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Final Written Report

EcoShores

Site Profile Framework for Assessing Trade-offs and Co-benefits of Coastal Wetland Conservation and Restoration Opportunities in Auckland.

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Executive Summary

Auckland is a large coastal city in New Zealand that faces significant threats from coastal hazards such as erosion, inundation, and flooding. Nature-based solutions (NbS) are one approach to climate adaptation that have the potential to mitigate these coastal hazards while creating benefits for local communities. This report specifically examines coastal wetlands such as mangroves, saltmarshes, and seagrass as potential NbS in the Auckland region. However, due to the relative novelty of NbS, the holistic impact they have on their surrounding community is not always considered. Coastal wetlands can impact environmental, social, and economic dimensions in the areas they exist and can create both benefits and trade-offs. Understand how these benefits and trade-offs interact can provide guidance to existing projects and give project proponents evidence to support conservation and restoration actions. For example, blue carbon storage is an environmental service that a wetland provides which can be easily quantified to support a project. However, local community dynamics can impact the effectiveness of the services created by coastal wetlands and may prevent projects from being implemented. We created a framework to explore the trade-offs and co-benefits of coastal wetland conservation and restoration projects to assist decision makers and community members with understanding how these projects can impact their communities. Additionally, we examined the importance for project proponents to engage with local communities before attempting a conservation or restoration project. In doing so, this report highlights a key gap in coastal wetland NbS research – that diverse co-benefits and trade-offs are not always examined – and proposes one structured approach to help project proponents understand the impacts coastal wetlands have on their surrounding environments.

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Introduction

Auckland is a coastal city on New Zealand's North Island. The county's largest urban area, it faces challenges from coastal climate hazards. Climate change is leading to increased sea level rise (Biswell, 2016) and challenges such as flooding, coastal erosion, and permanent inundation threaten many low-lying areas (Stephens et al., 2021). To help combat these challenges and protect local communities, climate adaptation strategies are needed.

Nature-based solutions (NbS) are one approach to climate adaptation that have the potential to reduce risks to public infrastructure while supplying societal benefits commonly referred to as ecosystem services (Mathieu et al., 2026). The International Union for Conservation of Nature (2016) defines NbS as "actions to protect, sustainably manage and restore natural and modified ecosystems in ways that address societal challenges effectively and adaptively, to provide both human well-being and biodiversity benefits" (p.2). This definition highlights the interconnected nature of NbS, emphasising their environmental impacts while incorporating human well-being. NbS are attractive solutions to many environmental challenges due to their creation of these co-benefits. For example, many NbS are chosen for a tangible purpose such as carbon sequestration, but they may also create wildlife habitat, help with flood mitigation, provide recreation space and other social benefits (do Amaral Camara Lima et al., 2023; Mathieu et al., 2026; Seddon et al., 2020).

This report specifically examines the potential of coastal wetlands to act as NbS in the Auckland region. Coastal wetlands include mangroves, salt marshes, and seagrass (Cinar et al., 2024) and can act as NbS, storing carbon and providing other benefits such as coastal protection, interception of nutrient runoff, and habitat for numerous species (Hagger et al., 2024). Additionally, in Auckland these environments often feature walking paths or boardwalks creating recreation space and the opportunity for residents to connect with nature (Auckland Council, 2026). These projects have the potential to provide numerous benefits, but the design of NbS must be adapted to local conditions or they may not support community resilience (Seddon et al., 2020).

When implementing projects, NbS face challenges compared to traditional engineered approaches. As a relatively new concept, it can be difficult identifying long term successful NbS projects to support new proposals (Collier, 2021) and best design practices are also still being explored. For example, a recent study found that NbS funded with market-based approaches may target affluent areas, undermining the equitable benefits inherently found in NbS projects (B. Hill et al., 2025). Existing NbS studies often focus on a handful of benefits provided by projects but miss capturing the broad swath of co-benefits these projects create. For example, in a review of ecosystem services provided by seagrass ecosystems, do Amaral Camara Lima et al. (2023) found that most studies focus on services such as carbon storage, habitat creation, and food production, but miss social impacts and disease regulation. In another project, Francis et al. (2011) conduct a life cycle analysis of wetlands to evaluate their cost effectiveness at protecting infrastructure, but did not include the costs of carbon storage which they stated could improve the economic argument for wetland projects. Without capturing the full picture of these impacts, key design considerations may be missed challenging the ability of practitioners to tailor NbS to local conditions and communities. Additionally, missing essential co-benefits in NbS analysis may make it difficult to convince decision makers a project is worthwhile (Martin et al., 2025). Without proper understanding of local conditions, NbS can have the opposite of their intended effect, creating land use conflict, harming native biodiversity, and releasing carbon instead of storing it (Mathieu et al., 2026).

When targeting environmental, social, and economic dimensions – key aspects of NbS projects – conflicts may arise (de Magalhães et al., 2019). While NbS create co-benefits, project proponents may need to identify trade-offs when deciding which aspects to emphasize in the design of a project. For example, if blue carbon storage is the primary goal of a project, it might be desirable to promote mangrove and saltmarsh spread across a coastal area. However, if a community relies on that coast for amenities such as a public beach then locals may not support complete mangrove spread over the area. While this is a simplistic example, it serves to show that diverse interests may come into conflict when exploring NbS projects and make implementation difficult.

To help overcome these challenges, this paper aims to provide practitioners and local communities with a tool they can use to capture key information relevant to a project and understand the trade-offs that may be created by a coastal wetland NbS. Given the relative recency of the employment of NbS, more work is needed to understand factors impacting local communities and how they interact with NbS. As a result, the purpose of this tool is descriptive not prescriptive. It does not try to suggest where conservation or restoration projects should be implemented, but instead to provide a structured approach to guide thinking about the vast co-benefits or drawbacks NbS can create. To increase the accessibility of the tool, it relies on open-source data and field observations so that local governments, non-governmental organizations (NGOs), or local community members could use it to identify trade-offs create by coastal wetland projects.

Portfolio of Works

Methods

This research followed a mixed-methods case study methodology, creating a tool to capture qualitative and quantitative data to assist in the creation of site profiles for potential wetland conservation and restoration sites.

First, a literature review was conducted examining research targeting NbS and coastal wetland restoration paying specific attention to work conducted in New Zealand. This project relied on existing literature due to the tight timeframe of a 12-week research project. From this review, key criteria were chosen to include in the framework. The framework was built in Microsoft Excel and identifies trade-offs and benefits based on information input into the template. See Appendix B for framework application examples.

Following a case study methodology, three research sites were chosen in consultation with the project supervisor. These sites were chosen to support unique applications of the framework. Multiple case study sites were included for independent applications of the framework, reinforcing the project's validity (Yin, 2014). These sites are geographically spread across the Auckland urban area with one each located in the north, central, and south parts of the city.

Table 1: Case Study Sites

	Tuff Crater	**Hobson Bay**	**Māngere Inlet**
Local board	Kaipātiki local board, north Auckland.	Ōrākei local board, central Auckland.	Māngere-Ōtāhuhu local board, south Auckland.
Description of area (Auckland Council, 2026)	Contains coastal mangroves through 530ha reserves and walkways.	Contains coastal mangroves and a popular walkway along the main basin.	Contains mangroves and other coastal wetlands. Surrounded by industrial areas.
Demographics (Stats NZ, 2026)	95,600 people with a median income of $50,000 and 64% homeownership.	86,800 people with a median income of $58,000 and 68.6% homeownership.	85,900 people with a median income of $34,700 and 40.8% homeownership.

The student researcher conducted site visits to apply the framework to each site and create profiles. These visits included the collection of photographs, written observations, and the criteria specified in the framework. Once these site profiles were completed, they were examined to identify key trade-offs relevant to local communities. The framework was then revised based on these results to complete one iterative cycle of design, testing, evaluation, and revision.

Figure 1 outlines the process to apply the framework to a site. The purple boxes include detailed instructions to fill out the framework spreadsheet. The light blue boxes provide a flowchart pathway to interpret the results output by the framework. Finally, the red, yellow, and green boxes follow a stoplight model where they suggest to the project proponent that a given site may be likely good (green), need to be further evaluated in great detail (yellow) or return to the conceptualization stage (red).

