional Integrated Water Management (IWM) forums which allow stakeholders to collaborate in planning and managing the water cycle in their areas. Fifteen IWM forums operate across Victoria, with 10 forums servicing regional Victoria. DELWP and stakeholders from the regional forums have identified a practitioner knowledge gap in identifying the benefit of IWM in regional/rural Victoria.

To address this issue, DELWP commissioned Water Sensitive Cities Australia (WSCA) to deliver the *Economic evaluation in regional Victoria* project. The project aims to foster understanding of the benefits of implementing IWM in small towns, while supporting regional stakeholders by improving capacity to undertake economic evaluation and deliver business cases. From a stakeholder perspective, the project will demonstrate ‘how better business cases help you to secure project funding’ – a value proposition for agencies and communities.

This document presents a worked example of conducting a rapid Benefit Cost Analysis (BCA) of an IWM project in regional Victoria. We applied the Investment Framework For Economics of Water Sensitive cities (INFFEWS) tools developed by the Cooperative Research Centre for Water Sensitive Cities (CRCWSC).

The case study is based on the Beaufort Linear project in the Pyrenees Shire. It describes the rapid economic assessment (BCA) of the project. It aims to show practitioners how the BCA process can be used effectively to support IWM in the regions. However, this case study was undertaken independently of DELWP’s IWM grant process, and the economic evaluation results will have no bearing on grant allocations.

Case study area

This section provides a general overview of the area and the project.

General socio-economic profile of the area

Beaufort is located in western Victoria between Ararat and Ballarat in Pyrenees Shire local government area. According to the ABS 2021 census, Beaufort (post code POA3373) has a population of 2,453 – 1,218 males and 1,235 females. Population density is about 2.5 persons per km^2. As shown in Table 1 and Figure 1, a high proportion of people are aged over 50 years – with a median age of 51 years. Aboriginal and Torres Strait Islander peoples account for 2% of the population. About 9% of the residents are born outside Australia. Its population has increased by 7% between 2016 and 2021. 40% of residents have attained year 12 or equivalent level of education. The median total person income is $591 per week, an increase of 23% since 2016. Mortgage repayments have increased by 12% while rent has increased by 38%. The proportion of people in higher household income groups increased 2021 when compared with 2016 (see Figure 2).

Table 1. Socio-economic profile of the adjacent local government areas

Category	Beaufort (2016)	Beaufort (2021)	Victoria (2021)	% change (2016-2021)
Total number of individuals	2,286	2,453	6,503,490	7
Age groups:				
0-4 years	124	95	375,900	
5-14 years	279	265	793,556	
15-19 years	91	141	363,201	
20-24 years	78	105	410,337	
25-34 years	182	187	975,493	
35-44 years	217	236	918,738	
45-54 years	295	348	826,885	
55-64 years	400	373	746,547	
65-74 years	373	425	605,557	
75-84 years	166	200	344,801	
85 years and over	81	77	142,475	
Highest year of school completed:				
Year 12 or equivalent	586	734	3,171,91	
Year 11 or equivalent	305	345	583,433	
Year 10 or equivalent	420	500	656,988	
Year 9 or equivalent	175	190	283,874	
Year 8 or below	155	123	248,202	
Did not go to school	0	0	67,416	
Medians				
Age of persons	51	51	38	0
Median Total personal income ($/week)	481	591	803	23
Median Total family income ($/week)	1,145	1,503	2,136	31
Median Total household income ($/week)	842	1,111	1,759	32
Median Mortgage repayment ($/month)	1,083	1,213	1,859	12
Median Rent ($/week)	168	231	370	38
Average number of persons per bedroom	0.7	0.7	0.8	0
Average household size	2.2	2.2	2.5	0

Source: ABS (2021a) (https://www.abs.gov.au/census/find-census-data/quickstats/2021/POA3373).

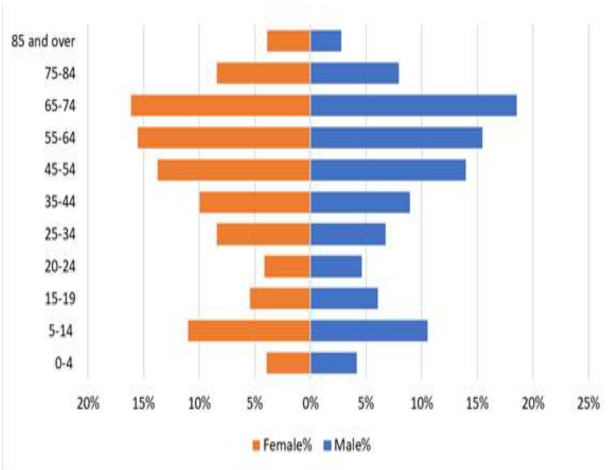


Figure 1. Beaufort population by age groups and gender

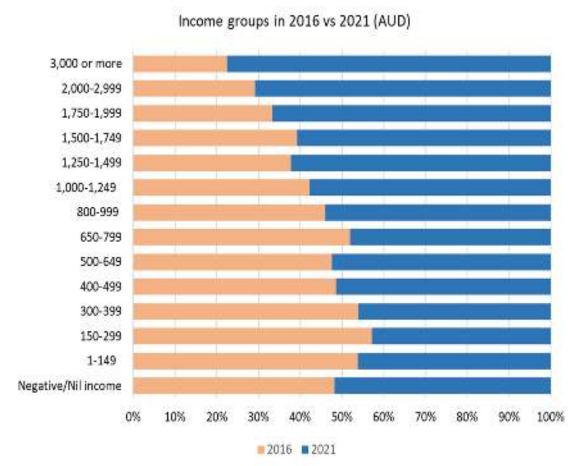


Figure 2. Beaufort total household Income in 2016 and 2021 ($)

Source: ABS (2021a) (https://www.abs.gov.au/census/find-census-data/quickstats/2021/POA3373).

