



JED RIVER AND BUXTON CREEK MOUTH: ISSUES AND OPTIONS

Hurunui District Council

April 2023

1 Introduction

Historically, the Jed River and Buxton Creek flowed to the sea with separate mouths. Approximately, 15-20 years ago during a period of heavy seas large amounts of gravels were deposited on the beach forming a gravel bar disconnecting these waterways from the sea. Heavy rain in the catchment increases flows in these waterways and without a direct connection to the sea the surrounding land is prone to inundation and erosion.

1.1 Purpose

This report aims to set out the current issues associated with the joining of the Jed River and Buxton Creek mouths and outline the potential management options.

1.2 Background

The Jed River mouth was located directly in line with the Jed River from the 1940s (longest living memory of Judy Grigor) until a large flood event in the late 1990s/early 2000s when the Jed River flowed south and created a joint mouth with Buxton Creek. The waterways have had a joint mouth since. There is no permanent outlet to the sea. The weakest point is now directly south of Limestone Lookout, and this is where the mouth usually forms.

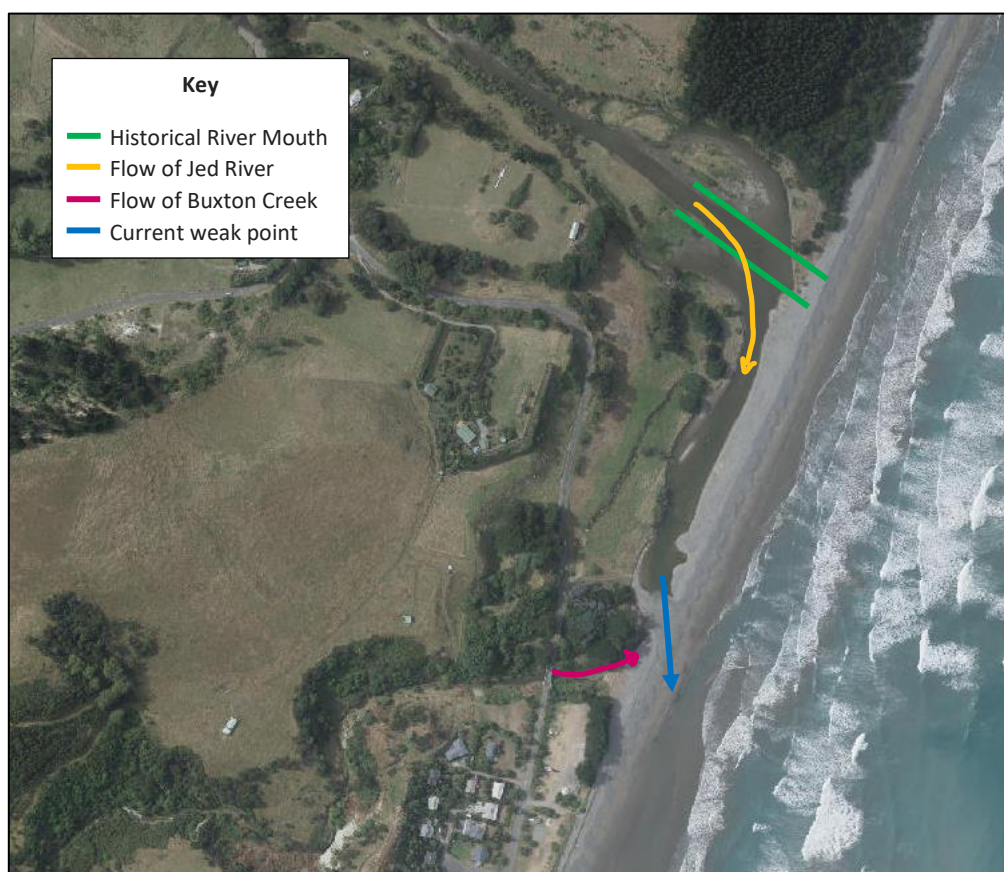


Figure 1: Map showing Jed River and Buxton River flow paths and river mouths

Anecdotally, in the 1940s and 1950s Athel Wilkinson, who had a market garden on the property adjacent to the lower Jed River, would dig with a shovel through the top of the beach single bar to create a river mouth to release the build-up of water. He would do this just before a high tide started to drop. Once weakened by digging, the force of the water would take over rapidly and he would have to make a hurried retreat as the water collapsed the shingle banks of the river mouth.

Manual opening of the river mouth has not been undertaken since and problems due to inundation and erosion have arisen.

Council owned reserve land is shown on the map below.