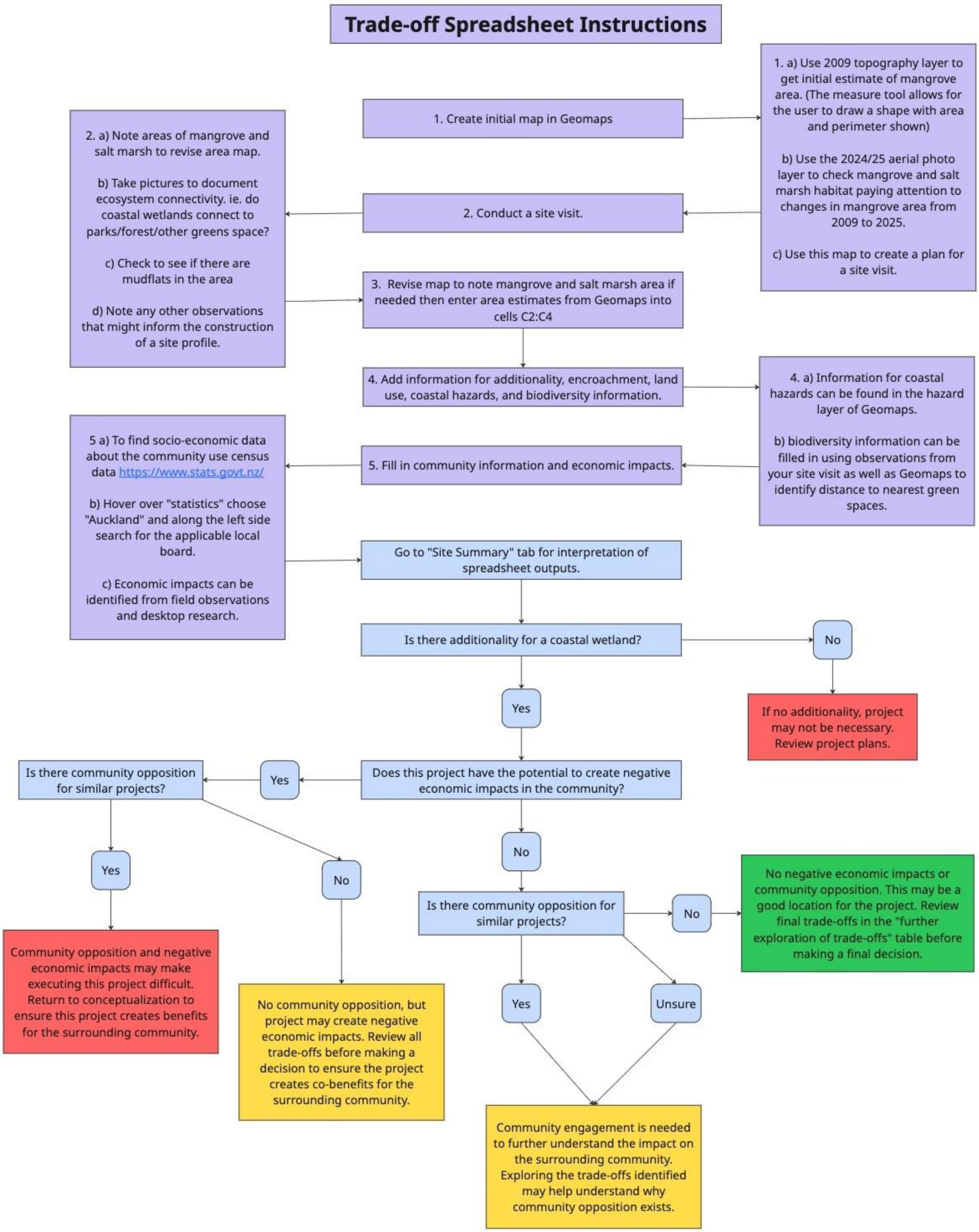

Figure 1: Framework Application Instructions and Flowchart

Overview of Framework Criteria

This section outlines the criteria included in the framework, providing a rationale for the inclusion of each point. For a concise table summary of this information please see Appendix A.

Type of Coastal Wetland

The first point of the framework identifies the type of coastal wetland present. Mangroves, salt marshes, and seagrass are included in this analysis as they each provide significant ecosystem services in coastal areas.

Mangroves are contested ecosystems in Auckland, with some residents viewing them positively while others view them negatively (Dencer-Brown et al., 2019). New Zealand is home to one mangrove species, *Avicennia marina* and they are found exclusively on the North Island (Morrisey et al., 2010). Temperate mangroves found in New Zealand are generally less productive than those found in tropical regions, but still provide ecological value (Morrisey et al., 2010). Mangroves help protect coastlines, store carbon, purify water, and create wildlife habitat (Dencer-Brown et al., 2020; Morrisey et al., 2010; Suyadi et al., 2019). New Zealand is also one of the few places in the world mangrove habitat is expanding. Sedimentation in estuaries replaces sand tidal flats creating conditions for mangroves to grow (Lovelock et al., 2007; Morrisey et al., 2010; Suyadi et al., 2019). However, these benefits are not always recognised by the public and expansion may be opposed by community groups (Dencer-Brown et al., 2019).

The second ecosystem explored here are salt marshes. These are vegetated ecosystems found in coastal areas with over 215 plant species in New Zealand (Ross et al., 2024). They provide climate adaptation benefits preventing coastal erosion and can shift overtime with rising sea levels (Cinar et al., 2024). Unlike mangroves, salt marshes are not expanding. Historical land use changes have led to the filling and draining of salt marshes, threatening this essential ecosystem (Ross et al., 2024). Additionally, numerous environmental factors are leading to mangroves encroaching on salt marshes (Kelleway et al., 2016). Finally, despite the challenges they face, restoration of salt marshes can be cheaper than other coastal wetlands as it primarily involves restoring seawater to the land (Ross et al., 2024).

The third ecosystem included in this study are seagrass meadows. One native species *Zostera muelleria* is found in New Zealand's coastal areas (Matheson et al., 2009). They are intertidal, exposed depending on the tide level, and face challenges from failing water quality (Matheson et al., 2009). Other threats include degradation from sediment and nutrient inputs as well as land reclamation (Ross et al., 2024; Zabarte-Maeztu et al., 2020). Additionally, they can face competition from mangroves under the right conditions (Alongi, 2023; Matheson et al., 2009). Understanding the impact of mangroves, salt marshes, and seagrasses on the surrounding community is essential when planning any conservation or restoration project.

Criteria:

- Are mangroves, salt marsh, or seagrass present? (Input number of hectare of each ecosystem)

Blue Carbon

Blue carbon refers to "the coastal carbon sequestered and stored by ocean ecosystems" (Alongi, 2018, p. 1). The carbon stored by coastal ecosystems has the potential to assist in climate change mitigation, but projects targeting blue carbon restoration require additionality, meaning the restoration or conservation of the ecosystem would not happen without the project (Jacobs New Zealand Limited, 2024). In temperate zones, like New Zealand, blue carbon is captured by coastal ecosystems such as mangroves, seagrasses, and salt marshes (Cinar et al., 2024). These three ecosystems are the only three that create quantifiable increases in blue carbon (Lovelock & Duarte, 2019). However, many of these coastal ecosystems face the impacts of run off, urban development, drainage, cropping, and tidal barriers (Jacobs New Zealand Limited, 2024). Given that coastal wetland ecosystems sequester significant carbon over time, the restoration and conservation of these ecosystems can assist with achieving climate goals. Representing the economic value of blue carbon can help provide an economic rationale for restoration projects. With these points in mind, we used carbon accumulation estimates from Bulmer, Stewart-Sinclair et al. (2024) to provide a rough calculation of the carbon accumulated in one year by the habitat being evaluated. This carbon stored per year can then be multiplied by 3.67 to convert to CO2 and finally by a current market price of carbon to estimate the price of blue carbon provided by the ecosystem.

