

Wairoa Flood Scheme

Dredging Option

Prepared for Hawke's Bay Regional Council
Prepared by Beca

19 June 2024



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Cover photo source: <https://www.localmatters.co.nz/news/dredging-operations-falter-as-cash-runs-out/>,
accessed 16/06/2024

Revision History

Revision N°	Prepared By	Description	Date
1	Andrew Hay Phoebe Watson	Draft for client review	19/06/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	Andrew Hay		19/06/2024
Reviewed by	Philip Robins		19/06/2024
Approved by	Matt Sanders		19/06/2024
on behalf of	Beca		19/06/2024

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Executive Summary

Hawkes Bay Regional Council (HBRC) working with Wairoa District Council and Tātau Tātau o Te Wairoa engaged WSP to identify feasible flood protection/management solutions to re-categorize 2A properties as 2C. The options included a variety of measures such as flood spillways, stopbanks, flood plain storage, upstream dams, up-catchment planting, dredging, wetland storage capacity, land drainage improvements and permanently opening the bar at the river mouth.

Beca has been commissioned to provide professional commentary on the dredging efforts projected to significantly diminish the anticipated flooding impacts during a 1% Annual Exceedance Probability (AEP) flood event. This includes evaluating the potential lifetime expenses associated with flood reduction through dredging, assessing environmental and consenting impacts and challenges associated with dredging,

To undertake the dredging works, a resource consent will likely be required under the Regional Resource Management Plan (RRMP). The works would be a discretionary activity with the consenting authority being able to consider all effects of the activity on the environment.

This is because the proposed dredging is not specifically provided for in the rules relating to the disturbance of riverbeds under the RRMP and is unlikely to meet the required conditions for disturbances to riverbeds not otherwise provided for.

The dredging works would extend beyond the stretch of the Wairoa River covered by the Severe Weather Emergency Recovery (Hawke's Bay Flood Protection Works) Order and would not benefit from this expedited consenting process.

International literature does not recommend relying solely on dredging as a standalone solution and recommends it is considered alongside a wider range of approaches. The river ecosystem operates in equilibrium and changing the natural form of the channel, could result in negative engineering feedbacks such as the channel refilling with sediment and decreased bank stability.

Maintaining bank stability is crucial, especially with nearby land vulnerable to liquefaction and sections of the riverbank identified by HBRC GIS as having a high risk of instability.

The dredging works would likely have environmental considerations such as disposal of material, turbidity in the river, disturbance of the river bed, as well as potential noise and odour issues. These would need to be appropriately managed to minimise environmental impacts.

Dredging has been considered as a management option for flood risk alleviation in the Wairoa River with two scenarios considered. However, due to the large flows in both the existing and future predicted 1% AEP storm events, the required channel size increase is enormous and removing the material would be cost-prohibitive. There is also a significant ongoing maintenance cost that could be up to NZ\$130 million per year depending on how much sediment occurs.

Based on the information provided, we consider that dredging is not an appropriate option for managing flood risk in the Wairoa River. It is cost-prohibitive, has a high ongoing maintenance burden, introduces likely environmental impacts and could have a significant effect on bank stability.

1 Introduction/Background

1.1 Background

Hawkes Bay Regional Council (HBRC) working with Wairoa District Council and Tātau Tātau o Te Wairoa engaged WSP to identify feasible flood protection/management solutions to re-categorize 2A properties as 2C. The options included a variety of measures such as flood spillways, stopbanks, flood plain storage, upstream dams, up-catchment planting, dredging, wetland storage capacity, land drainage improvements and permanently opening the bar at the river mouth.

Beca has been commissioned to provide professional commentary on the dredging efforts projected to significantly diminish the anticipated flooding impacts during a 1% Annual Exceedance Probability (AEP) flood event. This includes evaluating the potential lifetime expenses associated with flood reduction through dredging, assessing environmental and consenting impacts and challenges associated with dredging,

1.2 Wider Project Scope

In February 2023, Wairoa, North Clyde and Frasertown all experienced significant flooding during Cyclone Gabrielle when the Wairoa River burst its banks (Reference 1). The Wairoa River has a catchment area of 3,670 km² and is tidal for 25km (upstream of Frasertown) (Reference 2).

HBRC commissioned a study to identify feasible flood protection/management solutions for protecting properties in a future 1% AEP storm event. The options included a variety of measures such as flood spillways, stopbanks, flood plain storage, upstream dams, up-catchment planting, dredging, wetland storage capacity, land drainage improvements and permanently opening the bar at the river mouth. These were short listed to four different floodway options and stopbanks (Reference 3).

The conclusion about dredging of the Wairoa Short List Options Flood Report (Reference 4) was:

- As a general practice avoided by engineers as a standalone solution.
- There is potential for environmental harm.
- There is a potential impact on bank stability.
- Prohibitively expensive due to large volumes of excavated material.
- The benefits are short lived due to the disruption in sediment transport.

1.3 Background Information

Documents provided by HBRC:

- WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023
- WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024
- WSP, Addendum to Short List Options Flood Modelling Report, 10/04/2024
- WSP, Land Category 2A - Frasertown Building Information, 09/04/2024
- Email from WSP. Subject: 20240607-Wairoa Dredging Volumes and extents. Received: 7th June 2024

Other documents reviewed as reference literature:

- CIWEM, Floods and Dredging – A Reality Check, February 2014
- Environment Agency (UK), Evidence: Impacts of dredging, August 2013
- Environment Protection Authority, Best Practice Environmental Management Guidelines for Dredging, October 2001
- Thorne, C.R., Hey, R.D., Newson, M.D., Applied Fluvial Geomorphology for River Engineering, 1997, Wiley and Sons

2 What is Dredging?

Dredging is the removal of bank and/or bed material from any water body (rivers, lakes, harbours etc.). Dredging can be used to drain land for agricultural purposes, improve channel capacity as part of flood schemes or deepening channels for navigational purposes (Reference 5).