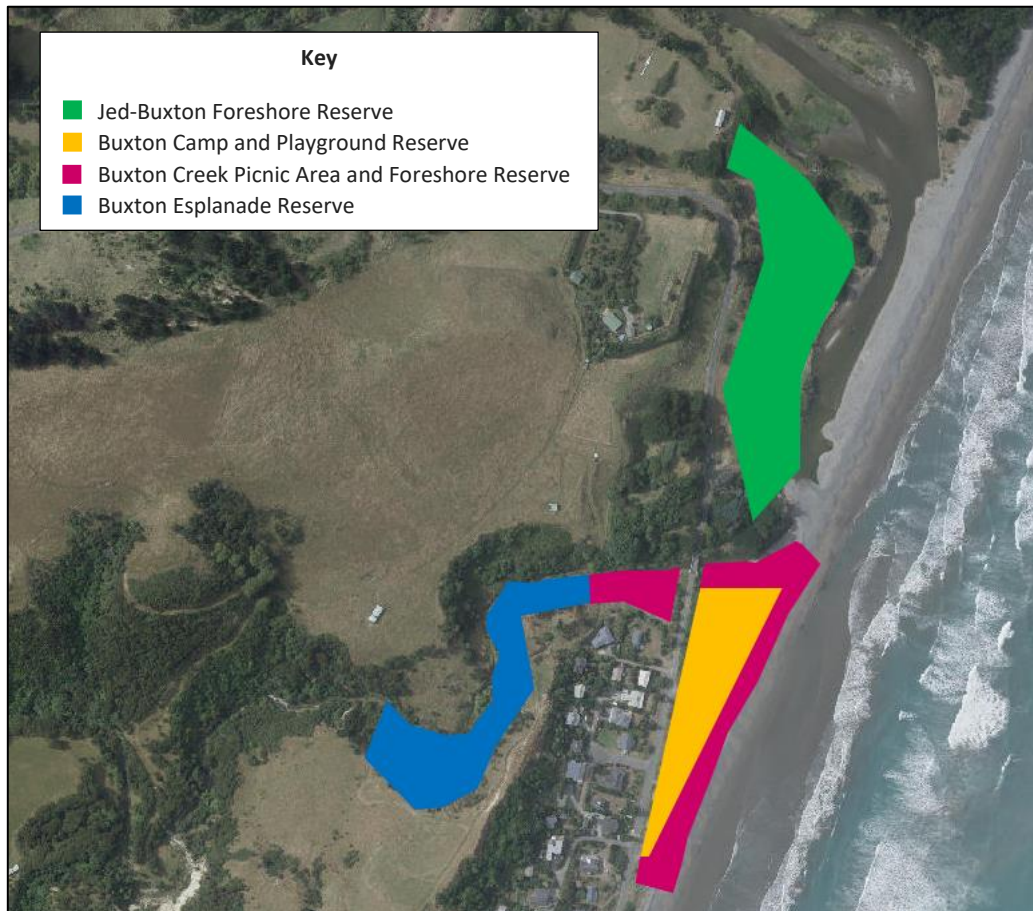


Figure 2: Council owned reserves

1.3 Coastal Hazard Risk

In 2020 the Hurunui District Council commenced a project to identify the current coastal hazards that impact Hurunui's coastal communities and to understand how these hazards will change over the next 100 years. This project is known as "Coastal Conversations." The project seeks to establish a long-term approach for managing the risk of coastal hazards at Gore Bay in partnership with the local community. The long-term approach will follow a dynamic adaptative planning pathway approach based on the approach set out in the Ministry for the Environment's *Coastal Hazards and Climate Change Guidance for Local Government*.¹ This work is informed by the Hurunui District Coastline Hazard and Risk Assessment² prepared by Jacobs New Zealand Limited.

¹ (Bell, Lawrence, Allan, Blackett, & Stephens, 2017)

² (Jacobs, 2020)

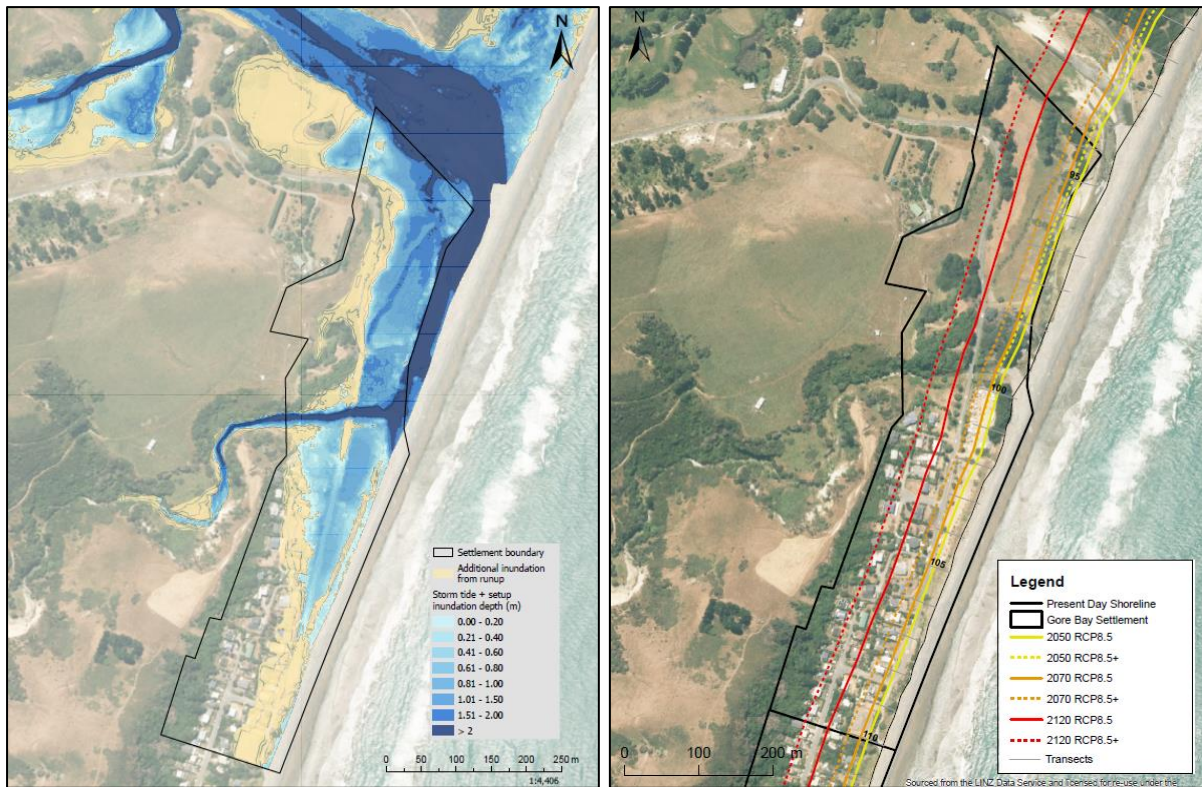


Figure 3a: Coastal Inundation Map for Northern Gore Bay; Figure 3b: Coastal Erosion Map for Northern Gore Bay

Figure 3a shows the coastal inundation hazard at Gore Bay for a 1 in 100-year coastal storm in 2070. This includes 0.45m of sea level rise. The deep blue shows the Jed River, Buxton Creek, and the lagoon. Flooding is expected to cover the nearby farmland, the campground and some of the northern properties within the settlement.