Sample Calculation: 10ha mangrove and 10 ha saltmarsh restoration.

$$Blue\ Carbon\ = \left(10ha\ mangrove \cdot \frac{0.64tC}{ha\ yr} + 10ha\ saltmarsh\ \cdot \frac{0.89tC}{ha\ yr}\right) \cdot 3.67 \frac{CO2}{tC}$$

$$Blue\ Carbon = \left(6.4 \frac{tC}{yr} + 8.9 \frac{tC}{yr}\right) \cdot 3.67 \frac{CO2}{tC}$$

$$Blue\ Carbon = 56.15 \frac{tCO2}{yr}$$

Assuming a price of $71/t which is the government’s current auction amount (World Bank Group, 2026), a restoration project of 10 ha mangroves and 10 ha saltmarshes would generate $3987 carbon storage a year.

Criteria:

Table 2: Criteria Mangrove, Salt marsh, and Seagrass Carbon Accumulation Estimates

Wetland Type	Carbon accumulation rate	Calculation
Mangrove	0.64tC/ha/yr (Bulmer et al., 2024)	0.64 * (hectare of wetland) = X tC/yr
Salt Marsh	0.89 tC/ha/yr (Bulmer et al., 2024)	0.89 * (hectare of wetland) = X tC/yr
Seagrass	0.32 tC/ha/yr (Bulmer et al., 2024)	0.32 *(hectare of wetland) = X tC/yr

Table 3: Criteria Additionality of Restoration or Conservation Project

Ecosystem Type	Additionality: will restoration or conservation happen without this project? (Y/N)
Mangrove	
Salt Marsh	
Seagrass	

- Are mangroves encroaching on seagrass meadow? (Y/N)
- Are mangroves encroaching on salt marshes? (Y/N)

Biodiversity and Habitat

Coastal wetlands serve as important habitat in New Zealand. In general, NbS supporting local biodiversity are more resilient to climate challenges in the long-term (Seddon et al., 2020) making a focus on habitat essential when exploring coastal wetland conservation and restoration. However, not all wetlands will provide the same biodiversity value. Research shows that connectivity between wetlands and other ecosystems can support increased biodiversity and “link species” who rely on diverse spaces. For example, most mangrove bird species provide important ecosystem functions, but cannot survive with mangrove habitat alone (Buelow & Sheaves, 2015). When coastal wetlands are connected to other areas, biodiversity is improved.

Biodiversity goals may also create tension between other restoration goals. For example, the Auckland Unitary Plan makes provisions to allow the removal of mangroves where they interfere with wading bird habitat (Auckland Unitary Plan F2 Coastal - General Coastal Marine Zone, 2016). Being aware of the trade-offs between wetland types and environmental goals is necessary when evaluating conservation and restoration options. With this in mind, diversity and connectivity of ecosystems are two important criteria to be aware of when considering conservation and restoration projects.

While area of green or blue space in a community can be a measure of biodiversity, it can also inform human well-being. Research shows the importance of green and blue space access for human well-being. Spending time in nature can reduce stress and promote a more active lifestyle (Sutton-Grier & Sandifer, 2019). As a result, criteria examining biodiversity are also a good measure of community access to green spaces. Here we chose questions that provide a clear view of connectivity and types of ecosystems in the area to understand how biodiversity and human health can be impacted by conservation and restoration projects.

Criteria:

- Is the area fragmented or part of a natural corridor? (Drop down answer)
  - Fragmented Area
  - Natural Corridor
- Are there natural or green spaces other than wetlands located within the study area? (Drop down answer)
  - Within 1km radius?
  - Within 5km radius?
- Type of natural or green space: (Short Answer)
- Does this area currently provide wading bird habitat? (Y/N)

Surrounding Land Use

Land use around a coastal wetland can impact the effectiveness of these NbS but also influence future conservation, restoration, and even drainage. Coastal wetlands can capture nutrient flows stopping them from reaching sensitive areas, however when receiving nutrient inputs they become less effective at storing carbon (Palacios et al., 2021). This trade-off demonstrates a key aspect of

NbS, depending on the goal of the project, different co-benefits may be emphasized. For example, if preventing nutrient runoff from reaching a sensitive area is the goal, using a salt marsh to intercept runoff may be a good strategy. However, if the aim is carbon storage, then targeting upstream inputs may be an effective solution. Additionally, phosphorus inputs from agriculture may support mangrove expansion by providing a limiting nutrient (Lovelock et al., 2007). However, expanding mangroves can lead to conflict in communities regarding access to waterways and public amenities.

Another aspect of surrounding land use that must be considered is the potential for future projects of public interest. Under the Auckland Unitary Plan, wetlands may disturbed if there is a required project that cannot take place in any other area (Auckland Unitary Plan E3 Lakes Rivers Streams and Wetlands, 2016). Additionally, grey infrastructure such as tidal barriers may lower the productivity of coastal wetlands and lead to vegetation loss (Palacios et al., 2026).

To assist with making a clear decision about wetland conservation and restoration, these questions ask about upstream and future land use.

Criteria:

- Is there upstream agricultural or industrial land? (Y/N)
- Is this an area of future public work? (Y/N)
- Is there existing grey infrastructure such as a tidal barrier? (Y/N)

Public Support and Community Impacts

NbS like urban wetland restoration, are inherently anthropocentric in nature. Concepts such as ecosystem services provide structure to view how humanity benefits from nature. Given this inherent focus on the benefits people receive from these ecosystems, numerous social factors must be considered when exploring NbS. NbS can make communities more resilience to climate change and support community cohesion. However, they must be designed with community needs in mind or they might not achieve these goals (Seddon et al., 2020). Social factors may include a broad range of criteria from health and accessibility implications to perceived aesthetics and community conflict. This section outlines which factors should be examined when exploring coastal wetland conservation and restoration in Auckland.

Public support or opposition can impact project success. NbS still face governance challenges and questions that may impact implementation. Understanding what trade-offs exist can help identify paths forward (Martin et al., 2025). This is especially important in the context of coastal wetland conservation and restoration where certain habitats can be opposed by local communities. Mangroves face opposition in the Auckland region, with local community groups supporting removal in some areas while conservation groups are generally supportive of conservation and restoration (Dencer-Brown et al., 2019). When exploring a potential conservation or restoration project, practitioners should note the presence of any large community support or opposition in the local area. Given finite resources, spending time and money in an area where the public is supportive of a project may be preferred over a community opposed to a project.

Additionally, exploring the socio-economic background of a community is necessary to ensure the benefits of NbS are not concentrated in affluent areas as has been documented in the past (B. Hill et al., 2025). Finally, community engagement is needed to explore what an effective NbS looks like to the local community. Priorities can vary leading to different measures of success based on individual viewpoints (Seddon et al., 2020). For example, one group of the community may emphasize access to waterways and public amenities from beaches while another group may prioritize flood resilience and biodiversity. Without understanding community values, coastal wetland conservation and restoration may be challenging.

Criteria:

- History of community groups opposing similar projects (Y/N)
- History of community supporting similar projects (Y/N)
- Community median income:
- % Home ownership:

Cultural value

Cultural services are important when examining the co-benefits of NbS. However, cultural value can be difficult to quantify (Clarke et al., 2021) and is often missing from ecosystem service studies (do Amaral Camara Lima et al., 2023). Research shows that coastal ecosystems can contribute to individual identity, experiences, and social capability (Clarke et al., 2021). However, economic valuation should not be the goal when examining cultural services. In a New Zealand context, Māori worldviews may be incompatible with economic questions asking about willingness to pay for environmental services. This is an important consideration given that ecosystem service frameworks can struggle to capture the impact and connection of ecosystems and Indigenous Peoples (Lyver et al., 2017). C. Hill et al. (2026) suggest incorporating the value demonstrated through stories as a way to understand cultural services. In this examination, there is no easy way to capture the cultural value provided by a conservation or restoration project. Instead, we highlight the importance of practitioners to engage with communities throughout the conservation and restoration evaluation process.

Economic Impacts

High level examinations can show the broad economic benefits of NbS. As previously shown, coastal wetlands can store blue carbon which has a quantifiable economic value. Additional studies show the cost effectiveness and broad scale of economic benefits individuals receive from NbS (González-García et al., 2025). However, these societal benefits are not always felt by the individual. When focusing on a local community it is important to understand how a conservation or restoration project can benefit individuals and groups. For example, coastal wetland restoration may come at the expense of a community beach that provides direct tourism dollars and public amenities to local residents. However, a NbS project may also create local jobs or lead to increased tourism (New Zealand Coastal Society, 2025). Documenting the economic impacts on local individuals and businesses can help practitioners tailor conservation or restoration projects to the local community.