While dredging can be done with large excavators from the bank or from a barge, with larger schemes typically undertaken with specialist equipment such as hydraulic suction. Figure 1 shows a photograph of dredging being undertaken with a long reach excavator on a barge in the Mahurangi River in Northland during 2019.



Figure 1: Photo of River Dredging Being Undertaken (Reference 6)

Most bed and bank material in waterbodies is a result of sedimentation. Sedimentation is an ongoing natural process whereby material is eroded (generally by means of water) and transported through the river system towards the ocean. As the river approaches the coast its channel is larger, the flow slower and therefore the energy within the river carries smaller particles. That is why as a river moves towards the coast, bed material which are boulders in the foothills, become gravels, and finally sand/silt at the coast.

Dredging cannot be done as a one-off activity, when done for flood alleviation. As sedimentation is an ongoing natural process, ongoing sediment removal is required.

3 Proposed Dredging Works

3.1 Outline

The Wairoa Flood Scheme Options Report (Reference 7), prepared for HBRC identified options for protecting the Category 2A properties. Category 2A are properties that require intervention to protect them from future flood events. One of the options identified was dredging.

The scheme is required to convey a future 1% AEP storm event. A 1% AEP storm is a rainfall event that has a 1% probability of occurring over the course of a year. To put such an event into perspective, Cyclone Gabrielle was a 1.4-1.7% AEP storm¹, so a 1% AEP storm would be larger than Cyclone Gabrielle. With the frequency and magnitude of rainfall events predicted to increase because of climate change, a scenario with an allowance for climate change has also been proposed.

The work done by WSP identified Wairoa River as needing:

- An additional 1,100 m³/s of flow capacity required to convey the current 1% AEP storm flow
- An additional 3,000 m³/s of flow capacity required to convey the future 1% AEP storm flow

Figure 2 shows the extent of the proposed dredging. A channel length of approximately 12 km from the railway bridge to the last bend before the coast. To achieve the current 1% AEP storm flow capacity this length needs to be dredged 4 m below present bed level and in order to achieve the future 1% AEP storm flow capacity, this length needs to be dredged 11 m below present bed level. The volume of dredging required is shown in Table 1.

Table 1: Dredging Volumes

Storm Event	Length (km)	Average channel width (m)	Depth (m)	Volume (m ³)
Current 1% AEP	12	110	4	5.28 million (approximately 2,000 Olympic sized swimming pools)
Future 1% AEP	12	110	11	14.52 million (approximately 6,000 Olympic sized swimming pools)

¹ WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024, Table 2.1

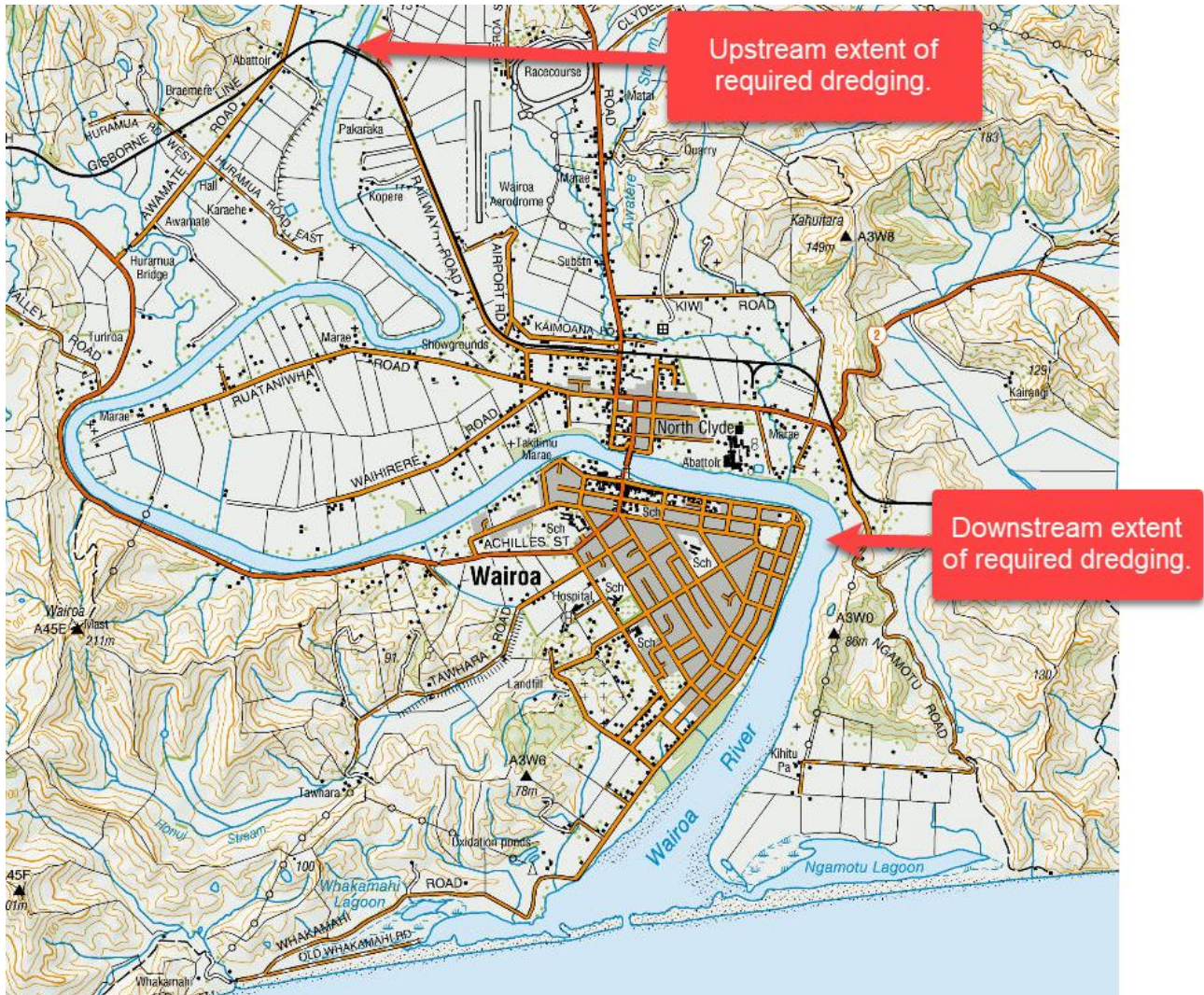


Figure 2: Proposed Dredging Extents (Reference 8)

3.2 Dredging as a Flood Management Approach

Dredging is typically costly and is primarily used where there's a clear economic benefit, such as for ship navigation in ports, harbours and rivers or gravel extraction for use as aggregate. Using dredging to increase flood capacity is less common and usually involves removing sediment that is prevented from moving naturally through the system such as behind dams, grade control structures, bridges, etc.