Beaufort Linear Park project

The case study is a BCA of a proposed upgrade of the Beaufort Lake precinct in Pyrenees Shire in Victoria, Australia. The proposed corridor (Figure 3) will link number of recreational assets which are significantly important to the Beaufort community. These assets are located between Beaufort Lake and a downstream area to the north of the railway line in Beaufort where the waterway intersects with Yam Holes Creek. VicRoads has identified the location to the north along Lexton Rd/Albert St as a future town entry, once a proposed highway bypass is constructed (Pyrenees Shire Council, 2022a).

The Beaufort Linear project includes Beaufort Lake, Garibaldi Creek, and a proposed entry to town (land bounded by the railway line and Albert St) (Pyrenees Shire Council, 2022a).

Figure 3. Beaufort Linear project site
Source: Pyrenees Shire Council.

. Garibaldi Creek, a key waterway corridor, is currently undervalued and provides limited amenity value for the local community and visitors. It is a critical link for key destination nodes including Beaufort Lake, the school precinct, sports precinct, the RV park, public pools, the skate park and future town entry.

The Beaufort Linear project aims to rehabilitate the environmental condition of Garibaldi Creek and establish a green corridor with walking and cycling path, and recreational spaces. A co-design process will investigate flood mitigation measures, stormwater management, and the development of cultural assets and environmental education and stewardship programs (Pyrenees Shire Council, 2022a).

Because the project is expected to deliver significant community benefit, Pyrenees Shire Council will lead project delivery in partnership with the Wadawurrung Traditional Owners, the Department of Education, DEWLP, Glenelg Hopkins Catchment Management Authority and Beaufort community (Pyrenees Shire Council, 2022a). The project is at conceptual level, so we conducted a rapid economics assessment or BCA for demonstration purposes. In the absence of an existing concrete project scope, we formulated a high-level project definition for selected options as shown in Figure 3.

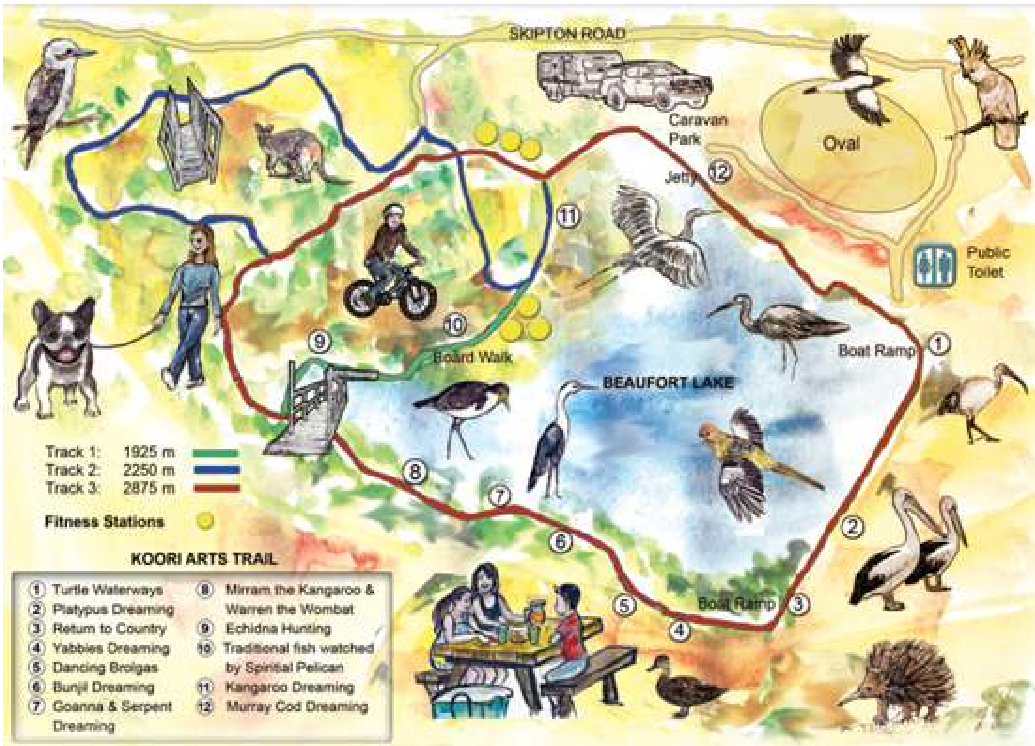


Figure 4. Beaufort Lake precinct
Source: Visit Pyrenees (https://visitpyrenees.com.au/seeanddo/koori-art-trail/)

Council requested the BCA after an initial concept design for the scheme was completed, to help decide whether it was worth proceeding to detailed design investigations. The concept investigation tested the scheme's feasibility and developed preliminary cost estimates and performance metrics such as increased visitors attracted by the upgraded Beaufort scenic facility (Figures 4 and 5). The scheme could also generate significant environmental and local community benefits, including:

- recreational benefits due to upgrading the children's playground, skate park, aquatic facility
- mental and physical health benefits, due to improved walking tracks
- biodiversity benefits and increased native vegetation
- amenity benefits
- increased cultural awareness and water education
- removal of pollutants from stormwater and potentially reducing downstream flood risk

Beaufort Lake seating

Beaufort play equipment

Beaufort Lake planting

Figure 5. Beaufort Lake precinct proposed upgrades
Source: Pyrenees Shire Council (https://www.pyrenees.vic.gov.au/Residents/Pyrenees-Shire-Projects/Beaufort-Lake-Foreshore-Improvements)

Methodology

The project uses the INFFEWS framework – an economic evaluation framework that identifies and quantifies economic, environmental and community values of investments in water sensitive practices and systems.