Criteria:

- Do individuals or groups rely on the project area for income?
- Will restoration enhance economic opportunities for the community?
- Will restoration reduce economic opportunities for the community?

Table 4: Community Economic Impact Categories

	Increase	Decrease	N/A
Public Beaches			
Public Walking Trails			
Public Boat Launch Access			
Construction/Management Jobs			
Ecotourism			
Fisheries			
Water-based recreation (ex. boating)			
Other:			

Results

With the selected criteria, we created profiles for each site. The profiles that follow provide an overview of each site, focusing on the process of applying the framework and identifying any trade-offs present. The full applications of the framework to each site are included in Appendix B.

Site Profiles

Tuff Crater

Overview: Tuff crater is a coastal wetland site featuring mangrove and marginal salt marsh. Currently undergoing restoration, the site is an interesting application of the framework as it is clearly bounded with slopes down into the crater on three sides and a highway on the fourth. As a result, mangrove encroachment and habitat conversion are not concerns, however there are challenges from invasive plant species such as those shown in the figure below as well as mammals such as rats and possums that threaten many native birds in New Zealand. The surrounding area is mostly residential however a commercial office space lies to the north.

Figure 2: Picture of Tuff Crater Restoration Overview

Ecosystem: The crater is filled with dwarf mangroves while salt marshes run along the edges. The crater provides a transition from coastal wetlands to forested space running up the surrounding hills and as a result multiple bird species such as Song Thrush, Eurasian Blackbird, Common Myna, New Zealand Fantail, and Tui were observed. Figures 3, 4, and 5 demonstrate the connectivity of the ecosystems however a busy highway cuts across the coastal edge of the crater preventing connectivity with the Oneoneroa Bay.

Figure 3: Mangroves in Tuff Crater with Highway on Edge

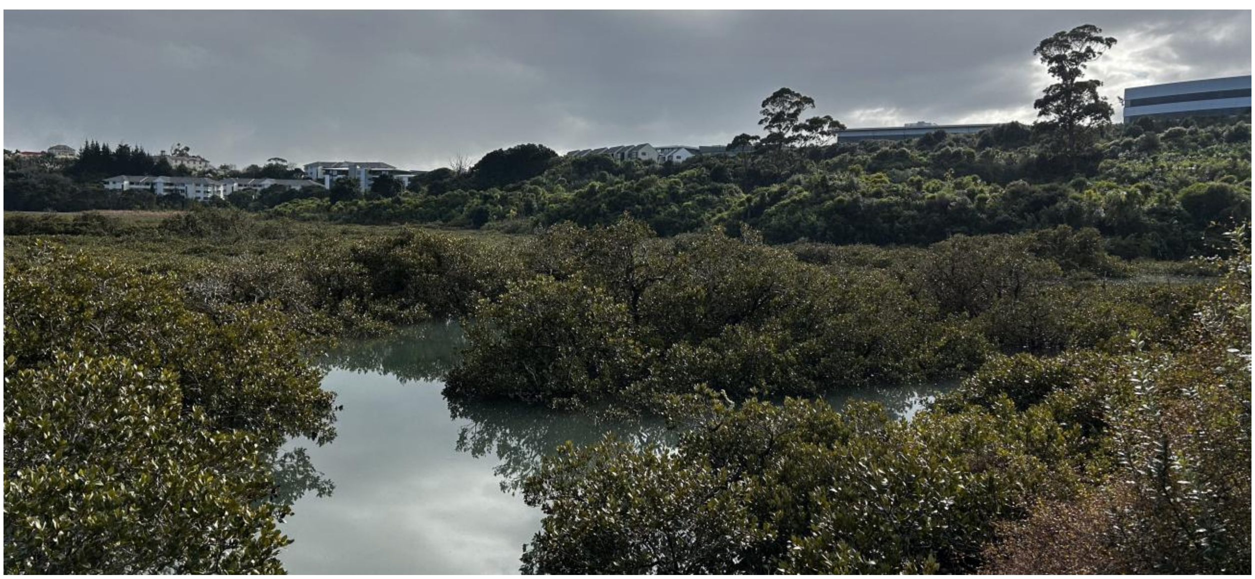

Figure 4: Mangroves with Forest Along Edge in Tuff Crater

Figure 5: Salt Marsh and Forest in Tuff Crater

Community and Economic Impact: It does not appear that Tuff Crater prevents or provides direct economic opportunities for the community. There is no access to shoreline or businesses that rely on the crater. However, the crater provides recreation benefits to the surrounding community. During the field visit, 12 people were observed using the trail and multiple posted signs asked for community volunteers. Additionally, we observed planting sights where restoration projects that appeared to rely on community volunteers were underway.

Figure 6: Wetland Restoration Planting Site in Tuff Crater

Application of Framework: As restoration is already underway in Tuff Crater, this site can be used to illustrate how the framework is applied. Essentially, if a small number of trade-offs are identified, then a practitioner applying the framework may conclude this is a strong site for restoration – which is already happening. Screenshots of the full spreadsheet are included in Appendix B however the information is summarized here. As shown in Figure 6, most of Tuff Crater is made up of mangrove habitat with marginal salt marshes. These wetlands are estimated to store roughly $4,697 dollars or 66 tons of CO_2 per year. There are no major trade-offs identified in this project.

Figure 7: Screenshot of Auckland Council Geomap Showing Hectares of Mangrove (Yellow) and Salt Marsh (Green)

The area is threatened by coastal erosion, inundation, and flooding. The restoration of mangrove and salt marsh in the area can help support adaptation while also providing wildlife habitat, biodiversity, and community recreation. Additionally, the evidence of community volunteering and number of individuals observed spending time in the area suggest community support for the conservation and restoration of this area.

Finally, if following the flowchart through the framework application, a project proponent would likely reach the green box where no significant opposition or negative economic outcomes are identified. Therefore, they should continue exploring trade-offs but are likely to proceed with a project. Overall, a practitioner applying this framework to the area might conclude that Tuff Crater is a strong candidate for conservation and restoration given the lack of trade-offs identified.

Hobson Bay

Overview: Hobson Bay is a coastal area near central Auckland with significant mangrove habitat, marginal salt marshes, and some mudflats. There is some mangrove spread in the eastern side of the bay but does not appear to be threatening salt marsh ecosystems.

Figure 8: Transition Between Mangrove, Saltmarsh, and Forest in Hobson Bay

Ecosystem: The majority of the area is made up of mangroves, mudflats, and some salt marsh. The mangroves are mostly shrub (shorter) but some fringe (larger near the edges of patches) were observed. A few bird species were observed in the area including Eurasian Blackbird, Welcome Swallow, and Tui. The area features some connectivity with a large park running along the bay. However, this park (Shore Road Reserve shown in figure 9) features few trees and large stretches of grass that support low biodiversity. Running deeper into the city however are Waitaramoa Reserve and Martyn Wilson Field both feature small streams and salt marshes adding some variety to the area. There appears to be minor mangrove spread into mudflats which may disrupt wading bird habitat.

Figure 9: Shore Road Reserve Next to Hobson Bay

Figure 10: Salt Marsh in Waitaramoa Reserve near Hobson Bay

Figure 11: Mudflats in Hobson Bay

Community and Economic Impacts: Tinana Wilson's Beach lies in the middle of the bay, providing a space for public enjoyment of the area. The area has been used historically for fishing. As a result, it's clear that certain areas of the bay provide value to the community that could be lost if converted to coastal wetlands. Additionally, multiple houses have private docks or walkways that end in mangroves. While purely speculative, it is possible these homeowners would prefer their docks have access to open water.