The water level of a river, and therefore what part of the wider river corridor contains flow, varies in different rainfall events. Flow is generally contained in the active river channel, but when the capacity of the river channel is exceeded, it spills out into adjacent low-lying land, activating the flood plain. The flood plain may in urban settings be contained by a stopbank. Figure 3 shows a stylised representation of a river corridor. In the context of the Wairoa River, there is a single actively flowing channel that takes up most of the width of the active river channel, even in low flow.

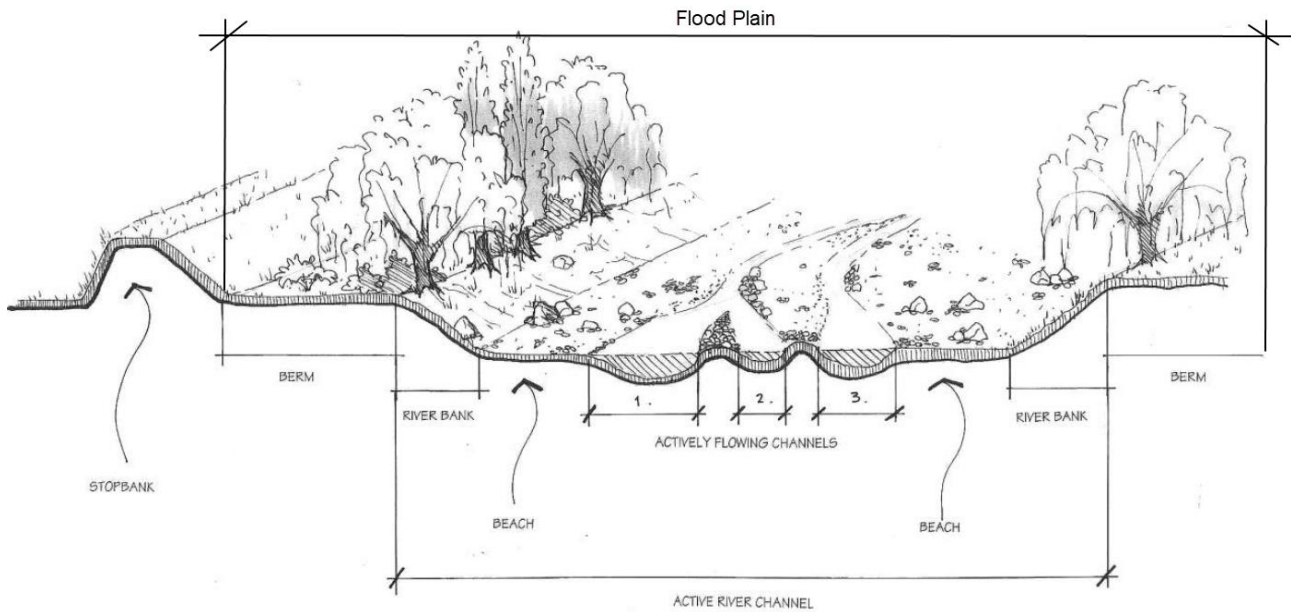


Figure 3: Stylised Representation of a River Corridor (Reference 9)

The capacity of the active river channel is generally insignificant when compared to the capacity of the wider floodplain (Reference 10). Therefore dredging channels (or even floodplains) to confine rare flood events (such as the 1% AEP) is typically not practical. While in some cases dredging can play an important role in the mitigation of flood risk, it is not a stand-alone solution. Dredging should be considered in the context of a range of flood mitigation tools and comes with significant risks that must be understood (Reference 11).

These conclusions support the same conclusion made in the Short List Modelling Report (see previous section 1.2).

3.3 Estimated Costs

3.3.1 Initial Dredge

The channel volume increase required to convey the 1% AEP storm events (both current and future) is significant. The costs associated with dredging lie in two main activities, extraction, and disposal. With an estimated 3 crews working 12 hours per day, the work duration to get capacity in the current 1% AEP storm event is over a year (14 months) and over 3 years (38 months) to get the capacity in the future 1% AEP storm event.

Beca's cost estimators have developed the following estimated dredging costs:

- Current 1% AEP storm capacity: Estimated cost of **NZ\$990 million**
- Future 1% AEP storm capacity: Estimated cost of **NZ\$2.7 billion**

Refer to Appendix A for the breakdown of estimated costs and assumptions.

3.3.2 Ongoing maintenance

There is also significant ongoing maintenance required to prevent the increased capacity being lost again with ongoing sedimentation. Figure 4 shows that sometimes there is high sedimentation (500mm/year between 1988 and 1993), and some years there is very little (1993-1997 and 2003-2010).