The BCA evaluates, compares and ranks projects, by estimating the Net Present Value (NPV) and Benefit: Cost Ratio (BCR) for each project. The BCA process involves:

- clearly defining the project scenario
- Identifying the activities required to deliver the project, and the expected impact of these activities
- identifying and quantifying relevant benefits of these impacts
- attributing costs and benefits to different stakeholders e.g. council, relevant private individual and businesses, other partner organisations (Figure 6).

The calculations should also consider the risks of project failure. Results (NPV and BCR) are calculated globally (for all identified stakeholders) and for the project organisation alone.

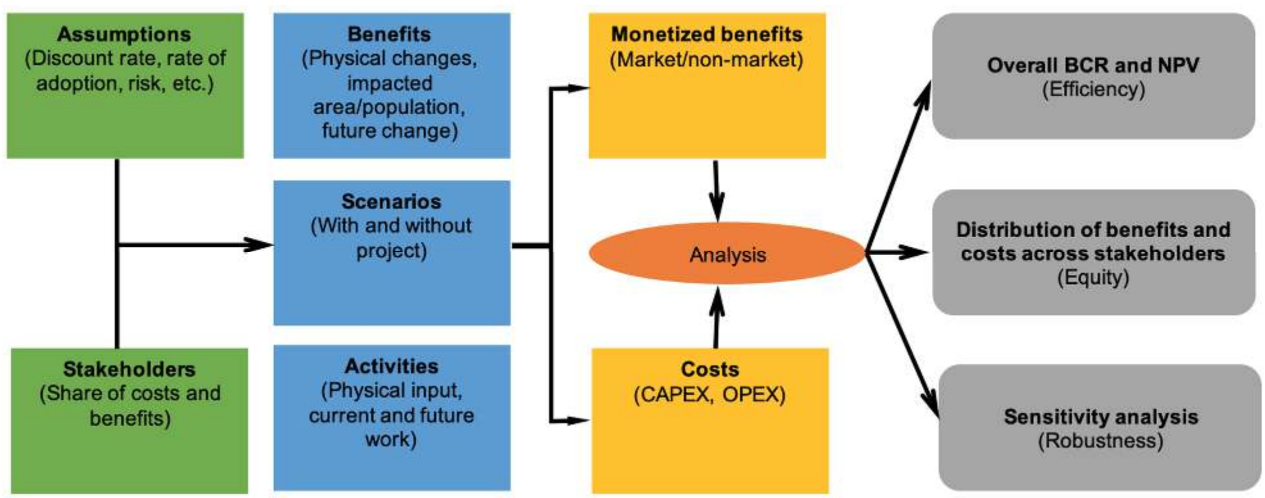


Figure 6. Key elements of the BCA framework (adapted from Iftekhar and Pannell, 2022)

We implemented the framework by following these steps:

Step 1: Defined the high-level project for the selected area, in the absence of an existing concrete project scope.

Step 2: Developed a high-level project description (including physical activities, costs, lifespan, and physical benefits) for the project.

Step 3: Conducted a benefit assessment based on the high-level project description using inputs from the council, existing literature and other stakeholders as practically feasible. We used the INFFEWS Value Tool to estimate the dollar values of the IWM benefits generated by the project.

Step 4: Conducted the preliminary BCA and shared the results with key stakeholders.

Step 5: Revised assumptions, as necessary, based on stakeholder feedback.

Stakeholder consultations

A number of stakeholder meetings were carried out to define the scope the analysis; such as gathering team ideas, technical details, and, research activities.

Workshop 1	**Items discussed**
Date: September 28, 2022 Method: Online Participants: 6 Council 2 University 1 WSCA	• Discussing views on potential benefits from the project • Identifying potential beneficiaries • Understanding opportunities and limitations • Identifying variables in the modelling tool • Understanding the structure, source of data needed for the analysis
Workshop 2 Date: November 10, 2022 Method: Online Participants: 1 Council 2 University 1 WSCA	• Discussing views on potential benefits from the project • Understanding opportunities and limitations • Identifying variables in the modelling tool • Understanding prior literature on similar studies • Understanding the structure, source of data needed for the analysis
Workshop 3 Date: November 18, 2022 Method: Online Participants: 1 Council 2 University 1 WSCA	• Clarifying assumptions, benchmarks used in benefit identification • Discussing parameter, calculations used in quantifying the physical benefit • Discussing parameter, calculations used in monetising the benefits • Justifying the underlying assumptions used in quantification and monetisation of benefits using prior research

Data collection

We collected information via the following steps:

- Analysis of council documents: We collected and reviewed relevant documents from the council:
    - Beaufort Lake Action Plan, adopted by council 16 February 2016
    - Beaufort Linear IWM Regional Project Funding 2022-23 (Pyrenees Shire Council, 2022a)
    - Pyrenees Shire Council Municipal Health and Wellbeing Plan 2021-25
    - Green Blue Infrastructure Guide: A guide for small towns in Victoria's Central Highlands Region.
- Expert consultation: An engineering consultant rapidly estimated the biophysical benefits and high-level cost of implementing the project.
- Validation of the assumptions: We validated the assumptions with council representatives.

Parameterisation of the analysis

We carried out the following steps to complete the analysis:

- Define with and without project scenarios
- Identify costs
- Identify benefits
- Identify other parameters.

These steps are described below.

Define with and without project scenarios

The 'without-project' scenario is the baseline for analysis. We use the difference between the two scenarios to estimate the costs and benefits of implementing the project.

In this case study, defining the with and without scenarios was crucial due to the high-level conceptual stage of the designs.

