



Values Assessment

Tuckean Swamp Implementation Toolkit

OzFish Unlimited

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→ The Power of Commitment

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1. Introduction

1.1 Purpose of this report

GHD Pty Ltd (GHD) has been engaged by OzFish Unlimited on behalf of the Tuckean Steering Committee (Committee) to prepare an implementation toolkit, including design and costing of infrastructure changes and ongoing maintenance costs, a comprehensive values assessment, landholder incentives/change options, for the management options identified in the Tuckean Swamp Options Study (Water Research Laboratory, 2020). The overarching aim of the Tuckean Swamp Options Study was to provide options to assist in restoring hydrological function and water quality within the Tuckean Swamp project area at Bagotville, NSW.

This implementation toolkit will produce information that will inform the decision-making process for key stakeholders, as well as provide information that can be utilised in further consultation with landholders and the broader community. The information will form an integral part of the decision-making framework regarding the long-term management of the Tuckean Swamp.

The engagement includes the following key deliverables:

- A report detailing the design and costing of the preferred options from those outlined in the Options Study (Water Research Laboratory, 2020).
- A values assessment which utilises desktop information already available, along with targeted, high level community and agency engagement to determine the relative value of each option (from the Options Study and Design and Cost Report) from an environmental, economic (including agricultural) and social perspective (this report).
- A toolkit for change that should include wide, varied, and innovative options for creating land use change, wherever it may be necessary, in the Tuckean catchment.

This report addresses the second deliverable outlined above.

1.2 Scope and limitations

This report: has been prepared by GHD for OzFish Unlimited and may only be used and relied on by OzFish Unlimited for the purpose agreed between GHD and OzFish Unlimited as set out in Section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than OzFish Unlimited arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

GHD has prepared this report on the basis of information provided by OzFish Unlimited and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Project context

Tuckean Swamp is a 6,000-hectare low-lying floodplain located approximately 25 kilometres upstream from Ballina on the Richmond River¹.

Prior to European settlement in Australia, the swamp constituted a significant wetland in the lower Richmond floodplain. It was linked tidally to the Richmond River by the Tuckean Broadwater, as well as fed by freshwater runoff from its upper catchment. Historically, it was an open freshwater swampland with mangrove and saltmarsh areas influenced by the tides, while more elevated areas were heavily wooded². The swamp was once home to a rich variety of species of flora and fauna, as well as ecologically important for fish production³.

The area around Tuckean Swamp shows evidence of Bora rings and cave drawings, confirming Aboriginal use and habitation in the swamp and surrounding area prior to European settlement⁴. Indeed, the area forms an important part of the landscape for the local Traditional Owners of the land, particularly the Ngyabul and Widjabul People of the Bundjalung Nation, who have an interest in the area and the Tuckean Nature Reserve that constitutes a section of it⁵. Their use of, and engagement with, the swamp is believed to date back at least 6,000 years⁶.

The first European occupants of land in and around Tuckean Swamp were timber cutters in the 1840s, who were soon followed by pastoral squatters who introduced grazing, dairy farming, as well as sugar cane and other crop production to the area⁷. This increased agricultural development led, in the 1880s, to the beginning of drainage works that enabled the rapid discharge of floodwaters from the area, to limit the impact of flooding and to protect crops⁸. However, while they were widely supported by farmers as they increased yields, these drainage works also significantly negatively impacted the natural environment of Tuckean Swamp⁹.

Drainage of the swamp intensified with the completion of the Tuckean Swamp drainage scheme in 1915, and so did the impact on the natural environment¹⁰. Perhaps most importantly, drainage meant that the once boggy swamps became largely dry land, which lowered the water table and increased the exposure of acid sulfate soils (ASS). This increased exposure of ASS meant that any time there has been heavy rainfall, acidic runoff flowed into the drains which then went on to contaminate the groundwater. This ecological process was recorded as resulting in environmentally destructive pH levels of as low as 2 and 3, on occasion¹¹.