Figure 3b shows the projected shoreline position in 2050, 2070 and 2120. As the beach barrier erodes the lagoon area is likely to be reduced. This is because coastal retreat occurs faster than lagoon relocation. This may increase the flood risk due to the reduced storage capacity or it may cause the mouth to breach quicker.

2 The issues

2.1 Issue 1 – Erosion of land

In the last 40 years, 15-20m of stable, vegetated land at the seaward side of the Jed-Buxton Foreshore Reserve has disappeared, including areas covered in marram grass, ngaio and tamarisk trees. The erosion is caused by the combined presence of floodwater and big seas.

Big seas are thought to be causing erosion in two ways:

1. When the combined river mouth is open water enters the river mouth and hits the bank behind the lagoon directly, and
2. When the combined river mouth is closed water overtops the gravel bar flowing across the backed-up water hitting the bank behind the lagoon.

The Jed-Buxton Foreshore Reserve north of the Buxton Bridge provides an important buffer between the coast and Gore Bay Road, one of two access points into the settlement. The Buxton Camp and Playground Reserve and the Buxton Creek Picnic Area and Foreshore Reserve south of the Buxton

Bridge experienced significant erosion because of the February 2023 weather event. The map below shows the key areas of concern.



Figure 4: Map showing known erosion issues around the Jed River and Buxton Creek lagoon

2.2 Issue 2 – Nuisance Flooding

The Jed River does not have a permanent river mouth. Water builds up in the lagoon and when the pressure becomes too great the force of the water breaks through the gravel bar. The water usually takes more than one rainfall event to build up. The river mouth opening is only temporary as heavy seas deposit gravels in the river mouth opening again.

The water can cover parts of the road reserve and the seaward sections of the Buxton Camp and Playground Reserve and the Buxton Creek Picnic Area and Foreshore Reserve. The Buxton Camp is located immediately south of the Buxton Bridge on the seaward side of Gore Bay Road. This land is currently at risk of flooding in a 1 in 100-year event. Care needs to be taken not to flood the campground while exploring means to prevent further erosion immediately north.

2.3 Issue 3 – Scouring of bridge foundations

As the lagoon fills up water flows upstream scouring out the Buxton Creek bridge abutments. This bridge is important as it is one of two access points to the Gore Bay settlement and the one closest to Cheviot.



Figure 5a and b: Buxton Bridge downstream abutments

2.4 Issue 4 – Area is ecologically significant

The area is known to be ecologically significant. An ecological survey was undertaken in 2019 to assess the ecological values of the area.

The survey of Buxton Creek identified limited inanga spawning habitat as most of the bank is too steep to be considered ideal spawning habitat; however, two eggs were found during the survey. The true right bank of the Jed River was determined to have some potential inanga spawning habitat. Given the potential habitat it was recommended that a mouth opening should not be created during peak inanga spawning season of March through July.

The banded dotterel nesting season is August to early November. It was also recommended that vehicles should not access the gravel bar during this time. If works are to be required near the Jed River mouth this leaves a limited window of mid-November to late-February where works can be undertaken in the area to create a mouth openings.

2.5 Issue 5 – Area is culturally significant

A Cultural Impact Assessment has not been completed however we know the area is significant to Ngāti Kuri and home to a number of culturally significant sites. The site is also abutted by the Coastal Statutory Acknowledgement Area.

2.6 Issue 6 – Logistical challenges in opening and retaining the river mouth

The Jed River can be opened to the sea by creating a weak point in the gravel bar with a digger when the conditions are right. Depending on where the mouth is to be opened there are logistical challenges in getting the digger to the right location at the right time. The window for works is fairly narrow as the constructed weak point will backfill with gravel if opened too soon.

The river will break the bar at the point of least resistance. This means that a strong barrier needs to be constructed to prevent water following its previous course and to encourage the river to continue to breach the bar in the new location.

2.7 Issue 7 – Limitations of working in bodies of water and coastal marine area

The New Zealand Coastal Policy Statement, the Canterbury Land and Water Regional Plan and the Regional Coastal Environment Plan all put limitations on the works that can be undertaken in the coastal area and in the body of waterways. These documents are discussed further below.

2.8 Issue 8 – Funding

All of the options to address the issues above come at a cost. There is currently no money set aside to investigate these options further or fund the works themselves.

3 Decision making framework

3.1 Resource Management Act 1991 (RMA)

The Resource Management Act 1991 (RMA) is the primary legislative document guiding national and regional policy planning in New Zealand. The purpose of the RMA is to promote the sustainable management of natural and physical resources (s5). In achieving that purpose councils must recognise and provide for a number of *matters of national importance* including:

- The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use and development (s6(a)).
- The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna (s6(c)).
- The maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers (s6(d)).
- The management of significant risks from natural hazards (s6(h)).

Council is also required to have particular regard to the effects of climate change (s7(i)).

3.2 National Policy Statements

The purpose of national policy statements is to state objectives and policies to achieve the overarching purpose of the RMA in relation to matters of national significance. The most significant of these for works at the river mouth is the New Zealand Coastal Policy Statement.

3.2.1 New Zealand Coastal Policy Statement (NZCPS)

The New Zealand Coastal Policy Statement (NZCPS) states objectives and policies to achieve the overarching purpose of the RMA in relation to the coastal environment. All regional and district plans must give effect to the NZCPS. The NZCPS is important as it guides the policy framework for all planning documents relating to the coastal environment throughout New Zealand. Objective 1 and 5 are the most relevant.