In initial project discussions, stakeholders identified a broad range of benefits, including increased tourism benefits, recreation, mental health, biodiversity and amenity. Importantly, all these benefits can be enhanced by irrigating the facility, keeping it green all year round. We refined this list based on consultation with the council, the document review and expert feedback. Table 2 lists the final benefits.

Table 2. Framing the 'with project' scenario to consider the proposed upgrade in the Beaufort Linear scenic precinct

Benefit types identified due to upgrade of the facility	With project	Without project
Tourism and Visitor benefits	The proposed upgrade in the scenic facility attracts additional visitors (day, overnight, and stopover). Beneficiary: Tourists and visitors (Broader community)	The current level of visitors to the facility will not change.
Recreational benefits to residents	The proposed project will encourage more people to use the swimming pool and children's playground. Beneficiary: Users of the swimming pool and playground (Local residents)	The current level of users will not change.
Health benefits	The proposed development of the walking track and scenic facility will attract additional users who receive health benefits. Beneficiary: Local residents	The current level of users will not change.
Biodiversity benefits	The proposed ecological restoration will provide additional biodiversity benefits. Beneficiary: Community	The current level of biodiversity benefits will not change.
Cultural benefits	The proposed Indigenous art trail will raise awareness about Indigenous culture. Beneficiary: Local residents	There will be no Indigenous art trails.
Amenity benefits to adjacent properties	Increased vegetation within the site from passive irrigation will provide amenity benefits to adjacent properties. Beneficiary: Adjacent property owners	Adjacent properties will not enjoy additional amenity benefits.
Public education benefits	Enhancing community awareness and education of the water cycle will impact people's perceptions about saving, recycling, and effective management of water. Beneficiary: Community	Current awareness of alternative water sources will not change.
Stormwater treatment benefits	Harvesting treatment in wetland removes pollutants, supports healthy ecosystems, increases water quality and improves amenity. Beneficiary: Broader community	The untreated stormwater will continue to affect ecosystems and water quality, because stormwater pollutes waterways.
Flood impact reduction benefits	The project will protect houses in the adjacent zones from flooding. Beneficiary: Adjacent property owners	Current exposure to flood severity will not change. .

Stakeholders approved the 'with project' and 'without project' scenarios to ensure the BCA assumptions were transparent. We examined all costs and benefits over a 20-year analysis timeframe to provide a long-term view.

Identify costs

The estimated the total capital expenditure required to implement the project to be about $6.77 million (Table 3).

Table 3. Capital expenditure of different items of the project

Item and Scope of works	Cost	Total
Item 1.1 - Wetland and passive recreation		
Wetland	1,237,500	
Passive recreation allowance	100,000	
TOTAL		1,337,500
Item 2.1 Wetland no.1		
Wetland	1,125,000	
TOTAL		1,125,000
Item 2.2 Wetland no.2		
Wetland	1,327,500	
TOTAL		1,327,500
Item 2.3 Wetland no.3		
Wetland	765,000	
TOTAL		765,000
Item 3.1 Drainage works		
Redirect existing drainage into lake	90,000	
TOTAL		90,000
Item 3.2 Garibaldi Creek revitalisation		
Waterway works – Yam Holes Creek to former school	400,000	
Terrestrial planting – Yam Holes Creek to former school	60,000	
Waterway works – former school to lake	1,100,000	
Terrestrial planting – former school to lake	165,000	
TOTAL		1,725,000
Item 3.3 Shared path Begg St to pool		
Shared path – Begg St to former school	60,000	
Shared path – former school to pool	30,000	
TOTAL		90,000
Item 3.4 Formalise share path crossing		
Shared path	6,000	
TOTAL		6,000
Item 3.5 Improved path crossing		
Shared path	4,000	
TOTAL		4,000
Item 3.6 Improved path		
Crossing shared path	4,000	
TOTAL		4,000
Item 3.7 Daylighting Garibaldi Creek		

Item and Scope of works	Cost	Total
Waterway works	100,000	
TOTAL		100,000
Item 3.8 Lake foreshore revitalisation		
Revitalisation works allowance		
TOTAL	200,000	
		200,000
Total capital costs		**6,774,000**

Council helped estimate annual operating costs, which were assumed to be 5% of capital expenditure. Given the long (20-year) time horizon of the analysis, it was important to consider possible assets that would need to be renewed. For simplicity and given the high-level nature of the estimates available, these replacement costs were annualised and lumped with the assumed operating expenditure.

In this case, both capital and operating costs will fall to council.

Identify benefits

Identifying and monetising benefits involves 4 stages:

Stage 1: Identify the categories of benefits when defining the with and without project.

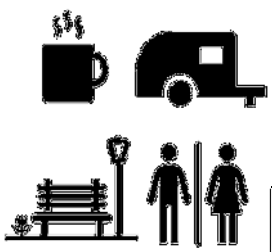
Stage 2: Quantify the physical unit or changes in benefits due to the proposed project. Take care to include and calculate only the additional benefits generated by the project.

Stage 3: Convert the quantified benefits into dollars using appropriate market or non-market values. Take care not to double count benefits.

Stage 4: Identify the key stakeholder or beneficiary groups for each benefit type.

Table 4 lists the benefit items, and the inputs and assumptions used to quantify and value them.