In 1971, another major drainage work, the Bagotville Barrage, was completed, comprising of large culverts with one-way floodgate flaps to not only enable greater drainage but also block tidal waters and backwater flooding. While the Bagotville Barrage has facilitated further agricultural development for predominantly grazing and sugar cane industries, it has also resulted in further environmental degradation. Alongside worsening issues with ASS and acidified water in the swamp, low-oxygen water (or 'blackwater') runoff has occurred that is harmful to native flora and fauna¹². The acidic environment has had a significant impact on aquatic productivity and is a key source of 'blackwater', which has led to major fish kills¹³. The Bagotville Barrage's exclusion of tidal flows into Tuckean Swamp also resulted in the loss of estuarine habitat and the substantial restriction of fish migration both in and out of the swamp¹⁵.

¹ S Rayner, AJ Harrison, and WC Glamore. 2020. *Tuckean Swamp Hydrologic Options Study*. Manly Vale: UNSW Water Research Laboratory.

² KH Taffs, LJ Farago, H Hejnis, and GE Jacobsen 2008, 'A diatom-based Holocene record of human impact from a coastal environment: Tuckean Swamp, eastern Australia', *Journal of Paleolimnology*, vol. 39, no. 1, pp. 71-82.

³ E Cook. 2022. 'Storylines: Return of the ginibii'. *Echo*. <https://www.echo.net.au/2022/03/storylines-return-of-the-ginibii/>.

⁴ JG Steele. 1994. *Aboriginal Pathways in Southeast Queensland and the Richmond River*. Brisbane: University of Queensland Press.

⁵ C Wolf. 2002. *Tuckean Nature Reserve Plan of Management*. Parramatta: NSW National Parks and Wildlife Service.

⁶ R Heron. 1996. *Brief for an Aboriginal Heritage study of Tuckean Swamp*. Richmond River County Council, Report 5.

⁷ Taffs et al., 2008. *Op cit*.

⁸ Rayner et al. 2020. *Op cit*.

⁹ E Smith and J Baldwin. 1997. *A landuse history of Tuckean Swamp*. Richmond River County Council, Report 6.

¹⁰ Taffs et al., 2008. *Op cit*.

¹¹ J Sammut, I White, and M Melville. 1996. 'Acidification of an estuarine tributary in eastern Australia due to drainage of acid sulphate soils'. *Marine and Freshwater Research*, vol. 47, no. 5, pp. 669-684.

¹² Rayner et al. 2020. *Op cit*.

¹³ S Walsh, C Copeland, and M Westlake. 2004. *North Coast Fish Kills – Issues, Causes and Management Responses*. NSW Fisheries Final Report Series No. 68.

¹⁵ Taffs et al., 2008. *Op cit*.

In 2003, the condition of Tuckean Swamp was summarised as being that of ‘a low-lying ASS backswamp ... which has been extensively drained for agriculture and has chronic acid drainage water problems’¹⁷. Since then, although minimal tidal flushing was introduced in 2002, numerous studies continue to find high levels of ASS in the water system, with the *Tuckean Swamp Options Study* (Water Research Laboratory, 2020) concluding that ‘the Tuckean floodplain [is] ... one of the worst acid sulphate soil affected areas in NSW’, and that ‘poor water quality from the Tuckean region continues to be an ongoing issue’¹⁸.

Visitation to Tuckean Swamp and the associated nature reserve has historically been minimal, with only low levels of canoeing and bird watching taking place. Visitation is likely impacted by both restricted public access due to private properties in the area, as well as the limited fauna offering following the completion of the barrage²⁰.

¹⁷ S Johnston, F Kroon, P Slavich, A Cibalic and A Bruce. 2003. *Restoring the balance: Guidelines for managing floodgates and drainage systems on coastal floodplains*. Wollongbar, NSW Agriculture.

¹⁸ Rayner et al. 2020. *Op cit*.

²⁰ Wolf. 2002. *Op cit*.