Objective 1

To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by:

- *maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;*

- *protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and*
- *maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.*

Objective 5

To ensure that coastal hazard risks taking account of climate change, are managed by:

- *Locating new development away from areas prone to such risks;*
- *Considering responses, including managed retreat, for existing development in this situation; and*
- *Protecting or restoring natural defences to coastal hazards.*

The following policies are also relevant in achieving the above objectives:

- Policy 2 The Treaty of Waitangi, tangata whenua and Māori heritage
- Policy 11 Indigenous biological diversity (biodiversity)
- Policy 13 Preservation of natural character
- Policy 15 Natural features and natural landscapes
- Policy 19 Walking access
- Policy 22 Sedimentation
- Policy 23 Discharge of contaminants
- Policy 26: Natural defences against coastal hazards
- Policy 27: Strategies for protecting significant existing development from coastal hazard risk.

3.3 Planning documents

3.3.1 Canterbury Regional Policy Statement (CRPS)

The Canterbury Regional Policy Statement gives an overview of the significant resource management issues facing the region, including issues of resource management significance to Ngāi Tahu. The purpose of the CRPS is to set out objectives, policies, and methods to resolve those resource management issues and to achieve the integrated management of the natural and physical resources of Canterbury.

A full and detailed review of the CRPS would be required prior to progressing any option. Of particular relevance are Policies 8.3.3, 8.3.4 and 11.3.7 which place an emphasis on maintaining the natural character of the area.

8.3.3 Management of activities in the coastal environment

Within the coastal marine area provide a framework for:

1. *the use and occupation of coastal space;*
2. *the use and development of the natural and physical resources of the coastal marine area;*
3. *the extraction of sand, shingle, shell, or other natural materials;*
4. *the emission of noise;*
5. *activities on the water and on the foreshore and seabed;*
6. *protecting the values of the coastal environment while avoiding, or where this is not practicable, remedying or mitigating adverse effects within the coastal environment on:*
 - a. *the life-supporting capacity and/or mauri of coastal ecosystems and the natural processes that sustain them;*
 - b. *indigenous species, areas of significant indigenous vegetation and significant habitats of indigenous fauna;*

- c. *natural character (including associated natural processes), outstanding natural features and outstanding natural landscapes;*
- d. *amenity, cultural and recreational values;*
- e. *coastal areas of cultural significance identified in consultation with Ngāi Tahu as tāngata whenua;*
- f. *the health and safety of people;*
- g. *historic heritage values, including historic heritage and historic cultural landscapes;*
- h. *surf breaks of national significance;*
- i. *the efficient and effective operation, maintenance and development of regionally significant infrastructure or other commercial maritime facilities.*

Policy 8.3.4 Preservation of the natural character of the coastal environment

To preserve and restore the natural character of the coastal environment by:

- 1. *protecting outstanding natural features and landscapes including seascapes from inappropriate occupation, subdivision, use and development;*
- 2. *protecting and enhancing indigenous ecosystems and associated ecological processes;*
- 3. *promoting integrated management of activities that affect natural character in the coastal environment and the coastal marine area, in particular coastal landforms and landscapes that are significant, representative or unique to the region;*
- 4. *avoiding new development adjacent to the coastal marine area that will compromise areas of high natural character; and*
- 5. *in appropriate situations, imposing or reviewing restoration or rehabilitation conditions on resource consents and designations.*

11.3.7 Physical mitigation works

New physical works to mitigate natural hazards will be acceptable only where:

- 1. *the natural hazard risk cannot reasonably be avoided; and*
- 2. *any adverse effects of those works on the natural and built environment and on the cultural values of Ngāi Tahu, are avoided, remedied or mitigated. Alternatives to physical works, such as the relocation, removal or abandonment of existing structures should be considered. Where physical mitigation works or structures are developed or maintained by local authorities, impediments to accessing those structures for maintenance purposes will be avoided.*

3.3.2 Canterbury Land and Water Regional Plan

The purpose of the Canterbury Land and Water Regional Plan (LWRP) is to identify the resource management outcomes for managing land and water resources in Canterbury to achieve the purpose of the RMA. It identifies the policies and rules needed to achieve the objectives and provides direction in terms of the processing of resource consent applications.

The following objectives and policies have particular relevance to this issue:

Objective 3.16 Freshwater bodies and their catchments are maintained in a healthy state, including through hydrological and geomorphic processes such as flushing and opening hāpua and river mouths, flushing algal and weed growth, and transporting sediment.

Objective 3.17 The significant indigenous biodiversity values of rivers, wetlands and hāpua are protected.

Policy 4.86 Activities that occur in the beds or margins of lakes, rivers, wetlands, hāpua, coastal lakes and lagoons are managed or undertaken so that:

- (a) *the character and channel characteristics of rivers including the variable channel characteristics of braided rivers are preserved;*

- (b) *sites and areas of significant indigenous biodiversity values or of cultural significance to Ngāi Tahu are protected; and*
- (c) *existing lawful access to the bed of the lake, river, wetland, hāpua, coastal lake, or lagoon for recreational, customary use, water intakes or supplies or flood control purposes, is not precluded, except where necessary to protect public health and safety.*

Policy 4.86A Within the beds and margins of lakes, rivers, hāpua, wetlands, coastal lakes and lagoons, damage to inanga spawning habitat is minimised by scheduling works to occur outside the inanga spawning period of 1 March to 1 June inclusive where it is practicable to do so, and by extending this period where the works involve vegetation clearance, cultivation or earthworks, so as to allow sufficient time for regeneration of the habitat.

Policy 4.88 Earthworks, structures, or the planting or removal of vegetation (other than by spraying) in the beds of lakes, rivers, hāpua, coastal lakes and lagoons, or within a wetland boundary do not occur in flowing or standing water unless any effects on water quality, ecosystems, or the amenity, recreational or cultural values will be minor or the effects of diverting water are more significant than the effects of the activity occurring in flowing or standing water.