Table 4. Input values and assumptions used to quantify and monetize benefits

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Tourism and visitor benefits 	**Benefits to same day visitors** Same day visitors are considered as people who come to this scenic facility for a family picnic, recreational activities, or enjoy BBQ	Visitors	11,700 visitor-day /year	Source: 6500 vehicles over two months (Council estimates) Assumptions: • An average of 1.5 people per vehicle • A 20% increase of day visitors due to the project Calculation: (6500/2) *12*1.5*20% =11,700 visitors/year	$50/ visitor-day	Source: $50 per day equivalent (Melbourne Water, 2021) Assumptions: • Average consumer surplus for visitors from Greater Melbourne region • The estimates reflect the benefits that near or on-water recreation visitation combines active and passive recreation
	Benefits to overnight stay visitors Visitors who spent more than one night in the caravan park is considered as “overnight stay” group	Visitors	165 visitors-day/year	Source: 3 vehicles per night at this location (Council estimates) Assumptions: • An average of 1.5 people per vehicle • A 10% increase of overnight stay visitors due to the project Calculation: 3*1.5*365*10% =165 visitors-day/year	$50/ visitor-day	Source: $50 per day equivalent (Melbourne Water, 2021) Assumptions: • Average consumer surplus for visitors from Greater Melbourne region Notes: The main user group profile of camping and caravanning consists of families with school age children (Rolfe *et al.*, 2021)
	Benefits to longer stop over visitors Visitors who stop over at this facility for coffee breaks, public toilet access, or scenic visit, during their journey considered as	Visitors	23,400 visitor hours/year	Source: 6500 vehicles over two months (Council estimates) Assumptions: • An average of 1.5 people per vehicle, they spend 2 hours on site • A 20% increase of longer stop over visitors due to the project Calculation: (6500/2) *12*1.5*2*20% = 23,400 visitor hours/year	$6.25/ visitor-hour	Source: $50 per day equivalent (Melbourne Water, 2021) Assumptions: • Day expenditure is assumed for an 8-hour time span Calculation: $50/8=$6.25/visitor-hour

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
	"longer stop over" group					
Recreational benefits 	**Benefits to swimming pool users** People who use the swimming pool facility for recreational activities	Swimming pool users	51 persons-day/year	Source: 1,282 residents are between 5-54 years age groups (ABS, 2021a) Assumptions: • 20% of the relevant age group (5-54 year) uses the facility daily • A 5% increase of daily use due to the project Calculation:1,282*80%*5%= 51 persons-day/year	$4.20 /person/day	Source: Pyrenees Shire Council (2022b) Assumptions: • In absence of the project the users would use an alternative option (cost savings benefit) Notes: Typical usage of a community aquatic facility is 4.4 visits/person/year for an Illawarra region pool, WA (Barnsley *et al.*, 2017)
	Benefits from children's playground and skate park Children who use playground, skate park for the recreational activities	Local park users	271 households value the upgrade of the park facilities to include Exercise equipment + Playground + Skate park	Source: 315 households with children (ABS, 2021a) Assumption: • 86% of the households positively value the improvement based on Iftekhar *et al.* (2022) Calculation: 315*86% = 271 households	$27.16/ households	Source: Iftekhar *et al.* (2022) Assumption: • The willingness to pay estimates for Beaufort was calculated as the difference between 'Exercise equipment + Playground + Skate Park' and 'Playground' option as cited in Iftekhar *et al*. (2022) for a Melbourne city case study • The difference is adjusted for median weekly household income in Beaufort for 2021 • Median weekly household income in Beaufort for 2021 is $1,111 (ABS, 2021a) • Median weekly household income in Melbourne city for 2021 is $1,677 (ABS, 2021b) Calculation: (128-87) *(1,111/1,677) = $27.16/households

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Health benefits 	**Mental and physical health benefits for aged residents** Aged residents using the scenic facility for recreation activities such as jogging, evening walks, or relaxing purposes	Aged residents	53 persons	Source: Council provided estimate of 49% residents do not have sufficient physical activity, out of a total of 1,075 elderly residents between 55 years or over ABS (2021a) Assumption: • Assuming a 10% increase of physically active users due to the project Calculation:1075*49%*10% = 53 persons	$916/ person	Source: MJA (2018) Assumption: • Urban greening results in an incremental increase in passive recreator of around 75 minutes a week, and that this passive recreation is maintained through their lifetime. • Permanently shifting one Victorian from the 2016 population aged 15+ from being physically inactive to being physically active will deliver present value benefits in the $300–1,350 range over the individual's lifetime, on average, using a 7% real discount rate. This estimate is conservative because it excludes recreation, leisure and home-based production activities to avoid double counting. • Adjusted for inflation Notes: Targeting older males for recreational activities 62% males have insufficient physical activity, 61% residents are overweight and 30% of the residents are obese Calculation: (300+1350) *0.5*1.11 =$916/ person
	Mental and physical health benefits for general community (excluding aged residents) People using the scenic facility for	Local park users	63 persons	Source: • 49% residents do not have sufficient physical activity (Council estimates) • Total of 1,282 residents between 5 years to 54 years ABS (2021a) Assumption:	$916/ person	Source: MJA (2018) Assumption: • Urban greening results in an incremental increase in passive recreator of around 75 minutes a week, and that this passive recreation is maintained through their lifetime.

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
	recreation activities such as jogging, evening walks, or relaxing purposes			• Assuming a 10% increase in physically active people due to the project Calculation:1282*49%*10% = 63 persons		• Permanently shifting one Victorian from the 2016 population aged 15+ from being physically inactive to being physically active will deliver present value benefits in the $300–1,350 range over the individual's lifetime, on average, using a 7% real discount rate. This estimate is conservative because it excludes recreation, leisure and home-based production activities to avoid double counting. • Adjusted for inflation Calculation: (300+1350) * 0.5*1.11 =$916/ person
Biodiversity benefit 	**Benefits from ecological restoration with biodiversity benefit** The project area consists of range of Instream biodiversity, native species such as frogs, birds, koalas, etc.	Community	976 individuals	Source: 1,951 individuals above 18 years (ABS, 2021a) Assumption: • 50% of the population (on average) positively value the ecological restoration with biodiversity management based on Matzek *et al.* (2019) Calculation: 1951*0.5 = 976 individuals	$15.34/ person	Source: $21.72/person, Willingness to pay per respondent for ecological restoration with biodiversity benefits (ecological enhancement and threatened species protection) Matzek *et al.* (2019) Assumption: • The willingness to pay estimate cited in Matzek *et al.* (2019) for Australian case study is adjusted for median weekly household income of 2021 in Beaufort • Median weekly household income in Beaufort for 2021 is $1,111 (ABS, 2021a) • Median weekly household income in Australia for 2021 is $1,746 (ABS, 2021b) • Adjusted for inflation Notes: 1000 additional trees planted over the project duration Calculation: $21.72*1.11*(1,111/1,746) = $15.34