3. Methodology

3.1 Aim

The aim of this values assessment is to review the different values of the Tuckean Swamp and compare management options (identified in the Tuckean Swamp Options Study (Water Research Laboratory, 2020)) to identify which option provides the best possible outcome for water quality against other environmental, cultural, social and economic changes that would occur as a result of implementing the option.

3.2 Stakeholder engagement

Engagement with landowners and the community regarding the management options for Tuckean Swamp has been ongoing since 2017. Key activities include:

- An 1800 number was established by OzFish in 2018 to act as a 'hotline' for any and all enquiries regarding the Tuckean Swamp project. This line is still operational.
- Drop-in information sessions were held in 2018.
- A project website was established and maintained by OzFish from 2018. All reports are published to this website.
- Project update information sheets were mailed to all landholders regularly at key milestones from 2018 to 2021.
- Presentations were made to the Tuckean Landholders Association on two occasions and several meetings were held with key representatives of the Association in 2018 and 2019.
- A presentation was made to Rotary Lismore regarding the project in 2021.
- Regular correspondence via letters and emails is maintained with the Tuckean Landholders Association.

Key messages from the engagement described above include:

- Landholders felt that the economic value of the land for agriculture was not being well represented or understood by the committee and suggested a Landholder Economic Study be conducted and compensatory measures for lost value be determined.
- Landholders have both encouraged and discouraged direct consultation with them during engagement for the project.
- Landholders advise they are successfully grazing (albeit with lower stock numbers) on swamp grasses such as *Persicaria* sp. and other native pasture species in wetter areas, managed under tea trees (*Melaleuca* sp.) so that grasses do not die out when wet and are protected during hot/dry weather.
- Generally not in favour of any changes that might change the careful native pasture balance they have been working to achieve over the past 10 or so years.
- Tuckean landholders have a range of businesses including breeding animals, farm stays, grazing, cane, macadamias and other home-business opportunities.
- An ex Dungarruba/Tuckean landholder commented that he knew his father made grave errors in digging drains right through the area back in the 1940s and 1950s. Agreement that not ALL drains on the floodplain were a problem.
- Landholders have noticed the smell of sulfates when cleaning drains and noted that nothing grows on/in the spoil for at least a few years, if not longer.
- Landholders are open to buy-out or compensatory payments.
- Landholders are open to looking at options such as additional building entitlements/subdivision as incentive for change on higher parts of their property.
- Criticism for lack of follow up from trials of management solutions in the past that only moved the scalded areas further back in the system and on to broader areas.
- Requested review of poorly functioning drains.
- Meerchaum Vale Drain not being maintained well enough, backing up and damaging cane.

- Concern over making cane lands wetter.
- Most landholders supportive of the project and have offered access to their properties, only two refused.
- Some critical that looking only at water quality was not a wholistic enough view and other environmental positives should be considered.
- Bird watchers from Alstonville very interested to share their data, bird and bird watching values.
- Concern over impact to cane properties.
- Concern over impact to macadamia properties, particularly as there has been large local investment in these recently.
- Concern about impact to productive lands raised by a number of landholders, especially grazing properties.
- General issues with wild dogs and lantana / weeds mentioned.
- Leaking gates, leaky drains, and maintenance all raised as concerns.

3.3 Multi-criteria assessment

To complete the values assessment and compare the options for improving water quality in the Tuckean Swamp, GHD undertook a multi-criteria assessment (MCA). The MCA involved the following key steps undertaken during a workshop held with the Tuckean Steering Committee on 20 September 2022:

- Key values of the study area were identified and described (see Section 4).
- Management options were defined based on those described in Tuckean Swamp Options Study (Water Research Laboratory, 2020) and the Design and Cost Report (GHD 2022) (see Section 5).
- The impact of the implementation of each option on the identified values was scored by the workshop attendees (see Section 6.1).
- Additional input was provided by OzFish regarding less obvious changes that would occur under the different options and scores were refined.
- Options were ranked based on the scores assigned in the workshop (see Section 6.2). Scores and ranking were mathematically calculated in a GHD template developed in Microsoft Excel® by the GHD Advisory team (see Appendix A).