Policy 4.89 Earthworks, structures (including defences against water), vegetation planting or removal, or other activities in the beds of lakes or rivers, do not materially restrict flood flows in any river, or create or exacerbate erosion of the bed or banks of any river or the bed or margins of any lake.

3.3.3 Canterbury Regional Coastal Environment Plan (RCEP)

The Regional Coastal Environment Plan includes objectives, policies and rules regarding the occupation of the coastal marine area and the activities which can occur within a coastal hazard zone. The policies in the RCEP are generally consistent with the NZCPS but both need to be considered. The following objectives and policies are relevant.

Policy 6.1

- a. *Within the Coastal Marine Area Environment Canterbury will:*
 - i. *control activities and development to remedy or mitigate adverse effects on:*
 - *coastal ecosystems and processes,*
 - *the identified values of Areas of Significant Natural Value,*
 - *the identified values of areas of high natural, physical, heritage or cultural value, and*
 - *natural character in areas of the coastal environment where natural character predominates; and*
 - ii. *control activities and development to avoid any significant adverse effects on:*
 - *coastal ecosystems and processes,*
 - *the identified values of Areas of Significant Natural Value,*
 - *the identified values of areas of high natural, physical, heritage or cultural value, and*
 - *natural character in areas of the coastal environment where natural character predominates; unless there are special or extraordinary and unique reasons why those adverse effects cannot be avoided; and*
 - iii. *adopt a precautionary approach¹⁰ when considering applications for resource consents where the effects, including cumulative effects, are as yet unknown or little understood, or where the functioning of marine ecosystems and coastal processes is poorly understood.*

Objective 7.1

Enable present and future generations to gain cultural, social, recreational economic, health and other benefits from the quality of the water in the Coastal Marine Area, while:

- a. *maintaining the overall existing high natural water quality of coastal waters;*

- b. *safeguarding the life-supporting capacity of the water, including its associated: aquatic ecosystems, significant habitats of indigenous fauna and areas of significant indigenous vegetation;*
- c. *safeguarding, and where appropriate, enhancing its value for providing mahinga kai for Tāngata whenua;*
- d. *protecting wahi tapu and Wāhi taonga of value to Tāngata whenua;*
- e. *preserving natural character and protecting outstanding natural features and landscapes, where water quality is an aspect of their value, from reductions in water quality;*
- f. *maintaining, and where appropriate enhancing, amenity values; and*
- g. *recognising the intrinsic values of ecosystems and any finite characteristics of the coastal environment.*

Policy 8.3

In considering applications for resource consents to undertake activities in the Coastal Marine Area, Environment Canterbury will have regard to:

- a. *the existing level of use and development in the area and the national priority in the New Zealand Coastal Policy Statement to preserve the natural character of the coastal environment; and*
- b. *the need to protect characteristics of the coastal environment of special value to Tāngata whenua; and*
- c. *effects on the public use and enjoyment of the coast, including public access to and along the Coastal Marine Area, and the contribution of open space to the amenity value of the coast; and*
- d. *cumulative effects of such activities on the coastal environment both within and outside the immediate location; and*
- e. *existing agricultural and other use and development of the adjacent land area, and any adverse effects on that activity; and*
- f. *the status of any lands or areas administered by the Department of Conservation that are affected; and*
- g. *the publicly notified purpose of any proposal for protected status, if the application affects an area proposed for protection under a statute administered by the Department of Conservation; and*
- h. *the possibility of natural features migrating inland as the result of dynamic coastal processes, including sea level rise, and the ability of natural features to protect subdivision, use and development from erosion and inundation; and*
- i. *the need to protect existing network utility infrastructure where such infrastructure is located adjacent to or within the Coastal Marine Area.*

Policy 8.7

Activities in the Coastal Marine Area should not take place where they have, or have the potential to have, a significant or irreversible adverse effect on the natural or cultural values of an Area of Significant Natural Value, or on the natural or cultural values of areas of the coastal environment adjacent to an Area of Significant Natural Value; unless:

- a. *there are special or extraordinary and unique reasons why the activity should be sited in the area; and*
- b. *any adverse effects on areas of significant indigenous vegetation or significant habitats of indigenous fauna, are avoided, remedied or mitigated.*

Policy 8.14

In considering applications for resource consents for coastal protection works in the Coastal Marine Area in order to protect existing subdivision, use or development, Environment Canterbury will:

- a. *only grant the consent where the works are the best practicable option for the future; and*
- b. *consider the option of abandonment or relocation of existing structures; and*

- c. *ensure that any such works are located and designed so as to avoid significant adverse effects on the environment to the extent practicable.*

Objective 9.1

- a. *To minimise the need for hazard protection works, and avoid or mitigate the actual or potential effects of coastal hazards by locating use and development away from areas that are subject to coastal erosion and sea water inundation.*
- b. *To avoid, remedy or mitigate significant adverse effects on the environment as a result of measures used to manage coastal hazards.*

Policy 9.1

- a. [...]
- b. *Any new development in the coastal environment should be designed or located in such a way that the need for coastal protection works, now and in the future, is minimised.*
- c. *The continued use and protection of essential infrastructure and services should be provided for, where no reasonable alternative exists, in areas subject to coastal hazards, provided adverse effects on the coastal environment are avoided, remedied or mitigated.*
- d. *New coastal protection works for existing use and development should only be considered where they represent the best practical option for natural hazard mitigation or avoidance, and adverse effects can be avoided, remedied or mitigated.*
- e. [...]

4 Options

The following options have been considered in the sections below:

1. Manual opening of the Jed River Mouth
2. Separate the Jed River Mouth and the Buxton Creek Mouth
3. Protection works around the bridge abutments
4. Protection works along the Buxton Camp
5. Protection as part of a whole of Gore Bay coastline approach
6. Do nothing.