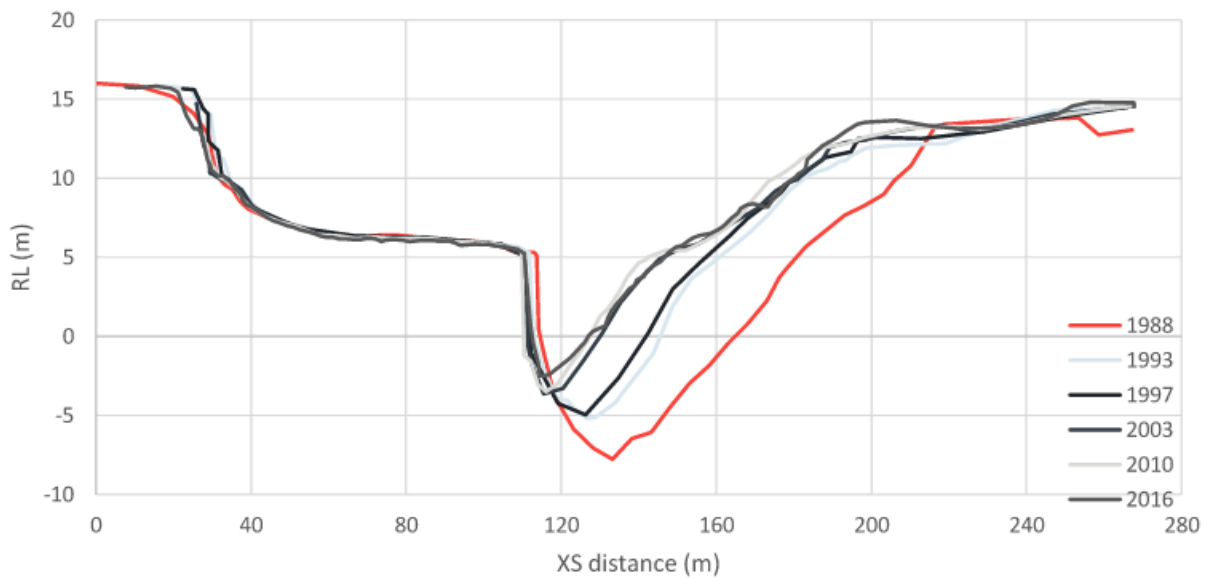


Figure 4: Example cross section of bed level changes following 1988 Cyclone Bola (red line) and surveys from later years taken after normal flows (Reference 13)

The lower the channel goes below sea level, the lower the velocities of flows in the channel are and therefore the more sedimentation would be expected to occur. Dredging for the current 1% AEP storm would put the bed level at a similar level to the 1988 level and the future 1% AEP storm 6m further below.

If dredged, it is probable that sedimentation could occur at a similar rate as between 1988 and 1993, 500mm/year, given the depth below sea level and therefore the resulting low velocities. This could therefore require an ongoing maintenance cost of NZ\$130 million per year. Even if sedimentation was one tenth this rate (50mm/year), NZ\$13 million per year would be a significant ongoing cost.

Refer to Appendix A for the full breakdown of costs and assumptions.

4 Regulatory Considerations (Planning)

4.1 Regional Resource Management Plan

The Regional Resource Management Plan (RRMP) is the combined regional policy statement and regional plan for Hawke's Bay and sets out the policy framework and rules for managing activities and the use of natural and physical resources throughout the region.

Dredging, which involves disturbing the bed of a waterbody such as the Wairoa River, falls under the RRMP's definition of "disturbance". Therefore, the activity has been considered against the provisions of Section 6.8 of the RRMP, which regulates the use of river and lake beds.

Based on a preliminary planning assessment, it is anticipated that these works are likely to require resource consent as a discretionary activity under Rule 69 of the RRMP. A discretionary activity status for a resource consent means that the consenting authority are able to consider all effects of the activity on the environment. This is the default rule for activities that are not expressly regulated by other rules, or activities which cannot comply with the relevant conditions of applicable rules.

In particular, the proposal to undertake dredging within the Wairoa River was considered against the following rules:

- Rule 70 provides for river control and drainage works as a permitted activity, meaning no resource consent is required, where these are described in the HBRC Environmental Code of Practice for River Control and Drainage Works 1999 and comply with the required conditions. These activities largely target management and maintenance works in and around waterways that would otherwise require a resource consent, such as the removal of accumulated sediment or reinstatement of eroded river banks. However, it is considered that the proposed dredging is likely to extend beyond the scope of the listed flood control and drainage works provided for under the Code of Practice. For example, while the removal of accumulated sediment is provided for, the activity of dredging goes beyond routine sediment removal as it will substantially change the profile of the riverbed. Accordingly, this rule would not apply.
- Rule 75 provides for disturbances of riverbeds not provided for by other rules as a permitted activity, provided the works comply with the required conditions. However, it is considered that the proposed dredging is unlikely to comply with the conditions relating to the quantity of disturbance (maximum of 5 m²), and the visual clarity of water resulting from the release of sediment.

A copy of the preliminary planning assessment undertaken against the provisions of Section 6.8 of the RRMP is included as Appendix B.

4.2 Severe Weather Emergency Recovery (Hawke's Bay Flood Protection Works) Order 2024

The Severe Weather Emergency Recovery (Hawke's Bay Flood Protection Works) Order 2024 came into force on 7 June 2024 and will expire on 31 March 2028. This order provides for flood protection works as a controlled activity where undertaken within specified areas, including Wairoa, by or on behalf of local authorities within Hawke's Bay. The controlled activity resource consents for flood protection works must be granted by Council subject to conditions, and public notification requirements are replaced with a process for affected parties to make written comments on the application.

Under the order, flood protection works are defined as "*activities that involve or are concerned with the construction or reinstatement of, making safety enhancements to, or improving the resilience of land and flood protection infrastructure, including stopbanks, spillways, retaining walls, bridges, pump stations, stream realignments, and earthworks*" and includes any incidental or subsidiary activities.

In this case, the area of the dredging works would extend outside of the section of the Wairoa River covered by the order.