This process is depicted in Figure 3.1.

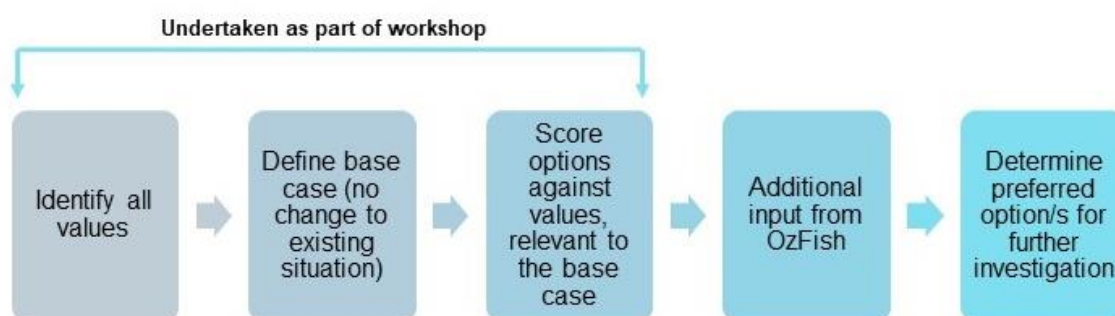


Figure 3.1 Values assessment methodology

The workshop was attended by the following members of the Tuckean Steering Committee and GHD:

- Cassie Price and Sophie Pryor – OzFish
- Max Osbourne – Department of Primary Industries – Fisheries
- Damien Hofmeyer – National Parks and Wildlife Service
- Chrisy Clay, Greg Telford and Brenda Ford – Rous County Council
- Chris Binge – Jali Local Aboriginal Land Council
- Suzanne Acret – Department of Planning and Environment
- Leonie Walsh – Lismore City Council
- Sarah Cuthbertson – Ballina Shire Council
- Nigel Blake – Local Land services
- Lisa King, Georgia Pelling and Jamie Bernardi – GHD

4. Values identified

Values were identified in consultation with the Tuckean Steering Committee at the values assessment workshop. Values identified are based on the professional opinions of the workshop attendees. Workshop attendees were chosen for their considerable experience and expertise in the study area to ensure outcomes reflect current knowledge and understanding of the Tuckean Swamp.

Landowner values were extracted from the extensive stakeholder engagement completed to date (see Section 3.2). These values were included with those identified for this values assessment and include:

- Productive grazing land
- Native pastures grazing land
- Necessary / emergency grazing land during dry times
- Productive cane land
- Productive macadamia land
- Area that provides them enough land for small home-business opportunities
- Area that provides them the opportunity to consider subdivision or additional housing on their properties
- Environmental values outside of just what is in the water (terrestrial values)
- Bird watching recreational area

Values were identified across four broad categories, namely:

- Environmental
- Social
- Cultural
- Economic.

The identified values are described in Table 4.1.

Table 4.1 Values identified

Category	Value	Description
Environmental	Restoration of ecosystems health for cultural use	The extent to which the option improves the health of the ecosystem such that it enables increased cultural use.
	Water quality (in Tuckean Swamp)	The extent to which the option reduces acidity from ASS in Tuckean Swamp.
	Water quality (in surrounding waterways)	The extent to which the option reduces acidity from ASS in downstream waterways.
	Fauna number and diversity	The extent to which the option effects the number and diversity of the fauna species in Tuckean Swamp and surrounding waterways.
	Holistic value of the land	The extent to which the option improves the holistic value of the land, recognising the important role that the Tuckean Swamp plays in the biodiversity of the area and wider natural environment.
	Resilience and resistance to disturbance	The extent to which the option improves the resilience and resistance of the Tuckean Swamp and surrounding ecosystems to environmental disturbances and shocks.
	Vegetation diversity	The extent to which the option improves the diversity of vegetation in Tuckean Swamp and surrounding waterways.
	Restoration of mangroves and salt marsh	The extent to which the option restores the mangroves and salt marshes in Tuckean Swamp and surrounding waterways.
	Groundwater quality and quantity	The extent to which the option improves the quality and quantity of groundwater water in the Tuckean Swamp.
	Soil health	The extent to which the option improves soil health on the land in the Tuckean Swamp area.