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Cultural benefits 	**Benefits of installing indigenous artwork** Raising awareness, cultural inclusion of demonstrating indigenous artwork	Community	112 households	Source: 1,115 households Assumptions: • 42% of the households have positive value (Elkins *et al.,* 2016). However, it might be too high for the case study. Therefore, it is reasonable to assume that • 10% of the households have positive value based on consultation with the Council. Calculation: 1115*.10 =112 households	$31.58/ level/h household/ year	Source: $41.1/level/household/year (2016) data People's willingness to pay through direct contributions to maintain the current level arts events and activities Elkins *et al.* (2016) Assumptions: • Assuming same level of WTP for providing indigenous arts/services • Adjusted for income difference and inflation • Median weekly household income in Beaufort for 2021 is $1,111 (ABS, 2021a) • Median weekly household income in Melbourne city for 2021 is $1,677 (ABS, 2021c) Notes: Willingness to pay to protect, raise awareness of indigenous artwork Calculation: $41.1*1.16*(1,111/1,677) = $31.58
Amenity benefits - adjacent property owners 	**Amenity benefit through property values** Increased amenities of this facility tend to impact adjacent property values	Households	19 dwellings	Source: 19 dwellings within 50m of the Garibaldi Creek (Council estimates)	$23,850/ dwelling	Source: 5.30% uplift in property price (Iftekhar *et al.* 2019) Assumption: • The uplift for improvement of a local park within 50 meters of the site • Median property sales price $450,000 Calculation: 450,000*5.3% = $23,850

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Public education benefit 	**Benefits from water education** Raising awareness about water reuse, enhanced community awareness and education of the water cycle	Community	836 households	Source: 1,115 households Assumptions: • 75 % of the households are willing to pay for water education and general community awareness activities based on the anecdotal evidence provided by the Council Calculation: 1115 * 0.75 = 836 households	$24.69/ household/ year	Source: $32.40/household/year (2017) (Davis *et al.,* 2019) Household willingness to pay for signage level three (information about facilities, e.g., appropriateness for swimming and availability of toilets or picnicking areas, and information about appropriate conduct within the area for visitors' safety and for the protection of native plants and animals, but also information on environmental attributes of the area) in Moreton Bay from an ecological sub-experiment Assumptions: • Adjustment for income difference and inflation • Median weekly household income in Beaufort for 2021 is $1,111 (ABS, 2021a) • Median weekly household income in Moreton Bay LGA for 2021 is $1,648 (ABS, 2021d) Calculation: $32.4*1.13*(1111/1,648) = $24.69

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Waterway health benefits 	**Benefits of pollution abatement in stormwater** Nitrogen is commonly used as a proxy to represent various types of pollutants that can be removed by stormwater treatment initiatives, the cost of purchasing nitrogen offset from Melbourne Water, which represents the cost of providing stormwater treatment in urban Melbourne	Broader Melbourne community	625 KG TN/Year	625 KG TN/Year (Consultant estimates)	$4,961/KG TN	Source: $6,645/kg TN Melbourne Water (2022) Assumption: • TN is the limiting pollutant (in other words, if nutrients are the most significant pollutant affecting waterway health) • The offset rate depends on cost of wetland installation and land price • Offset rates are adjusted for land prices • The average land prices for mixed-use lands per sq meter for outer Melbourne region (Mooreland, Brimbank, Casey, Knox, Monash and Kingston) was $855.48 / sq m (DEWLP, 2020) • The average land prices for mixed-use lands per sq meter for Pyrenees Shire was $638.69 / sq m (DEWLP, 2020) Calculation: $6645*(638.69/855.48) = $4,961

Benefit identified	Benefit description	Key beneficiary	Physical benefit	Basis for physical benefit	Monetary value	Basis for value
Flood mitigation benefit 	**Cost savings benefit from reducing flood impacts**	Property in adjacent flood-prone areas	1.6 property/ year	Source: Properties flooded nearby to the Garibaldi = 16 of which 6 are prone to flooding above floor level (Council estimate) Assumption: • On average, 10% of the currently flooded property will be saved every year due to the project Calculation: 16*0.1 = 1.6 property/year	$4,200/pro perty direct cost savings benefits	Source: Table 2 of Water Technology (2008) Assumptions: • Expected direct tangible damage is calculated as $2,937/property/event (2007) which is expected to be saved • This has been adjusted for inflation Calculation: $2,937*1.43 = $4,200/property

Identify other parameters

The values used for other parameters required to complete the BCA are presented below.

Project duration: We assumed project duration of 20 years based on council consultation.

Discount rates: We assumed a constant 5% discount rate over time. We conducted sensitivity analysis for low (3%) and high (7%) rates.

Adoption: A factor in influencing the delivery of many water sensitive projects is the behaviour of community members or businesses who would need to adopt new practices. With regards to this project, we assume increased usage of the walking tracks, recreational facilities, and people will prefer active transport over cars. However, not everybody may adopt this behaviour.