4.1 Option 1 – Manual opening of the Jed River Mouth

Option 1 would involve the construction of a barrier along the lower banks of the Jed River to channel the water to a fixed point (blue on Figure 6). When the water level in the river was high a small swale would be formed at the orange point to help create a weak point. This would allow the water to naturally scour out the opening and reroute the Jed River mouth to the desirable location.

For this to work the barrier between the Jed River and the lagoon would need to involve hard engineering. If a gravel barrier was used this is likely to remain the weak point and the river would scour this out as opposed to opening the river mouth directly in line with the river.

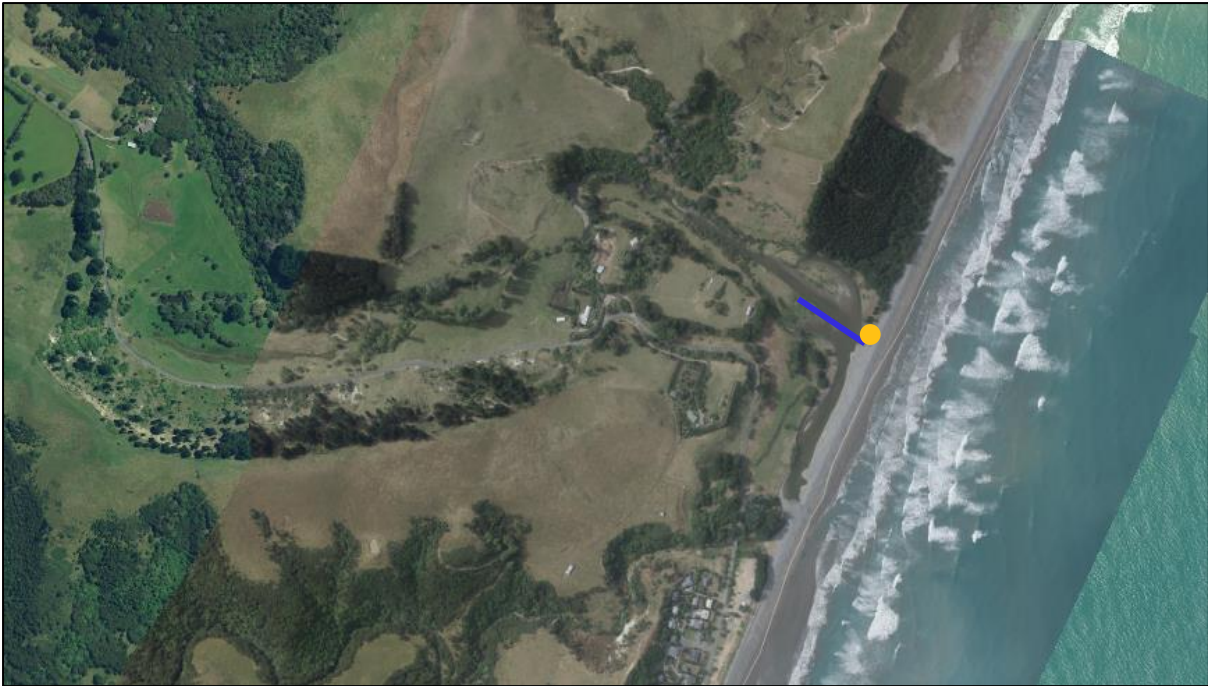


Figure 6: Proposed location of barrier and opening of mouth to sea

4.1.1 Ecological considerations

The area is known to be ecologically significant. An ecological survey was undertaken in 2019 to assess the ecological values of the area. The true right bank of the Jed River was determined to have some potential inanga spawning habitat. Given the potential habitat the ecological report recommended that the mouth should not be created during peak inanga spawning season of March through July.

The area is known to be home to the banded dotterel. The banded dotterel nesting season is August to early November. It was also recommended that vehicles should not access the gravel bar during this time unless a nesting survey was undertaken prior to works.

This leaves a limited window of mid-November to late-February where works can be undertaken. This window does not allow the mouth to be opened during the winter storm season when conditions are favourable for this.

4.1.2 Coastal geomorphological considerations

This option considers the placement of hard protection along the southern edge of the river mouth to act as a barrier between the river and the lagoon. The effect of this work on the northern banks of the river mouth are not known. It is possible a new weak spot could form inland at the termination of the wall rerouting water a different way into the lagoon or alternatively a new weak point could emerge to the north of the Jed River flooding the land to the north of the river mouth prior to breaking out to the sea. These effects would need to be investigated as part of a resource consent application.

4.1.3 Consenting

The consents required depend on the exact scope of works and in particular whether the activities will occur on land or in the riverbed, and in the coastal marine area or landward of the coastal marine area. It is anticipated the following consents would be required:

- Rule 7.2 of the RCEP for the discharge of any water or any contaminant, into water, or onto or into land, in the Coastal Marine Area (discretionary activity);
- Rule 8.8 of the RCEP for works within the coastal marine area (discretionary activity);
- Rule 9.2 of the RCEP for works within Hazard Zone 1 or 2 (restricted discretionary);

- Rule 5.141B of the LWRP for the disturbance of the bed of a river and associated discharge (discretionary activity); and
- Rule 5.144 of the LWRP for the disturbance of the bed of a river (discretionary activity).

Once the project is scoped additional resource consents may be required. Due to the significant ecological and cultural values in the area and the requirement for hard engineering a resource consent for these works will be challenging.

4.1.4 Cost

An accurate costing would require the works to be scoped and costed by an engineer. The below is intended to give an indicative order of magnitude cost based on other projects to inform whether more detailed costings are to be obtained.