Category	Value	Description
Social	Indigenous wellbeing	The extent to which the option will enhance Indigenous wellbeing.
	Recreational use	The extent to which the option impacts the recreational use value of Tuckean Swamp and surrounding waterways, for example as a fishing or boating destination.
	Access to natural space for local community	The extent to which the option impacts the ease of access to Tuckean Swamp and surrounding waterways for locals in the Northern Rivers region, and broader NSW community.
	Lifestyle value	The extent to which the option impacts the lifestyle of the local community by providing a non-monetary value through enabling them to live the lifestyle they want.
	Access and egress in floods	The extent to which the option impacts access and egress through the Tuckean Swamp during floods.
	Respect for the story of the Tuckean	The extent to which the option restores the Tuckean Swamp to its natural state, respecting the history and story of the area.
Cultural	Restoration of Indigenous culture	The extent to which the option restores Indigenous cultural values associated with the Tuckean Swamp.
	Presentation of non-Indigenous culture	The extent to which the option impacts the value of Tuckean Swamp and surrounding waterways for non-Indigenous (i.e., European) cultural use.
	Rural identity	The extent to which the option preserves rural identifies associated with the area (e.g. intergenerational ties to land and farming)
Economic	Agricultural productivity value of land	The extent to which the option impacts the agricultural productivity and profitable productive capacity of surrounding land.
	Tourism value	The extent to which the option impacts the ability of Tuckean Swamp and surrounding waterways to generate an economic benefit through tourism.
	Indigenous opportunities	The extent to which the option increases opportunities for Traditional Owners to engage with/manage the land (e.g. monitoring, care, management, experiences).
	Flood mitigation	The extent to which the option impacts the flood mitigation capacity of Tuckean Swamp and surrounding waterways, with secondary economic effects such as reduced flood damage.
	Conservation economic value	The extent to which the option impacts the ability of Tuckean Swamp to reduce the amount of greenhouse gasses in the atmosphere, by acting as a carbon sink.
	Commercial fish production	The extent to which the option may enable commercial fish production in Tuckean Swamp and surrounding waterways.
	Ongoing sustainability of infrastructure	The extent to which the option delivers sustainable infrastructure, that reduces operational and maintenance activities.

5. Options considered

Options considered as part of the values assessment were those identified in Tuckean Swamp Options Study (Water Research Laboratory, 2020) and further defined in the Design and Cost Report (GHD 2022). A summary of the options and their implications are provided in Table 5.1.