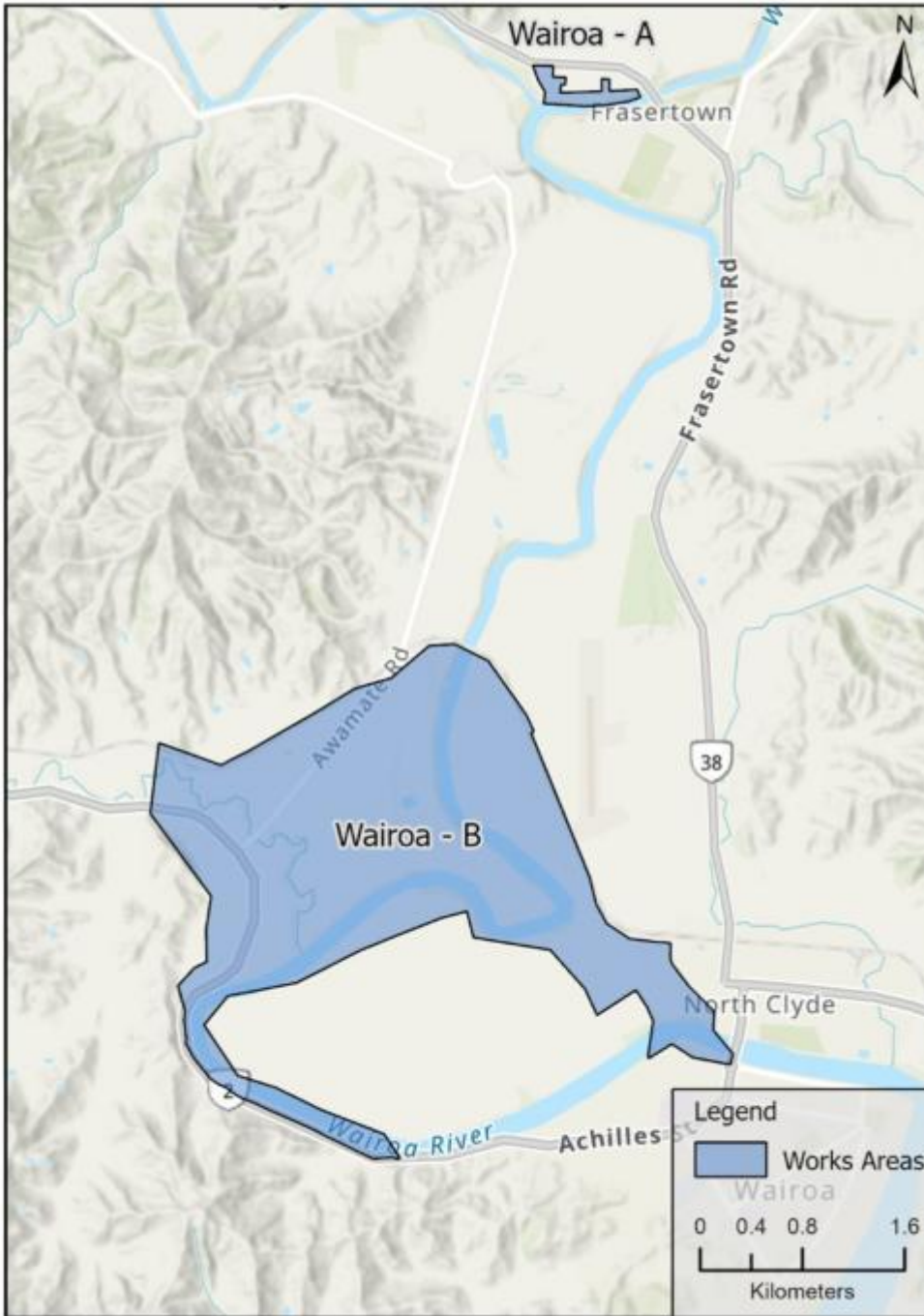


Figure 5: Extent of Wairoa River covered by the Severe Weather Emergency Recovery Order 2024

5 Engineering Considerations

5.1 Outline

When looking at the engineering context of dredging, it is important to think of the river as an integrated system of processes in equilibrium rather than an individual entity. Sediment is flushed through the system naturally in large flood events. Dredging is an engineered emulation of this natural process. However, these systems are in balance and there is potential feedback that comes about from engineering adjustments within the complex river system.

In the Wairoa River, some of the engineering considerations for dredging are:

- Channel silting up
- Banks failure

Further discussion of these engineering considerations follow.

5.2 Channel Silts Up

The tidal extents of the Wairoa River extend 25 km up the river (Reference 14), this extends to past Frasertown. Sediment is moved through energy generated by moving water. In the river this comes from flow in the watercourse, however on the coast this comes from waves and (to a lesser extent) tidal currents. In the middle, where these two forces meet, there is a mixing zone where neither the river nor marine energy sources dominate. This creates a low energy zone where higher sedimentation occurs. As the bed of the river throughout the reach is approximately 5m below mean sea level (NZVD16 vertical datum)(Reference 15). Increasing the depth below sea level further will result in a deeper permanent water depth where this sedimentation can occur.

The silting up of the channel, in order to maintain flood capacity, needs to be maintained. Where dredging is proposed for the purposes of flood risk, a monitoring program is required, and the channel cleared to the required depth. In some cases, this could be after every major flood. If ongoing surveillance is not implemented, the solution is temporary. Continual dredging is therefore not recommended if analysis shows other countermeasures are available (Reference 16).

5.3 Bank Stability

Increasing the channel depth can raise the height of banks, which in turn can lead to increased risk of bank collapses. The stability of a riverbank is generally affected by the material it is made of, its height, slope, groundwater levels, and any additional weight placed on it. Figure 6 shows schematically some of the failure mechanisms.