Benefits are adjusted to reflect judgements about the level of adoption that is realistic, by first estimating the benefits assuming full adoption, and then scaling down the benefits. Most of the benefits of this project are intangible and attributed to local and broader communities, so we adjusted the adoption parameters slightly downwards (Table 5).

Table 5. Adoption proportion used in the analysis

Benefit	Adoption proportion used in the analysis
Benefits to same day visitors	0.8
Benefits to overnight stay visitors	0.8
Benefits to longer stop over visitors	0.8
Benefits from swimming pool users	0.8
Benefits from children's playground and skate park	0.8
Mental and physical health benefits for aged residents	0.8
Mental and physical health benefits for general community (excluding aged residents)	0.8
Benefits from ecological restoration with biodiversity benefit	0.8
Benefits of installing indigenous artwork	0.8
Public education benefit	0.8
Amenity benefit through property values	1.0
Flood mitigation benefit	1.0

Consideration of different types of project risks: Given the council will manage the project, we assumed the overall risk of the whole project failing is very low (0–5% risk of failure). Example of a potential project risk would be insufficient allocation of maintenance budget by the council to maintain the quality of vegetation etc.

Ranges of parameter values for sensitivity analysis: To understand the sensitivity of the outcomes (i.e., NPV and BCR) to the parameter values, we included low and high values for each parameter. The difference between the low and high values should reflect the level of confidence in the values used (Table 6).

Table 6. Low and high level of values used for different parameters

	Low level (negative % change)	High level (positive % change)
Benefits to same day visitors	-50%	50%
Benefits to overnight stay visitors	-50%	50%
Benefits to longer stop over visitors	-50%	50%
Benefits from swimming pool users	-30%	30%
Benefits from children's playground and skate park	-30%	30%
Mental and physical health benefits for aged residents	-30%	30%
Mental and physical health benefits for general community (excluding aged residents)	-30%	30%
Benefits from ecological restoration with biodiversity benefit	-30%	30%
Benefits of installing indigenous artwork	-30%	30%
Public education benefit	-30%	30%
Amenity benefit through property values	-30%	30%
Flood mitigation benefit	-30%	30%
Benefits of pollution abatement in stormwater	-30%	30%
Adoption	-30%	30%
Project risks	-10%	10%
Costs	0%	30%

Results

The main evaluation metrics the BCA Tool produces are the net present value (NPV) and benefit cost ratio (BCR), which indicates whether it is worthwhile to invest in the project. If the NPV is positive or BCR is greater than one, it is assumed that it might be worthwhile to invest in the project. The tool produces results for both overall and the project organization. Given that no benefit item is attributed to council we only discuss the performance of the overall project.

Baseline outcomes

The present value of the benefit is about $15.06 million (Table 7). Adjustment for project risk and adoption bring the present value of benefit to $14.60 million. The present value of cost is $12.24 million which includes project implementation (capital and operating) and excess burden to raise funding by the Council.

At the base values the overall project seems to be beneficial. The overall net present value is $2.36 million, and the benefit cost ratio is 1.19. The NPV is immune to the assumptions related to the constrained nature of the budget. The BCR is lower 1.13 if the constrained nature of the budget is considered.

Table 7. Baseline outcome of the project

Overall BCA results	Present values	Explanation
Potential benefits	$15,055,147	(not adjusted for adoption and project risk)
Deduction	$451,654	(adjustment for adoption and project risk)
Benefits	$14,603,492	(adjusted for adoption and project risk)
Costs (total)	$12,240,343	
- Project organisation	$11,333,651	
- Other stakeholders	$0	
- Excess burden	$906,692	
Net Present Value	$2,363,149	NPV
Equivalent Annual Value	$189,625	EAV = annuity for 5% constant discount rate
Benefit: Cost Ratio (constrained budget)	1.13	BCR = (Benefits − Unconstrained costs) / Constrained costs
Benefit: Cost Ratio (unconstrained budget)	1.19	BCR = Benefits / All costs

In Figure 7 the annual and the cumulative net benefit over the analysis period has been presented which shows the initial cost of implementing the project and gradually increasing net benefits.