Table 5.1 Options considered

Option	Overview	Implications
Base case	No change to current operation	<ul style="list-style-type: none"> – Current situation
Option 1	Reshaping of major drains in the north-eastern corner of the floodplain (Slatteries, Meerschaum Vale and Jumbo Drains)	<ul style="list-style-type: none"> – Shallowing and widening out drains so that invert levels are higher – Would somewhat reduce ASS generation into waterways, potentially improving water quality and fauna number and diversity – Reduce the likelihood of blackwater events
Option 2	Weir implementation at the downstream end of Meerschaum Vale Drain	<ul style="list-style-type: none"> – Installation of weir structure to increase surface and groundwater elevations – Would reduce acidic discharge into nearby drains but also result in longer periods of wet landscape, potentially impacting on agricultural use
Option 3	Alternative management of barrage sluice gates during dry periods	<ul style="list-style-type: none"> – Management option that looks at different opening strategies for the existing sluice windows during dry periods <p>Scenario 3a is the current base case.</p> <ul style="list-style-type: none"> – Would buffer acidity during dry periods and may be beneficial for fauna and vegetation diversity – Would result in tidal inundation of some areas upstream, reducing agricultural use and changing the ecology of the Tuckean Nature Reserve – Would have significant ongoing maintenance implications as gates would need to be closed during wet periods
Option 4	Hinging open the Bagotville Barrage	<ul style="list-style-type: none"> – Hinging open all the flood gates on the Bagotville Barrage – A large portion of the Tuckean Swamp would return to tidal, brackish water state reducing acidity and improving outcomes for estuarine fauna and vegetation – Would result in tidal inundation of some areas upstream, reducing agricultural use and lifestyle value – New infrastructure is required to hinge open the floodgates, which would then have ongoing maintenance and operation implications
Option 5	Reshaping of drains (as per Option 1), but encouraging small catchment flows onto the floodplain	<ul style="list-style-type: none"> – As per option 1 – Would result in water more frequently being pushed overland, reducing the agricultural use
Option 6	Hinging open the Bagotville Barrage, and installing structures on the boundaries of Tuckean Nature Reserve on all the major drains	<ul style="list-style-type: none"> – Hinging open all the flood gates on the Bagotville Barrage and installing upstream tidal gates and levees – A portion of the Tuckean Swamp would return to tidal, brackish water state reducing acidity and improving outcomes for estuarine fauna and vegetation – Additional structures would reduce some negative impact on private land that occurs in Option 4, however some agricultural land would be impacted and the ecology of the Tuckean Nature Reserve would still be changed – Significant new infrastructure required which will have on-going maintenance and operation implications

6. Values assessment

6.1 Scoring

To determine which option, on balance, results in the best possible outcome for water quality against other environmental, cultural, social and economic changes that would occur as a result of implementing the option, options were scored against each value. Scoring was considered relative to the base case (no change in current situation). Options were assigned a score between -2 and 2, where:

- A score of -2 suggests the option is likely to have a significant net negative impact on the value, relative to the base case.
- A score of -1 suggests the option is likely to have a net negative impact on the value, relative to the base case.
- A score of 0 suggests the option is likely to have little to no net impact on the value, relative to the base case.
- A score of 1 suggests the option is likely to have a net positive impact on the value, relative to the base case.
- A score of 2 suggests the option is likely to have a significant net positive impact on the value, relative to the base case.

6.2 Results

On balance, all the options assessed were determined to improve the overall condition of Tuckean Swamp, relative to the base case. Generally, options enhance the natural and cultural values of the area (respect for the story of the Tuckean, water quality, fauna, and vegetation diversity etc), however most also result in a reduction in the agricultural use of the land due to tidal inundation.

A summary of the results of the values assessment is provided in Table 6.1. Capital costs for each option as presented in the Design and Cost Report (GHD, 2022) are also included. However, cost was not identified as a value when scoring the options. A detailed copy of the MCA values assessment is provided in Appendix A.

Table 6.1 Results of values assessment

Option	Overview	Score	Ranking	Indicative cost
Base case	No change to current operation	0	6	-
Option 1	Reshaping of major drains in the north-eastern corner of the floodplain (Slatteries, Meerschaum Vale and Jumbo Drains)	0.08	4	\$2.3 M
Option 2	Weir implementation at the downstream end of Meerschaum Vale Drain	0.04	5	\$0.4 M
Option 3	Alternative management of barrage sluice gates during dry periods	0.31	3	-
Option 4	Hinging open the Bagotville Barrage	0.58	2	\$0.4 M
Option 5	Reshaping of drains (as per Option 1), but encouraging small catchment flows onto the floodplain	0	6	\$2.6 M
Option 6	Hinging open the Bagotville Barrage, and installing structures upstream of the Tuckean Nature Reserve on all the major drains	0.73	1	\$1.9 M

The values assessment undertaken herein identifies the options that provide the greatest overall benefit when compared to the negative impact associated with implementing them.