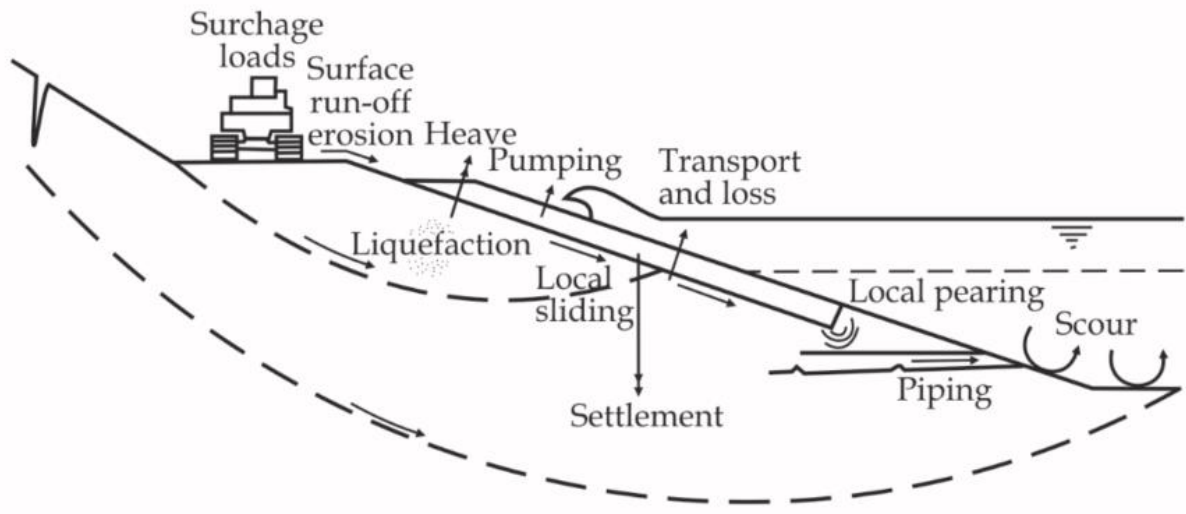


Figure 6: Schematic representation of causes of geotechnical stability of riverbanks (Reference 17)

The required dredging depth is 4m to 11m to convey the flood flows. Hawke's Bay Hazard Portal shows the banks beside the river as being a mixture of low and high instability, see Figure 7. With the increase of bank height of this magnitude, there is a concern that the failure plane (dashed arcs shown in Figure 6) would be much further away from the river than presently.

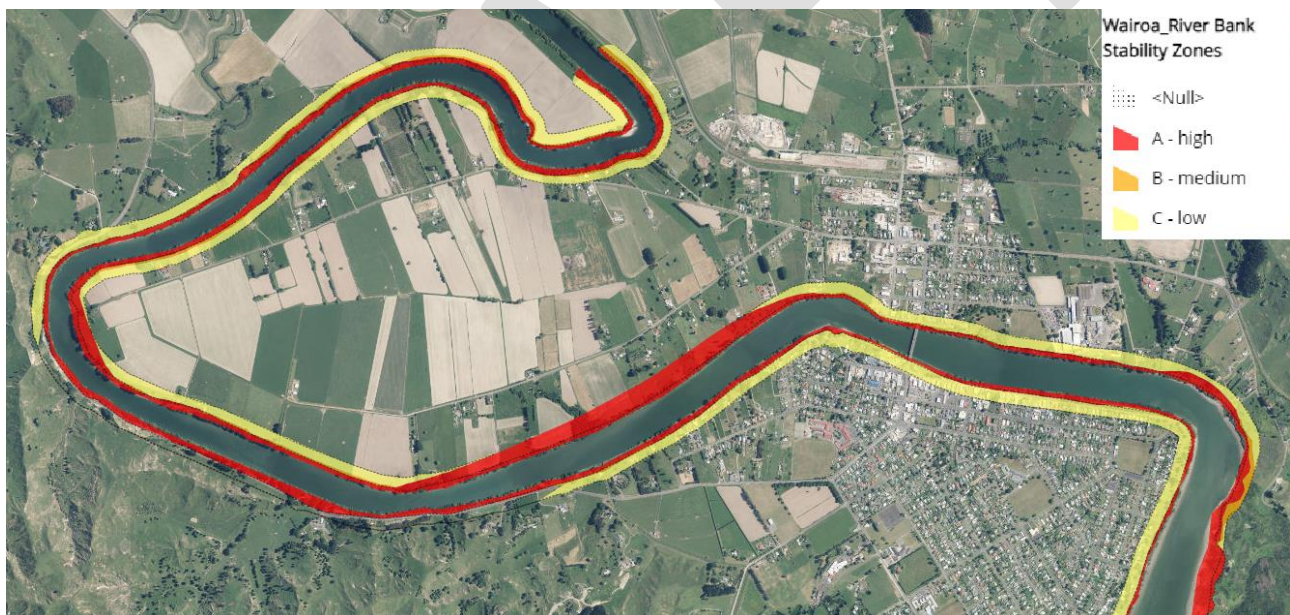


Figure 7: Hawke's Bay Hazard Portal - Wairoa River Bank Stability (Reference 18)

Being a tidal river, the surrounding ground is likely to be high in silt and therefore at risk of liquefaction, this is also confirmed by the hazard portal, see Figure 8. During an earthquake some soils behave more like a liquid than a solid, this is called liquefaction. When this occurs next to an unconfined edge, such as a riverbank, then it results in the lateral spread. Increasing the height of the bank would potentially increase the risk failure given the already high risk of liquefaction in the area.



Figure 8: Hawke's Bay Hazard Portal – Liquefaction (Reference 19)

These risks would need to be understood and potentially mitigated as part of any proposed dredging works.

5.4 Some New Zealand Case Studies

There are two recent examples in New Zealand where dredging has been discounted as an option for flood risk mitigation. These are:

1. Westport Flood Scheme in Westport (Reference 20)
2. Anzac parade Resilience-Building Project in Whanganui (Reference 21)

In their project information published online, both answer the question, “Why is dredging not a viable option?” The conclusions relevant to this river being:

- At the lower end of the river, tide has a much greater influence on flood levels than the bed of the river does.
- When floods occur, sediment in the bed of the river are mobilised increasing the capacity of the river during these times and then more sediment is deposited as the flood water recedes.
- Dredging is expensive and it comes at a significant cost if there is no commercial demand for the material (i.e. gravel extraction).