The works are likely to require approximately 125 m of concrete or rock on the south side of the river to prevent the outflanking of the wall. The depth of the lagoon is not known, and the costings consider the placement of 1 m³ concrete blocks two blocks high for the length of the required works. Concrete blocks are considerably cheaper than their rock equivalent. This is anticipated to cost around \$800,000 with a significant part of the cost being the transport of material to the site. Additional to this the preparation of the resource consent application and associated technical reports, and the processing of the resource consent could cost a further \$80,000.

These costs could increase significantly if the scope of the project is required to be amended as a result of the technical assessments.

4.2 Option 2 – Separate the Jed River Mouth and the Buxton Creek Mouth

Option 2 involves using beach gravel to help block off the point where the Jed River mouth meets the Buxton Creek mouth (approximate location shown in Figure 7). This would create two separate mouths and prevent water from the Jed River flowing up Buxton Creek. A site visit was undertaken with a Coastal Scientist in October 2022. It is considered likely that this would happen naturally over time, however we could help speed the process up. Water from the Jed would continue to fill the lagoon until such a time as the mouth relocates further north.



Figure 7: Map showing the narrow point of the lagoon where gravel would be placed

4.2.1 Ecological considerations

This option may be favourable from an ecological point of view. The works could be undertaken outside of the banded dotterel nesting season and would not intersect with the inanga spawning habitat of the righthand bank of the Jed River. While manual works are required this would mimic a natural process.

4.2.2 Coastal geomorphological considerations

As these works mimic the natural process the coastal effects could be relatively minor. Some assessment would be required to support this hypothesis and to ensure there are no adverse effects on the shoreline immediately north or south of the project site.

4.2.3 Consenting

The consents required depend on the exact scope of works and in particular whether the activities will occur on land or in the riverbed, and in the coastal marine area or landward of the coastal marine area. It is anticipated the following consents would be required:

- Rule 8.8 of the RCEP for works within the coastal marine area (discretionary activity);
- Rule 9.2 of the RCEP for works within Hazard Zone 1 or 2 (restricted discretionary);
- Rule 5.141B of the LWRP for the disturbance of the bed of a river and associated discharge (discretionary activity); and
- Rule 5.144 of the LWRP for the disturbance of the bed of a river (discretionary activity).

This is likely to be easier to consent than Option 1 as it would be a more natural solution and addresses some of the ecological issues with Option 1. The cultural significance of this site is still unknown.

4.2.4 Cost

Based on the cost of beach scraping the physical works could cost around \$22,000. The consenting of these works could cost around \$60,000.

4.3 Option 3 – Protection works around the bridge abutments

It is an option to focus on protecting the road into the settlement and leave the coast to go through its natural processes. This could involve protecting the bridge abutments with additional concrete or other material if scouring of the abutments was becoming a significant concern.

An option is to focus on protecting the bridge abutments. This would involve additional concrete reinforcements to prevent the scouring of material from the foundations. This would have the benefit of protecting the road but would not address erosion or inundation concerns.



Figure 8: Protection of Buxton Creek Bridge abutments

4.3.1 Ecological considerations

All works within the bed of a river have some ecological effect. An ecological assessment would be required to determine the significance of the site. The works would be fairly limited in natural and limited to a site that is already heavily modified.

4.3.2 Consenting

Resource consent would be required for undertaking works in the bed of a river.

Given the bridge already exists, the area affected is small and the purpose of the works is to maintain existing infrastructure it is likely that consent would be granted.

It is anticipated the following consents would be required:

- Rule 5.141B of the LWRP for the disturbance of the bed of a river and associated discharge (discretionary activity); and
- Rule 5.144 of the LWRP for the disturbance of the bed of a river (discretionary activity).

4.3.3 Cost

No costs have been obtained but given the small scale of this work the costs are likely to be significantly cheaper than the alternative options.

4.4 Option 4 – Protection works along the Buxton Camp

The most immediate area of concern is the land seaward of the Buxton Camp. Recent storms felled some macrocarpa trees which now lie in the coastal marine area and expose the bank to further erosion. One option is to push the macrocarpas up against the bank to act as a lunker wall. Alternatively, rocks could be used to provide greater and more lasting protection.



Figure 9: Buxton Reserve after February weather events

4.4.1 Ecological considerations

An ecological assessment may be required but based on the previous report the works may be able to avoid the band dotterel nesting season limiting the effects.

4.4.2 Coastal geomorphological considerations

A formal assessment would need to be completed to show that the structure would not exacerbate erosion elsewhere on the coastline. Protection works can cause end effects where the protection structure ends and the natural coastline resumes. These stretches of coastline can be prone to increased erosion rates. The effects need to be carefully considered to ensure that by protecting the camp we are not adversely affecting the settlement.

4.4.3 Consenting

It is anticipated that these works would occur landward of the coastal marine area boundary but within the Coastal Hazard Zone. Provided this is the case it is anticipated the following consent would be required:

- Rule 9.2 of the RCEP for works within Hazard Zone 1 or 2 (restricted discretionary).

Additional consents will be required if we are required to work within the bed of the river. There is a high bar for the use of hard protection in the NZCPS. We would need to show this work is necessary to protect significant development and that other options have been considered. The works are more likely to gain consent if they are linked to the primary access into Gore Bay.

4.4.4 Cost

Jacobs provided us with costs for rock revetment for 400 m to protect Cathedral Road and 300 m to protect Gore Bay Road. The total cost estimate was \$12,182,000. The required length of protection works in front of the Buxton Reserve is approximately 150 m. Based on this, the estimated cost of rock

revetment could be around \$2,800,000. This accounts for some overhead costs that exist regardless of the amount of protection to be installed.

The use of trees is likely to be significantly cheaper and the costs of consenting may be greater than the costs of the works themselves.

4.5 Option 5 – Protection as part of a whole of Gore Bay coastline approach

The entire Gore Bay coastline is approximately 1.3 km. The Jacobs' Report³ states that by 2050 the shoreline could be in the order of 22 to 50 m landward of its current position. If only part of the coastline is protected there is a risk that the erosion to the remainder of the coastline increases. This risk should be assessed prior to any protection works being installed. The settlement could look to install protection works along the entire coastline now to protect the reserves, roads and private property.