Figure 12: Tinana Wilson's Beach in Hobson Bay

Figure 13: Private Docks in Hobson Bay in Mangroves

Application of the Framework:

The area is threatened by coastal erosion, inundation, and flooding. The mangrove forests and salt marshes in the bay provide protection for the coastline, create habitat for numerous species, and store roughly $4218 of blue carbon. The main trade-offs identified in the framework are the potential for mangrove spread into areas that currently provide other services. For example. If mangroves are allowed to spread into nearby mudflats, wading bird habitat may decrease. Additionally, there is a public beach in the area and mangrove spread may decrease access to this public space. There is also evidence of fishing in the bay. Applying the framework suggests that there is good balance between coastal wetland area and community access to water. Following the flowchart, the proponent would likely reach a yellow box where potential tension exists, here it is primarily the potential for mangrove spread creating tension. As a result, the framework would encourage a thorough review of all trade-offs.

Figure 14: Mangrove (Yellow) and Salt Marsh (Green) Area in Hobson Bay

Māngere Inlet

Overview: Māngere Inlet connects to Manukau Harbour in South Auckland. With large mangrove habitat, comparing aerial photos from Auckland Council Geomaps reveals significant spread through the inlet. The majority of the inlet is surrounded by industrial areas and historically the inlet has poor water quality (New Zealand Transport Agency, 2016)

Figure 15: Example of Tall Mangroves in Māngere Inlet

Ecosystem: The inlet has large mangrove forests spread throughout. There are trees along the edges providing diverse habitat for bird species, however further connectivity is disrupted by the presence of industrial sites and a train yard. Comparing mangrove area from 2025 aerial photos and 1990s aerial photos shows significant spread over the last 35 years. Mudflats in the area appear to face mangrove encroachment. While thin fringes of salt marsh were observed in the field, they are too small to properly demarcate on the map. Multiple bird species were observed including House Sparrow, Australasian Swamphen, New Zealand Fantail, Silvereye, Australian Magpie, and Tui. These birds were observed across the area but were seen less around the industrial sites with significant noise.

Figure 16: Comparison of Mangrove Area Between 1990 and 2025

Figure 17: Industrial Area Beside Māngere Inlet

Figure 18: Transition from Mudflats to Mangrove and Forest in Māngere Inlet

Community and Economic Impacts: Māngere Inlet is the site of significant industrial and economic activity in the community. However, as a result, the inlet has low amenity value for the community. There are no public beaches, and the water quality is historically poor. However, when conducting the site visit, 18 people were observed using the walking path along the inlet, showing the value green spaces provide.

Application of Framework: Mangroves in this area generate $32,252 of blue carbon storage per year. This is a significant amount and due to the industrial nature of the area may help offset some of the associated emissions. The amount of salt marsh in the area is low, existing in small strips along some mangrove edges. Additionally, the presence of industrial sites around the inlet may disrupt the connectivity of ecosystems in the inlet with nearby parks. While these industrial areas economically support the community, there are environmental trade-offs that must be examined. For example, when conducting the site visit, we noticed significant noise along the green space and observed fewer birds in these noisy areas. Finally, the area does face some inundation and flooding risk with minor erosion risk.

Due to the low reliance on the inlet for public amenities outside of walking trails, this may be an area where mangrove spread is not a significant concern as increased mangrove area can store more carbon and lower climate risks. Following the flowchart, a project proponent would likely reach the green box suggesting action may be taken if all trade-offs are considered.

Discussion

The purpose of the research was to create a framework to assist with decision making about coastal wetland conservation and restoration projects. To achieve this goal, a literature review was conducted to justify the components included in the framework. Finally, we tested the framework at three different urban coastal wetland sites in Auckland.

This project sought to answer existing research gaps in NbS work, specifically regarding coastal wetland NbS. One current gap is the need to understand the co-benefits created by projects as many existing approaches only examine one or two components of an NbS project (Mathieu et al., 2026). This project helped fill that gap by creating a structured approach for practitioners and community members to follow. This approach does not attempt to classify projects as good or bad, but instead to help the user brainstorm or identify the trade-offs and co-benefits possible to help them plan next steps. For example, in the Hobson Bay application, the potential for tension over mangrove spread was identified. While the tool is agnostic to whether this spread is a good thing or not, it suggests to the user that further community engagement may allow for a better understanding of these tensions.

Applying the framework to three different sites allowed an examination of the various trade-offs and interactions between different environmental and social factors. In Tuff Crater, the area is already protected with restoration projects underway. Due to geographic features, mangrove spread is not a concern, and biodiversity, carbon storage, and community goals all appear to support each other. In Hobson Bay, mangrove spread exists and may threaten existing public beaches or fishing, however, there currently appears to be a balance between environmental and community objectives suggesting current coastal wetland area is acceptable but further increases may see community opposition. In Māngere Inlet, due to the large industrial presence, public amenities such as beaches are not considerations. As a result, the significant mangrove spread seen over the last 35 years could likely continue without creating tension between environmental and community or economic goals. With each site possessing different characteristics, the framework allowed us to understand how various factors interact without requiring direct comparison between sites. Instead, these case studies should be viewed as independent examinations into the diverse co-benefits and trade-offs a coastal wetland NbS may create.

One area the framework struggled to capture was the presence of seagrass, one of the three coastal wetland types this study focused on. Unlike mangrove and saltmarshes, seagrasses are intertidal, meaning they may be hidden beneath the water while site visits were conducted (do Amaral Camara Lima et al., 2023). Additionally, Auckland Council Geomaps does not have a layer that shows seagrass habitat and we were unable to identify seagrass in any of the three study sites. However, just because we could not identify seagrass does not mean it is unimportant. Seagrass are one of three coastal wetland types that store quantifiable blue carbon (Ross et al., 2024) and they are also a strong indicator of water quality due to their sensitivity to sediment pollution (Zabarte-Maeztu et al., 2020). Some literature highlights the importance of seagrass ecosystems, but to our knowledge there is no database accessible to the public that shows seagrass extent in the Auckland region. While the ability to accurately estimate seagrass area in a potential study site is currently not possible, seagrass was still included in the framework spreadsheet as future work may allow for estimates of seagrass area and the carbon storage it provides.

The blue carbon estimates from the framework for salt marshes and mangroves provided clear rationale's for specific conservation and restoration projects. Assigning a monetary value to an ecosystem is a simple way to represent its value in a way most people will understand. In the case of blue carbon, most research examines the potential to assist with climate mitigation (Alongi, 2018; Ross et al., 2024). In this project, blue carbon estimates provided clear rationale's for conservation and restoration projects. For example, Māngere Inlet stores roughly $32,252. This value is a representation of an ecosystem service created by a coastal wetland, but that value is rarely felt by an individual. The storage of blue carbon may assist with justifying a project to a government or institution, but when engaging with local communities, abstract numbers should not be relied upon. While blue carbon does have the potential to assist with climate change mitigation, its relevance to local projects should be examined in more detail.

Overall, the environmental considerations captured in the spreadsheet, such as a clear estimation of blue carbon storage or identification of habitat fragmentation were strengths of the approach. These factors and how they interact may be estimated from desktop work or field visits and provide clear rationales for coastal wetland conservation and restoration work. The blue carbon estimates specifically are clear numbers that may be used to support a project. However, the second group of factors included which focused on socio-economic aspects are more difficult to capture. The socio-economic aspects of a community are essential to understand if a project can actually be implemented (Seddon et al., 2020). If there is community opposition and a project may reduce economic potential, then implementing it may be challenging. Without being designed properly, created co-benefits may not be as effective (Mathieu et al., 2026). Therefore, local community engagement is necessary when planning projects.

While this paper tried to take a holistic approach to coastal wetland conservation and restoration projects, due to the constraints of a 12-week research project we were unable to conduct community-based research. We did not have time to move through the research ethics process and talk to community members about their interactions with the study sites. Without the ability to engage with community members, we were reliant on searching for news articles and other documentation of community opposition or support for a project. This was possible in Tuff crater where signage indicated community volunteer programs to support restoration in the area, however in Hobson Bay and Māngere Inlet it was difficult to identify any evidence of support or opposition. The number of people observed using walking trails is one indicator of community support for green spaces however does not provide an understanding of deeper views and beliefs about coastal wetlands.

Future work could tailor community engagement approaches to supplement the data gathered here in the proposed framework. It should be noted that the trade-offs are not an exhaustive list. This tool presents some common trade-offs identified in coastal wetland restoration and conservation projects and is intended to assist conservation practitioners or community members with brainstorming the impacts of a potential project. Each community is different, and the ways communities may be impacted by a project are different. We encourage practitioners to consider what aspects of their projects may impact individual community members before committing to any project.