Ultimately, the values assessment found that Option 6, on balance, provides the best possible outcome for water quality for the Tuckean Swamp. It is recommended that Option 6 is investigated further, alongside Option 4 (given Option 4 also scored relatively highly and has a significantly lower cost).

7. References

- E Cook. 2022. 'Storylines: Return of the ginibii'. Echo. <https://www.echo.net.au/2022/03/storylines-return-of-the-ginibii/>.
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- Water Research Laboratory. (2020). Tuckean Swamp Hydrologic Options Study.
- C Wolf. 2002. Tuckean Nature Reserve Plan of Management. Parramatta: NSW National Parks and Wildlife Service.

Appendix A

Values assessment

Tuckean Swamp - Values Multi Criteria Assessment

Category	Values	Base Case - no change	Scenario 1 - Reshaping of major drains in the north-eastern corner of the floodplain	Scenario 2 - Weir implementation at the downstream end of Meerschaum Vale Drain	Scenario 3 - Alternative management of barrage sluice gates including dry periods	Scenario 4 - Hinging open at Bagotville Barrage	Scenario 5 - Reshaping the drains (as per S1), but encouraging small catchment flows onto the floodplain	Scenario 6 - Hinging open the Bagotville Barrage, and installing structures upstream of the Tuckean Nature Reserve on all the major drains
		Score (-2 - 2)	Score (-2 - 2)	Score (-2 - 2)	Score (-2 - 2)	Score (-2 - 2)	Score (-2 - 2)	Score (-2 - 2)
Environmental	Restoration of ecosystems health for cultural use	0	0	0	1	2	0	2
	Water quality (in Tuckean Swamp)	0	1	1	1	2	1	2
	Water quality (in surrounding area)	0	0	0	2	2	0	2
	Fauna number and diversity	0	1	0	1	2	1	2
	Holistic value of the land	0	0	0	0	0	0	0
	Resilience and resistance to disturbance	0	1	1	2	2	1	2
	Vegetation diversity	0	0	0	1	2	1	2
	Restoration of mangroves and salt marsh	0	0	0	1	2	0	2
	Ground water quality and quantity	0	0	0	0	1	0	1
	Soil health	0	0	0	0	1	0	1
Social	Indigenous wellbeing	0	0	0	1	1	0	1
	Recreational use	0	0	0	0	1	0	1
	Access to natural space for local community	0	0	0	0	1	0	1
	Lifestyle value	0	-1	0	-1	-2	-1	0
	Access and egress in floods	0	0	0	-1	-1	-1	-1
	Respect for the story of the Tuckean	0	0	0	1	2	0	1
Economic	Agricultural value of land	0	-1	-1	-1	-2	-2	-1
	Tourism value	0	0	0	1	1	0	1
	Indigenous opportunities	0	0	0	1	1	0	2
	Flood mitigation	0	0	0	-1	-2	0	-2
	Conservation economic value	0	1	1	1	2	1	2
	Commercial fish production	0	1	1	1	2	1	2
	Ongoing sustainability of infrastructure	0	0	-2	-2	-2	0	-2
Cultural	Restoration of Indigenous culture	0	0	0	1	1	0	1
	Presentation of non-Indigenous culture	0	-1	0	-1	-2	-2	-1
	Rural identity (intergenerational ties to land and farming)	0	-1	0	-2	-2	-1	-2
TOTAL		0	0.08	0.04	0.31	0.58	0.00	0.73
		6	4	5	3	2	6	1
Construction cost (excl. contingency, escalation etc)		\$ -	\$ 2,260,000.00	\$ 369,000.00	\$ -	\$ 396,000.00	\$ 2,629,000.00	\$ 1,933,000.00

Rating scale - Negative and positive impacts of an option

- 2 Likely to have a negative net impact on a criteria
- 1 Likely to have a negative net impact on a criteria
- 0 Likely to have little to no net impact on a criteria
- 1 Likely to have a positive net impact on a criteria
- 2 Likely to have a significantly positive net impact on a criteria



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