6 Environmental Considerations

The key environment considerations from dredging are:

- Disposal of material: There is an enormous amount of material being removed and it needs to be disposed of responsibly. Sediment within the urban area may have contaminants harmful to human health, such as heavy metals, cyanide, hydrocarbons, etc.
 - Dredged sediment quality would require characterisation as part of the dredging process to confirm disposal options. A landfill facility, or similar, would need to be identified or established to receive the large volume of material requiring disposal, which would also be able to handle sediment dewatering procedures.
- Increase in turbidity: Turbidity is a measure of suspended sediment in flow. Extreme turbidity may kill fish and long-term exposure to non-lethal turbidity levels may affect the behaviour and population of fish (Reference 22).
- Disturbance of river bed: The river bed is a habitat to a variety of flora and fauna and disturbances to the river bed (particularly through ongoing sediment removal) may have long term adverse impacts on this ecosystem. These impacts can include the destruction of instream habitats for native freshwater fish. Furthermore, consideration to unintentional fish kill would need to be considered under the Conservation Act 1987 and can result in prosecution if not managed effectively.
- The removal of a large volumes of material from river channels can have several unforeseen downstream impacts, including:
 - degradation downstream receiving environments;
 - changes in downstream channel geomorphology;
 - impacts on coastal process and environments, such as increased localised coastal erosion (i.e. increased coastal erosion)
- Dredged material can have strong unpleasant odours caused by the exposure of organic materials undergoing anaerobic decomposition, or other contaminants. The odours from this material may affect residents or adjoining land users during dredging operations and requires management during dredging and disposal operations.
- Dredging operations are noisy therefore can affect residents during operations.

In the context of this scheme, the environmental impacts would need to be managed in order to minimise the impact on the environment, and further investigation or assessment undertaken to determine these impacts and mitigation controls required if this proposal was to proceed.

7 References

- Reference 1: WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023, Section 1.1
- Reference 2: WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023, Section 2
- Reference 3: WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024
- Reference 4: WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024, Section 9.1
- Reference 5: CIWEM, Floods and Dredging – A Reality Check, February 2014, p.8
- Reference 6: <https://www.localmatters.co.nz/news/dredging-operations-falter-as-cash-runs-out/>, accessed 08/06/2024
- Reference 7: WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023
- Reference 8: <https://gis.hbrc.govt.nz/LocalMapsViewer/?map=49ff3505253d421e8c558a36ad6f45f9>, accessed 08/06/2024
- Reference 9: HBRC, Environmental Code of Practice, Version 4, March 2017, p.13
- Reference 10: CIWEM, Floods and Dredging – A Reality Check, February 2014, p.9
- Reference 11: CIWEM, Floods and Dredging – A Reality Check, February 2014, p.4
- Reference 12: WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024, Section 9.1
- Reference 13: WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023, Section 2.1.1
- Reference 14: WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023, Section 1.1.3
- Reference 15: WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024, Appendix B
- Reference 16: Mussetter Engineering Inc., Sediment and Erosion Design Guide, November 2008, p.5-7
- Reference 17: Holanda, F., Rocha, I., Streambank Soil Bioengineering Approach to Erosion Control, August 2011, Fig.1
- Reference 18: <https://gis.hbrc.govt.nz/Hazards/>, accessed 09/06/2024
- Reference 19: <https://gis.hbrc.govt.nz/Hazards/>, accessed 09/06/2024
- Reference 20: <https://bullaerrecovery.org.nz/wp-content/uploads/2022/07/QA-on-Westport-Flood-Resilience-Options.pdf>, accessed 09/06/2024
- Reference 21: <https://www.horizons.govt.nz/HRC/media/Media/Flood%20protection/Anzac-Parade-flood-modelling,-dredging,-stopbanks-and-the-Matarawa-diversion-scheme.pdf?ext=.pdf>, accessed 05/06/2024
- Reference 22: <https://niwa.co.nz/freshwater/setting-maximum-turbidity-levels-riverine-fish-dss>, accessed 09/06/2024

8 Disclaimer

This report provides an overview based on the available data and design inputs supplied by others. Focus has been on generally using publicly available sources, the key sources being listed in section 1.3 of this report. This review is not exhaustive and there may be additional factors outside the reviewed sources. The findings also rely on the accuracy and completeness of the provided design inputs, which may vary and impact the conclusions.

9 Limitations

This report has been prepared by Beca Ltd (Beca) on the specific instructions of Hawke's Bay Regional Council (Client). It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

In preparing this report Beca has relied on key information including the following:

- WSP, Wairoa Flood Scheme Option Report, Final Issue, 06/10/2023
- WSP, Wairoa Short List Options Flood Report, V07, 13/02/2024
- WSP, Addendum to Short List Options Flood Modelling Report, 10/04/2024
- WSP, Land Category 2A - Frasertown Building Information, 09/04/2024
- Email from WSP. Subject: 20240607-Wairoa Dredging Volumes and extents. Received: 7th June 2024

Unless specifically stated otherwise in this report, Beca has relied on the accuracy, completeness, currency and sufficiency of all information provided to it by, or on behalf of, the Client, including the information listed above, and has not sought independently to verify the information provided.

This report should be read in full, having regard to all stated assumptions, limitations and disclaimers. No part of this report shall be taken out of context and, to the maximum extent permitted by law, no responsibility is accepted by Beca for the use of any part of this report in any context, or for any purpose, other than that stated herein.

A

Appendix A – Rough Cost Estimate

DRAFT

Project: Wairoa River Dredging Building:	Details: Cost Estimate
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Code	Description	Quantity	Unit	Rate	Total
	Wairoa River Dredging Feasibility Study <u>Cost Estimate</u>				
	Dredging Works - Current Dredging				989,789,000
	Dredging Works - Future Dredging				2,721,920,000
	Maintenance Dredging				1,544,857,000
	<p><i>These are concept level estimates and as such are considered to reflect an accuracy range of -10% to +30% as outlined in the AACE Cost Estimate Classification System.</i></p>				
	<p>Inputs</p> <p>Dredging Volumes from WSP Information table</p>				
	<p>Assumptions</p> <p>Work during normal hours - 12 hours per day</p> <p>Relocation of existing services not included</p> <p>Among dredged material, 40% assumed to be clean fill, 40% silt, and 20% contaminated material</p> <p>Min. 3 working crew utilised</p> <p>Construction period Current dredging plan - 14 Months Future dredging plan - 38 Months</p>				
	<p>Allowances</p> <p>No allowance for slip remediation</p> <p>No allowance for mudcreting or other soil treatment to dredged material</p> <p>Contingency - 30%</p>				