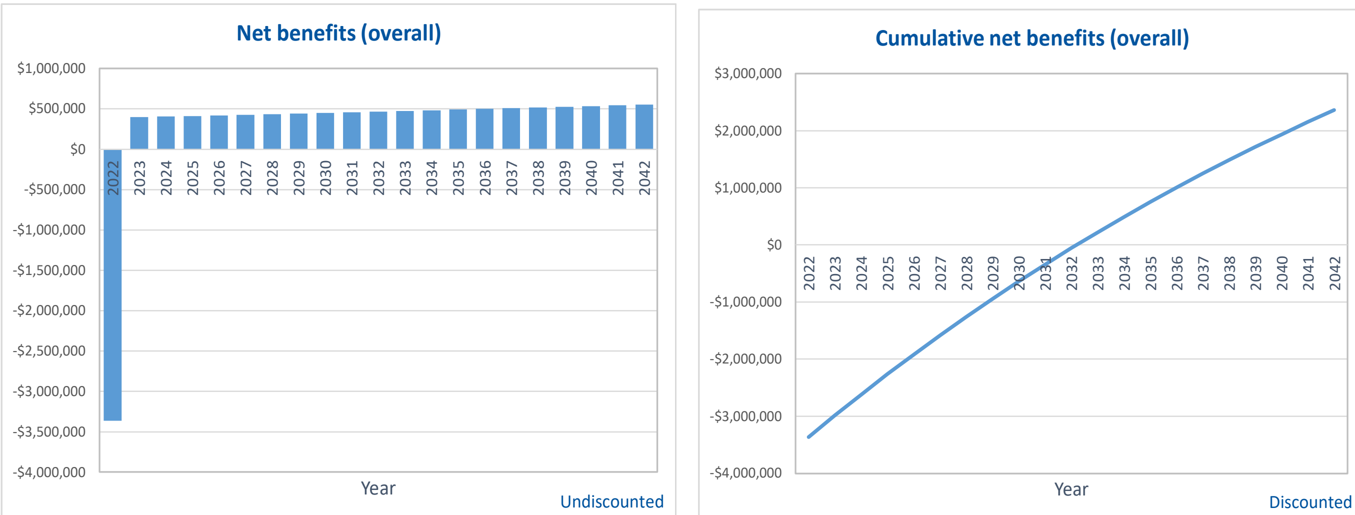


Figure 7. Evolution of net benefits

Distribution of costs and benefits

It seems the largest share of benefits is accrued to the same day visitors to the region (Table 8). They will receive around 57% of the total benefits of the project. This is followed by the benefits due to pollution abatement (21%) and benefits to longer stop-over visitors (14.22%).

Table 8. Share of benefits

Benefit	Overall	% Share
Benefits to same day visitors	8,306,396	56.88
Benefits to overnight stay visitors	117,141	0.80
Benefits to longer stop over visitors	2,076,599	14.22
Benefits from swimming pool users	3,041	0.02
Benefits from children's playground and skate park	104,510	0.72
Mental and physical health benefits for aged residents	47,092	0.32
Mental and physical health benefits for general community (excluding aged residents)	55,977	0.38
Benefits from ecological restoration with biodiversity benefit	14,523	0.10
Benefits of installing indigenous artwork	50,221	0.34
Public education benefit	293,079	2.01
Amenity benefit through property values	439,556	3.01
Flood mitigation benefit	87,752	0.60
Benefits of pollution abatement in stormwater	3,007,606	20.60
	14,603,492	100.00

Sensitivity analysis

Given the high uncertainty with input parameters it is reasonable to examine the distribution of net present value and benefit cost ratio. Based on the sensitivity analysis it could be suggested that 48% of the time the overall net present value of the project would be positive or the BCR is greater than 1 (Figure 8).

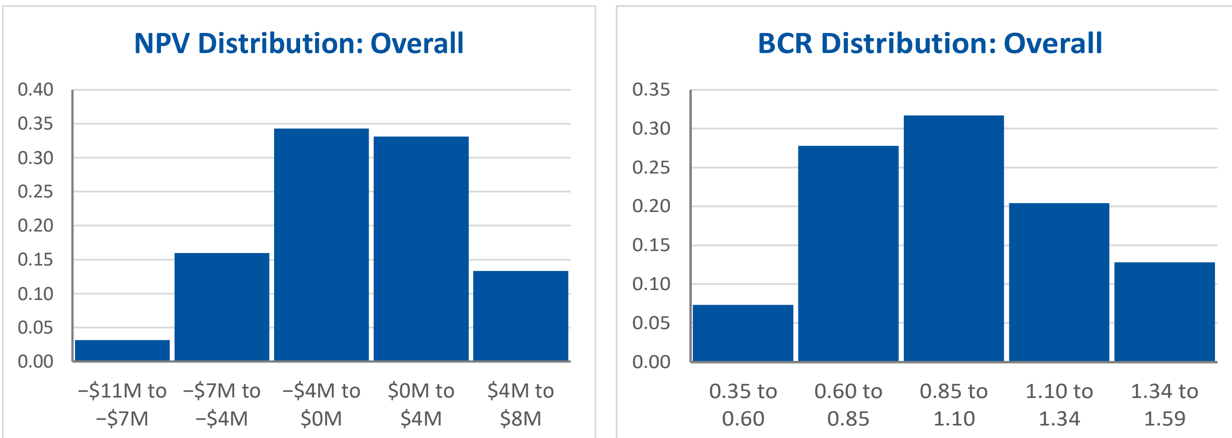


Figure 8. Distribution of overall net present value and benefit cost ratio

Another important parameter to check is the impact of discount rate. It can be seen that even with high discount rate the net present value of the project is positive (Table 9).

Table 9. NPVs and BCRs for different discount rates.

	Low discount rate	Default discount rate	High discount rate
Overall	3%	5%	7%
Benefits (present value)	$16,672,521	$14,603,492	$13,010,795
Costs (present value)			
- Project organisation	$12,151,701	$11,333,651	$10,700,893
- Other stakeholders	$0	$0	$0
- Excess burden	$972,136	$906,692	$856,071
Net Present Value (NPV)	$3,548,684	$2,363,149	$1,453,831
Benefit: Cost Ratio (constrained budget)	1.21	1.13	1.06
Benefit: Cost Ratio (unconstrained budget)	1.27	1.19	1.13

Conclusion

The rapid economic (cost benefit analysis) assessment process adopted for Beaufort Linear Project reveals several important issues that could be useful for assessing IWM projects in regional Victoria –

- IWM projects generate a wide range of benefits. Focusing on a few benefits that are easier to monetize (such as potable water savings or removal of pollutants) would lead to underestimation of the value of such projects.

- The magnitude of co-benefits could be larger than the main targets or benefits of IWM projects. For example, in this case study, tourism and visitation benefits is the largest contributor to the overall project benefit.

- The rapid assessment process demonstrated in this case study could be used to conduct a rapid appraisal of projects at a design level that is easily scalable. Such rapid but rigorous process could provide valuable information guidance before going into more detailed designing and proper cost-benefit analysis.

- Many of the projects are not beneficial to the project proponent in purely financial sense, even though the overall net benefit of the project could be positive. In such cases, project proponents might seek co-contribution/support from other agencies (such as DEWLP) and form partnerships with other agencies.

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Water Sensitive Cities Australia

PO BOX 8000 Monash University LPO,
Clayton, VIC 3800, Australia

watersensitivecities.org.au

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