Conclusion

Coastal wetlands provide numerous co-benefits and trade-offs. Understanding these co-benefits and trade-offs is essential when considering conservation and restoration projects. This paper highlighted a key literature gap, that existing NbS examinations often focus on a few impacts of conservation and restoration projects but can fail to capture the broad impacts of these ecosystems. To address the identified gap, we built a framework to assist with the evaluation of the trade-offs and co-benefits created by coastal wetland NbS projects. This framework highlighted key environmental impacts such as estimating blue carbon potential while providing the tools for project proponents to understand the community context they're working in. We found that our estimates of blue carbon provide clear rationales for a conservation or restoration project, however environmental rationales are not enough. Understanding the socio-economic background of a community allows for project proponents to understand if the project actually benefits a community and has the potential of gaining support.

While the proposed framework has gaps such as the need for more in-depth community engagement, this project serves as a formal recognition of the diverse co-benefits and trade-offs created by coastal wetland NbS. Future work could build on our approach by formalizing community engagement into the process and assist in tailoring coastal wetland NbS to local communities. Having a holistic picture to view a project through can assist in the evaluation of these co-benefits and any trade-offs they create when supporting community climate adaptation.

Reflections on the Project

Conducting research in a 12-week timeframe allowed for deep immersion in the project however came with drawbacks as well. The initial research brief for the project called for the creation of a multi-criteria assessment framework. Over time, this goal shifted to focus on the trade-offs of coastal wetland NbS – a key gap identified in the literature. We also intended for the assessment tool to be used by practitioners such as Auckland Council, but due to the timeframe and need to engage adequately with council to create something useful for them, this was not possible. Additionally, as researchers the desire to create something tangible may sometimes face difficult questions such as whether the group a tool is intended for actually needs it. In the case of this project, the tool created may serve as a jumping off point for future research but is unlikely to be used by practitioners.

This research can be interpreted as a formal examination of a key research gap, that many coastal wetland NbS may focus on a few benefits but fail to understand how all trade-offs and co-benefits interact to serve the local community. Future work could build on this to formalize community engagement into the project. Overall, we intended to capture the trade-offs of coastal wetland NbS and that goal was achieved. The framework created provides an overview of key trade-offs and provides a foundation to assist project proponents with furthering their own understanding of coastal NbS projects.

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Appendix A – Summary of Framework Criteria

Table 5: Summary of Information used in the Framework Construction

Criteria	Background	Key Indicators
Blue Carbon	Blue carbon refers to "the coastal carbon sequestered and stored by ocean ecosystems" (Alongi, 2018, p. 1). The carbon stored by coastal ecosystems has the potential to assist in climate change mitigation, but projects targeting blue carbon restoration require additionality, that is they protect or restore something that would otherwise not happen (Jacobs New Zealand Limited, 2024). In temperate zones, like New Zealand, blue carbon is captured by coastal ecosystems such as mangroves, seagrasses, and salt marshes (Cinar et al., 2024). These three ecosystems are the only three that create quantifiable increases in blue carbon (Lovelock & Duarte, 2019). However, many of these coastal ecosystems face the impacts of run off, urban development, drainage, cropping, and tidal barriers (Jacobs New Zealand Limited, 2024). Given that coastal climate ecosystems sequester significant carbon over time, the restoration of these ecosystems can assist with achieving climate goals. Representing the economic value of blue carbon can help provide an economic rationale for restoration projects.	- Mangrove present (*Avicennia marina*) (Matheson et al., 2009; Morrisey et al., 2010) Est 0.64 t/C/ha/yr (Bulmer et al., 2024) - Salt Marsh present 0.89 t/C/ha/yr (Bulmer et al., 2024) - Sea grass meadow present 0.32 t/C/ha/yr (Bulmer et al., 2024) - Mangroves can outcompete other coastal wetlands (Alongi, 2023; Matheson et al., 2009). - Upstream sediment and nutrient loads can lead to mangrove expansion (Lovelock et al., 2007; Morrisey et al., 2010; Suyadi et al., 2019).
Blue Carbon Impacts	Factors that increase or decrease efficiency of ecosystems should be noted as they can alter a wetland's potential for blue carbon storage. Understanding these trade-offs is necessary when designing or evaluating conservation and restoration projects. Connections between ecosystems can enhance carbon accumulation through allochthonous matter (inputs from outside the ecosystem. As debris from outside coastal wetlands accumulate, organic matter increases (Alongi, 2023). The presence of predators can also increase carbon rates, as	- Connections between ecosystems increase blue carbon potential. Salt marsh, Mangrove, and seagrass connections. - Bioturbators present. Difficult to measure visually in field so not included in tool. - Drainage increases emissions.

	bioturbators (organisms that disturb sediment) increase emissions. Draining a coastal wetland leads to C02 emissions and potential for methane (Negandhi et al., 2019). Tidal barriers can degrade coastal wetlands leading to lower productivity and eventually collapse (Palacios et al., 2026). Reinstatement of saltwater flows can restore ecosystems (Palacios et al., 2026).	- Tidal barriers lead to lower productivity, biodiversity loss, and collapse. -Tidal reinstatement can increase blue carbon potential.
Biodiversity /Habitat	Conservation and restoration projects can have a big impact on local biodiversity. The conservation of areas with threatened species is a positive. However, wetland restoration may be hindered if occurring in an area with sensitive species that prevent work (Hagger et al., 2024). Supporting biodiversity is also a plus as generally NbS rooted in biodiversity are more resilient (Seddon et al., 2020). Mangroves are important habitats for numerous native and non-native species in NZ (Dencer-Brown et al., 2020) and the connectivity between wetlands and other ecosystems can provide habitat for "link species" which helps biodiversity (Buelow & Sheaves, 2015).	- Is the project creating important habitat? - Links between ecosystems help biodiversity. - Presence of threatened species may prevent restoration work.
Climate Risk	Understanding the climate risks to a coastal area can help inform adaptation strategies. Coastal wetlands provide many benefits that can assist with adaptation, but local conditions should be considered. Shoreline adaptation plans from Auckland Council outline the relevant climate risks for a given area. Check the rating under relevant shoreline adaptation plans for the level of concern. These ratings include no action, maintain, protect, and adaptation priority (Auckland Council, n.d.). To help protect coastlines, vegetation from mangroves and salt marshes can attenuate storm waves and protect coastlines from erosions and flooding (Gedan et al., 2011). Areas that will be inundated with sea level rise and vertical land movement may be ideal sites for coastal wetland restoration (Palacios et al., 2026). Long term coastal wetlands can help combat sea level rise through the accumulation of peat and other sediments. If a	- Future inundation sites provide good spots for coastal wetland restoration. - Protection and Adaptation priority sites under the shoreline adaptation plans may be good areas for coastal wetland NbS. - Mangrove and salt marsh veg can act as buffers for storm surges. - Root systems can help prevent coastal erosion.

	wetland is established, it can handle some sea level rise (Gedan et al., 2011).	
Surrounding Land use	Understanding the factors that impact coastal wetlands is necessary. Surrounding land use can lead to changes such as mangrove expansion due to sedimentation or decreased coastal wetland efficiency from tidal barriers or other grey infrastructure. Surrounding agricultural land can increase phosphorus inputs leading to mangrove expansion (Lovelock et al., 2007). Additionally, sedimentation can increase potential habitat allowing for mangroves to spread (Lovelock et al., 2007). However, the goal of a conservation or restoration project can impact the interactions with the surrounding land. For example, coastal wetlands can capture nutrient flows stopping them from reaching sensitive areas, however when receiving nutrient pulses they become less effective at storing carbon (Palacios et al., 2021). Finally, regulations can influence conservation and restoration activities. The Auckland Unitary Plan generally permits wetland conservation and restoration activities, but in certain protected areas restoration may not be permitted if it involves altering the landscape. For example, the Resource Management Act mentions restoration of resources in a deteriorated state, but this definition appears to be up to the interpretation of regional councils (Resource Management Act, 1991).	- Agriculture land upstream of site. -Is capturing nutrient flows to protect a downstream area a priority? -What type of land is this? Do government regulations protect or prevent conservation activities? - Restoration of degraded wetlands may target upstream activities.
Economic implications	Conservation and restoration projects do not exist in a vacuum. Understanding their economic impact on the surrounding community can help inform messaging strategies about a project. Previous research shows that communities can oppose projects when they perceive them as negatively impacting their economic opportunities (Martin et al., 2025).	- Does the restoration or expansion of a coastal wetland threaten economic livelihood? For example, will mangrove expansion impact local fishing?
Public Support	Public support or opposition can impact project success. NbS still face governance challenges and questions that may impact implementation. Understanding what trade-offs exist can help identify paths forward (Martin et al., 2025).	- Do community groups exist that oppose certain coastal wetland types? - Do community or conservation

		groups exist that support certain coastal wetland types?
Cultural Considerations	In a New Zealand context, Māori worldviews may be incompatible with economic questions asking about willingness to pay for environmental services. This is an important consideration given that ecosystem service frameworks can struggle to capture the impact and connection of ecosystems and Indigenous Peoples (Lyver et al., 2017). In this examination, there is no way to capture the cultural value provided by a conservation or restoration project in a simple framework. Instead we highlight the importance of practitioners to engage with communities throughout the conservation and restoration evaluation process.	N/A