The map below shows the breakdown of what each section of the protection works are protecting.

- Green – protection works required because roads are vulnerable in the next 30-50 years,
- Red – protection works desirable around the Buxton Reserve to prevent erosion issues,
- Orange – Council-owned reserves
- Purple – private property.

If the green and red areas are to be protected (approximately 850 m) it may make sense to join the protection works up now to prevent parts of the settlement remaining exposed. The additional 450 m of works would come at an additional cost but would protect the integrity of the Gore Bay settlement. This option sits outside the scope of this paper but is included as there is merit in considering this if protection works are desired elsewhere.

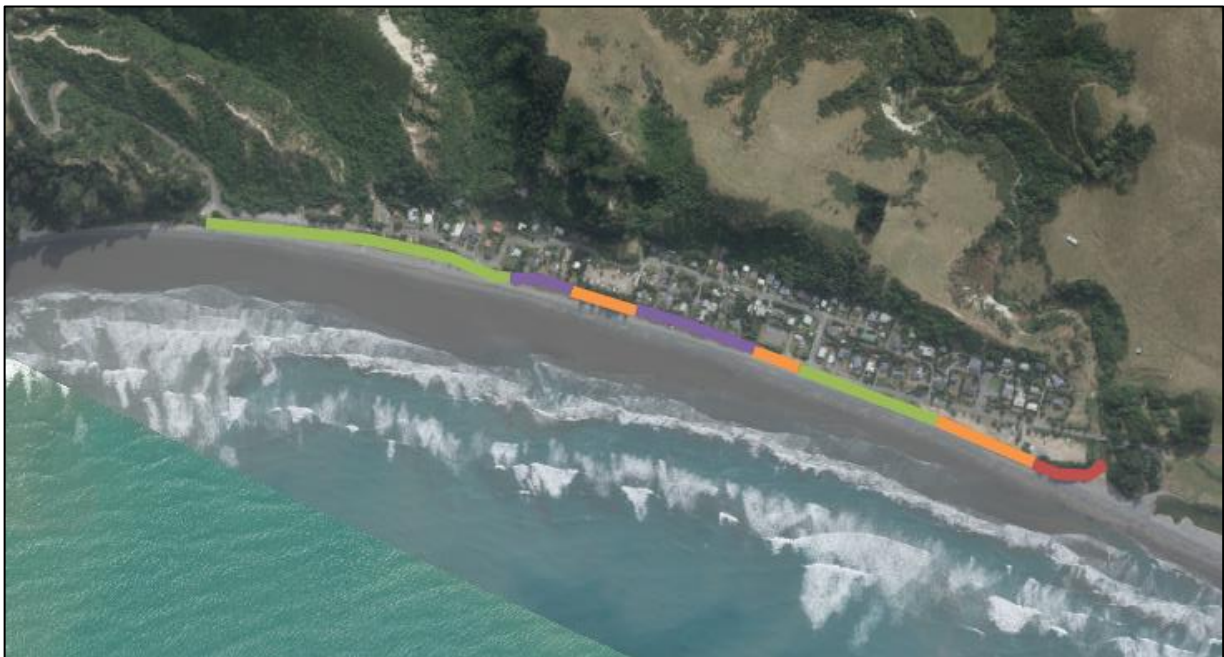


Figure 10: Map of Gore Bay showing ownership

³ (Jacobs, 2020)

4.5.1 Ecological considerations

An ecological assessment may be required but based on the previous report the works may be able to avoid the band dotterel nesting season limiting the effects.

4.5.2 Coastal geomorphological considerations

A detailed assessment would be required to show the effects of the proposed protection works.

4.5.3 Consenting

It is anticipated that these works would occur landward of the coastal marine area boundary but within the Coastal Hazard Zone. Provided this is the case it is anticipated the following consent would be required:

- Rule 9.2 of the RCEP for works within Hazard Zone 1 or 2 (restricted discretionary).

There is a high bar for the use of hard protection in the NZCPS. We would need to show this work is necessary to protect significant development and that other options have been considered.

4.5.4 Cost

Jacobs provided us with costs for rock revetment for 400 m to protect Cathedral Road and 300 m to protect Gore Bay Road. The total cost estimate was \$12,182,000. The total length required to protect the whole settlement is approximately 1.3km. Based on this it would cost approximately \$22 million to protect the full length of coastline with rock revetment. Concrete options are harder to consent but cheaper to install and natural solutions tend to be easier to consent, cheaper to install but have a much shorter lifespan.

4.6 Option 6 – Do nothing

There is always the option to do nothing. Coastal erosion occurs faster than lagoon relocation. This means that the area of the lagoon will be reduced. More water will back up in the river due to the reduction of ponding area. This will either:

- increase the risk of flooding at the lower reaches before the beach is breach; or
- it may force the beach to breach faster.

4.6.1 Ecological considerations

This is the natural process and does not involve disturbing any habitat.

4.6.2 Consenting

No consent is required.

4.6.3 Cost

No financial cost directly associated with the action. However, there is a cost to losing land to erosion or coastal inundation.

5 Summary of Options

The table below summarises the options available.

	Ecological	Engineering	Consenting	Cost
Manual opening of the Jed River Mouth	High	High	Very Challenging	\$880,000
Separate the Jed River Mouth and the Buxton Creek Mouth	Moderate	Moderate	Moderate	\$82,000
Protection works around the bridge abutments	Moderate	Minimal	Easier	Low
Protection works along the Buxton Camp	Unknown	High	Challenging	\$2.8m
Protection as part of a whole of Gore Bay coastline approach	Unknown	High	Challenging	\$22m
Do nothing	Nil	Nil	Nil	Nil