Appendix B – Sample Framework Spreadsheet

The framework spreadsheets used for each site are included below. The yellow boxes indicate fields that the student researcher input based on desktop research and site visits. The fields in the "project summary" and "further exploration of trade-offs" pages are all outputs of the framework. These outputs change depending on the site characteristics noted on the first page of the framework. To see differences in the outputs, examine spreadsheets from each site.

Tuff Crater

Type of Wetland	Carbon Accumulation Rate (Bulmer et al., 2024)	**Area (ha)**	tC/yr	tCO2/yr	Price of Carbon	NZ$/yr
Saltmarsh	0.89	1.7	1.513	5.55271	71	$ 394.24
Mangrove	0.64	25.8	16.512	60.59904	71	$ 4,302.53
Seagrass	0.32	0	0	0	71	$ -
			Total:	**66.15175**	**Total:**	**$ 4,696.77**

Additionallity: Does this project lead to conservation or restoration that would not happen otherwise?		
	Yes	No
Saltmarsh	☑	☐
Mangrove	☐	☑
Seagrass	☐	☐

Are mangroves encroaching on the following?		
	Yes	No
Saltmarsh	☐	☑
Seagrass	☐	☑

Land Use		
Upstream agricultural land?		☐
Future public work through area?		☐
Existing grey infastructure such as tidal barriers?		☐

Coastal Climate Risk		
	Coastal Risk Present	
Coastal Erosion	☑	
Catchment Flooding	☑	
Coastal Inundation	☑	

Biodiversity and Habitat	
Does the area currently provide wading bird habitat? (Mudflats)	No
Is this area fragmented or part of a natural corridor?	Natural Corridor
Are there non-wetland natural or green spaces within the study area?	Within a 1km radius
Type of natural or green space (Short Answer):	Forest, public parks

Community Impacts	
Community Name	**Kaipātiki**
History of community groups opposing similar projects?	☐
History of community groups supporting similar projects?	☑
Community median income	$ 50,000.00
% Home ownership	63.00%
Local economic Impact	
Do individuals or groups rely on the projected area for income?	**No**
Will restoration enhance economic opoprtunities for the community?	**No**
Will restoration reduce economic opportunites for the community?	**No**

Economic Activity	Increase	Decrease	N/A
Public beaches	☐	☐	☑
Public walking trails	☑	☐	☐
Public boat launch access	☐	☐	☑
Construction/Management jobs	☐	☐	☑
Ecotourism	☑	☐	☐
Fisheries	☐	☐	☑
Water-based recreation	☐	☐	☑
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Project Summary	
Cultural Context:	When any conservation or restoration project is being considered it is essential to work together with the iwi who hold a connection to the land. This assesment tool cannot capture the cultural importance of the land so it is essential to engage with the iwi in the area. Existing partnership on coastal management are outlined in the relavent shoreline adaptation plan for the target area. Each plan outlines existing partnerships and may mention relavent iwi planning doccuments that must be taken into account as specified in the Resource Management Act.
Estimated Blue Carbon ($NZ/yr):	$ 4,696.77
Additionallity for:	Saltmarsh
Encroachment:	No mangrove encroachment
Coastal Risk:	Coastal Erosion, Catchment Flooding, Coastal Inundation
Biodiversity and Habitat:	The area does not provide wading bird habitat. It is part of a Natural Corridor. Non-wetland natural or green spaces are present within a 1km radius. These areas include Forest, public parks .
Land use:	No impact from surrounding land use
Median Income:	Median income of Kaipātiki is $50000. This is $5300 above the median income for the Auckland region.
Percent Homeownership:	Percent homeownership of Kaipātiki is 63.0%. This is 3.5% above the homeownership rate for the Auckland region.
Comunity impacts:	Community support for similar projects
Local economic impacts:	Currently no community economic relience on local area. No major economic impacts identified.
Potential to improve:	Public walking trails, Ecotourism
Potential to decrease:	No negative impacts identified

Further exploration of trade-offs	
Blue Carbon:	The project is estimated to generate $4696.77425 of blue carbon per year. Additionally, multiple types of coastal wetlands are present. When connected to external ecosystems they can increase blue carbon storage due to the introduction of outside organic matter into the wetland.
Climate Risk:	Threat from permanent inundation. Where tidal barriars are present they may help protect the coastline but can degrade existing wetlands. Early establishment of coastal wetlands including reflooding of previous protected areas may help combat rising sea levels and protect coastlines from storm surges. However, this process may be costly and reduce existing shoreline area. Threat from erosion. Mangrove and saltmarsh root systems may help protect the coastline from erosion. Increasing coastal wetland area may help with climate adaptation but can decrease public amenities from beaches or other non-wetland coastal areas. Threat from flooding. Coastal wetlands can help reduce flood impacts by preventing contaminated runoff from reaching sensitive ecosystems.
Impacts on local community:	Potential benefits to the local community include improved Public walking trails, Ecotourism. There are no identified negative economic impacts.
Equity Consideration:	This area has higher than average income and home ownership rates. Existing research shows that NbS may primarily target affluent areas. Consider equitability of project.
Habitat:	Designing the project to maximize biodiversity imapct may reduce economic imapcts along with blue carbon storage potential.

Hobson Bay

Type of Wetland	Carbon Accumulation Rate (Bulmer et al., 2024)	Area (ha)	tC/yr	tCO2/yr	Price of Carbon	NZ$/yr
Saltmarsh	0.89	2.8	2.492	9.14564	71	$ 649.34
Mangrove	0.64	21.4	13.696	50.26432	71	$ 3,568.77
Seagrass	0.32	0	0	0	71	$ -
			Total:	**59.40996**	**Total:**	**$ 4,218.11**

Additionallity: Does this project lead to conservation or restoration that would not happen otherwise?		
	Yes	No
Saltmarsh	☐	☑
Mangrove	☐	☑
Seagrass	☐	☑

Are mangroves encroaching on the following?		
	Yes	No
Saltmarsh	☐	☑
Seagrass	☐	☑

Land Use		
Upstream agricultural land?		☐
Future public work through area?		☐
Existing grey infastructure such as tidal barriers?		☑

Coastal Climate Risk		
	Coastal Risk Present (Check SAR)	
Coastal Erosion	☑	
Catchment Flooding	☑	
Coastal Inundation	☑	

Biodiversity and Habitat	
Does the area currently provide wading bird habitat? (Mudflats)	Yes
Is this area fragmented or part of a natural corridor?	Natural Corridor
Are there non-wetland natural or green spaces within the study area?	Within a 1km radius
Type of natural or green space (Short Answer):	Forest, public parks, salt marsh

Community Impacts	
Community Name	**Ōrākei**
History of community groups opposing similar projects?	☐
History of community groups supporting similar projects?	☐
Community median income	$ 58,000.00
% Home ownership	68.60%
Local economic Impact	
Do individuals or groups rely on the projected area for income?	**No**
Will restoration enhance economic opoprtunities for the community?	**No**
Will restoration reduce economic opportunites for the community?	**Yes**

Economic Activity	Increase	Decrease	N/A
Public beaches	☐	☑	☐
Public walking trails	☑	☐	☐
Public boat launch access	☐	☑	☐
Construction/Management jobs	☐	☐	☑
Ecotourism	☑	☐	☐
Fisheries	☐	☑	☐
Water-based recreation	☐	☑	☐
	☐	☐	☐
	☐	☐	☐

Project Summary	
Cultural Context:	When any conservation or restoration project is being considered it is essential to work together with the iwi who hold a connection to the land. This assesment tool cannot capture the cultural importance of the land so it is essential to engage with the iwi in the area. Existing partnership on coastal management are outlined in the relavent shoreline adaptation plan for the target area. Each plan outlines existing partnerships and may mention relavent iwi planning doccuments that must be taken into account as specified in the Resource Management Act.
Estimated Blue Carbon ($NZ/yr):	$ 4,218.11
Additionallity for:	
Encroachment:	No mangrove encroachment
Coastal Risk:	Coastal Erosion, Catchment Flooding, Coastal Inundation
Biodiversity and Habitat:	The area provides wading bird habitat. It is part of a Natural Corridor. Non-wetland natural or green spaces are present within a 1km radius. These areas include Forest, public parks, salt marsh.
Land use:	No impact from surrounding land use
Median Income:	Median income of Ōrākei is $58000. This is $13300 above the median income for the Auckland region.
Percent Homeownership:	Percent homeownership of Ōrākei is 68.6%. This is 9.1% above the homeownership rate for the Auckland region.
Comunity impacts:	No community support or opposition for similar projects
Local economic impacts:	Currently no community economic relience on local area. No major economic impacts identified.
Potential to improve:	Public walking trails, Ecotourism
Potential to decrease:	Public beaches, Public boat launch access, Fisheries, Water-based recreation

Further exploration of trade-offs	
Blue Carbon:	The project is estimated to generate $4218.10716 of blue carbon per year. Additionally, multiple types of coastal wetlands are present. When connected to external ecosystems they can increase blue carbon storage due to the introduction of outside organic matter into the wetland.
Climate Risk:	Threat from permanent inundation. Where tidal barriars are present they may help protect the coastline but can degrade existing wetlands. Early establishment of coastal wetlands including reflooding of previous protected areas may help combat rising sea levels and protect coastlines from storm surges. However, this process may be costly and reduce existing shoreline area. Threat from erosion. Mangrove and saltmarsh root systems may help protect the coastline from erosion. Increasing coastal wetland area may help with climate adaptation but can decrease public amenities from beaches or other non-wetland coastal areas. Threat from flooding. Coastal wetlands can help reduce flood impacts by preventing contaminated runoff from reaching sensitive ecosystems.
Impacts on local community:	Potential benefits to the local community include improved Public walking trails, Ecotourism. Potential adverse impacts may include decreased Public beaches, Public boat launch access, Fisheries, Water-based recreation.
Equity Consideration:	This area has higher than average income and home ownership rates. Existing research shows that NbS may primarily target affluent areas. Consider equitability of project.
Habitat:	Presence of wading bird habitat may disrupt conservation and restoration plans. Designing the project to maximize biodiversity imapct may reduce economic imapcts along with blue carbon storage potential.

Māngere Inlet

Type of Wetland	Carbon Accumulation Rate (Bulmer et al., 2024)	**Area (ha)**	tC/yr	tCO2/yr	Price of Carbon	NZ$/yr
Saltmarsh	0.89	0	0	0	71	$ -
Mangrove	0.64	193.4	123.776	454.2579	71	$ 32,252.31
Seagrass	0.32	0	0	0	71	$ -
			Total:	**454.2579**	**Total:**	**$ 32,252.31**

Additionallity: Does this project lead to conservation or restoration that would not happen otherwise?		
	Yes	No
Saltmarsh	☐	☑
Mangrove	☐	☑
Seagrass	☐	☑

Are mangroves encroaching on the following?		
	Yes	No
Saltmarsh	☑	☐
Seagrass	☐	☑

Land Use	
Upstream agricultural or industrial land?	☑
Future public work through area?	☐
Existing grey infastructure such as tidal barriers?	☐

Coastal Climate Risk		
	Coastal Risk Present	
Coastal Erosion	☐	
Catchment Flooding	☑	
Coastal Inundation	☑	

Biodiversity and Habitat	
Does the area currently provide wading bird habitat? (Mudflats)	Yes
Is this area fragmented or part of a natural corridor?	Fragmented Area
Are there non-wetland natural or green spaces within the study area?	Within a 1km radius
Type of natural or green space (Short Answer):	Forest, public parks, volcanic hill

Community Impacts	
Community Name	**Māngere-Ōtāhuhu**
History of community groups opposing similar projects?	☐
History of community groups supporting similar projects?	☐
Community median income	$ 34,700.00
% Home ownership	40.80%
Local economic Impact	
Do individuals or groups rely on the projected area for income?	**Yes**
Will restoration enhance economic opoprtunities for the community?	**No**
Will restoration reduce economic opportunites for the community?	**No**

Economic Activity	Increase	Decrease	N/A
Public beaches	☐	☐	☑
Public walking trails	☑	☐	☐
Public boat launch access	☐	☑	☐
Construction/Management jobs	☐	☐	☑
Ecotourism	☑	☐	☐
Fisheries	☑	☑	☐
Water-based recreation	☑	☑	☐
	☐	☐	☐
	☐	☐	☐
	☐	☐	☐

Project Summary	
Cultural Context:	When any conservation or restoration project is being considered it is essential to work together with the iwi who hold a connection to the land. This assesment tool cannot capture the cultural importance of the land so it is essential to engage with the iwi in the area. Existing partnership on coastal management are outlined in the relavent shoreline adaptation plan for the target area. Each plan outlines existing partnerships and may mention relavent iwi planning doccuments that must be taken into account as specified in the Resource Management Act.
Estimated Blue Carbon ($NZ/yr):	$ 32,252.31
Additionallity for:	
Encroachment:	Mangrove encroachment on Saltmarsh
	Check if nutrient runoff or sedimentation upstream encourages mangrove spread.
Coastal Risk:	Catchment Flooding, Coastal Inundation
Biodiversity and Habitat:	The area provides wading bird habitat. It is part of a Fragmented Area. Non-wetland natural or green spaces are present within a 1km radius. These areas include Forest, public parks, volcanic hill .
Land use:	Upstream agricultural land.
Median Income:	Median income of Māngere-Ōtāhuhu is $34700. This is 10000 below the median income for the Auckland region.
Percent Homeownership:	Percent homeownership of Māngere-Ōtāhuhu is 40.8%. This is 18.7% below the homeownership rate for the Auckland region.
Comunity impacts:	No community support or opposition for similar projects
Local economic impacts:	Local communities rely on target area for income. No major economic impacts identified.
Potential to improve:	Public walking trails, Ecotourism, Fisheries, Water-based recreation
Potential to decrease:	Public boat launch access, Fisheries, Water-based recreation

Further exploration of trade-offs	
Blue Carbon:	The project is estimated to generate $32252.31 of blue carbon per year. Mangrove encroachment on saltmarsh may lower blue carbon estimates and decrease associated biodiversity.
Climate Risk:	Threat from permanent inundation. Where tidal barriars are present they may help protect the coastline but can degrade existing wetlands. Early establishment of coastal wetlands including reflooding of previous protected areas may help combat rising sea levels and protect coastlines from storm surges. However, this process may be costly and reduce existing shoreline area. Threat from flooding. Coastal wetlands can help reduce flood impacts by preventing contaminated runoff from reaching sensitive ecosystems.
Impacts on local community:	Potential benefits to the local community include improved Public walking trails, Ecotourism. Potential adverse impacts may include decreased Public boat launch access. Conservation and restoration projects may have positive and negative effects on the following: Fisheries, Water-based recreation.
Equity Consideration:	This area has lower than average income and home ownership rates.
Habitat:	Presence of wading bird habitat may disrupt conservation and restoration plans. Fragmentation of habitat may also disrupt biodiversity goals. Consider if project design can be adaptated to contribute to a wildlife corridor. Designing the project to maximize biodiversity imapct may reduce economic imapcts along with blue carbon storage potential.