Project: Wairoa River Dredgeing	Details: Cost Estimate
Building:	

Code	Description	Quantity	Unit	Rate	Total
	<p>Exclusions</p> <p>GST</p> <p>No allowance has been made for the impacts of extraordinary global events within the base estimate.</p> <p>Land acquisition</p>				

Project: Wairoa River Dredgeing	Details: Cost Estimate
Building:	

Code	Description	Quantity	Unit	Rate	Total
Dredging Works - Current Dredging					
	Current Dredging	5,280,000	m3		
1	Allow for Mobilisation and Demobilisation	1	LS	Included	0
2	Dredging	5,280,000	m3	50.00	264,000,000
3	Removal and disposal of dredged material offsite - Assumed 40% clean fill	2,112,000	m3	50.00	105,600,000
4	Removal and disposal of dredged material offsite - Assumed 40% silt material	2,112,000	m3	60.00	126,720,000
5	Removal and disposal of dredged material offsite - Assumed 20% Contaminated fill	1,056,000	m3	230.00	242,880,000
6	Preliminary and General	0.03	%	739,200,000	22,176,000
	Current Dredging Total	5,280,000	m3	144.20	761,376,000
7					
8	Allow 30% Contingency	0.30	%	761,376,000.00	228,412,800
	Current Dredging Total including 30% Contingency				989,789,000

Project: Wairoa River Dredgeing	Details: Cost Estimate
Building:	

Code	Description	Quantity	Unit	Rate	Total
Dredging Works - Future Dredging					
	Future Dredging	14,520,000	m3		
1	Allow for Mobilisation and Demobilisation	1	LS	Included	0
2	Dredging	14,520,000	m3	50.00	726,000,000
3	Removal and disposal of dredged material offsite - Assumed 40% clean fill	5,808,000	m3	50.00	290,400,000
4	Removal and disposal of dredged material offsite - Assumed 40% silt material	5,808,000	m3	60.00	348,480,000
5	Removal and disposal of dredged material offsite - Assumed 20% Contaminated fill	2,904,000	m3	230.00	667,920,000
6	Preliminary and General	0.03	%	2,032,800,000	60,984,000
	Future Dredging Total	14,520,000	m3	144.20	2,093,784,000
7	<hr/>				
8	Allow 30% Contingency	0.30	%	2,093,784,000.00	628,135,200
	Future Dredging Total including 30% Contingency				2,721,920,000

Project: Wairoa River Dredgeing	Details: Cost Estimate
Building:	

Code	Description	Quantity	Unit	Rate	Total
Maintenance Dredging					
1	Maintenance Dredging Year 1	660,000	m3	149.97	98,978,880
2	Maintenance Dredging Year 2	660,000	m3	155.97	102,938,035
3	Maintenance Dredging Year 3	660,000	m3	162.21	107,055,557
4	Maintenance Dredging Year 4	660,000	m3	168.69	111,337,779
5	Maintenance Dredging Year 5	660,000	m3	175.44	115,791,290
6	Maintenance Dredging Year 6	660,000	m3	182.46	120,422,942
7	Maintenance Dredging Year 7	660,000	m3	189.76	125,239,859
8	Maintenance Dredging Year 8	660,000	m3	197.35	130,249,454
9	Maintenance Dredging Year 9	660,000	m3	205.24	135,459,432
10	Maintenance Dredging Year 10	660,000	m3	213.45	140,877,809
	Total Maintenance Dredging for 10 years	6,600,000	m3	180.05	1,188,351,036
11	<hr/>				
12	Allow 30% Contingency	0.30	%	1,188,351,036. 19	356,505,311
	Total Maintenance Dredging for 10 years including 30% Contingency				1,544,857,000

B

Appendix B – Preliminary Planning Assessment

DRAFT

File Note

By: Phoebe Watson, Senior Planner
Subject: Preliminary Planning Assessment

Date: 18 June 2024
Our Ref: 3326942

Preliminary Planning Assessment – Hawke’s Bay Regional Resource Management Plan

Rule	Assessment
6.8.1 USE, REPAIR & MAINTENANCE OF STRUCTURES	
Rule 63 provides for the use of any lawfully established structure in, on, under or over the bed of a river, lake or artificial watercourse as a permitted activity .	This rule is not applicable to the activity. The extent of dredging proposed will occur within the vicinity of two existing bridges, at State Highway 2 and a rail bridge near Railway Road, however the works can be managed so as not to affect these structures.
Rule 64 provides for the maintenance of any lawfully established structure in, on, under or over the bed of a river or lake, and any associated disturbance, discharge of sediment, and diversion of water (except as provided for by Rule 70) as a permitted activity .	This rule is not applicable to the activity.
Rule 65 provides for the replacement and upgrading of any line or cable, owned or managed by a network utility operator, over the bed of any river or lake as a permitted activity .	This rule is not applicable to the activity.
Rule 66 provides for the removal or demolition of a structure, or any part of a structure, in, on, under, or over the bed of a river or lake and any associated disturbance of the river or lake bed, discharge of sediment, and diversion of water (except as provided for by Rule 70) as a permitted activity .	This rule is not applicable to the activity. The extent of dredging proposed will occur within the vicinity of two existing bridges, at State Highway 2 and a rail bridge near Railway Road, however the works will not require the removal or demolition of these structures in order to undertake dredging.
6.8.2 ERECTION & PLACEMENT OF DAMS & OTHER BARRIER STRUCTURES, & DAMMING OF WATER	
Rule 67 provides for the erection or placement of any dam, weir or other barrier structure in, on, under, or over the bed of a river, lake and artificial watercourse, and any associated damming or diversion of water, discharge of sediment; and disturbance of the river or lake bed as a permitted activity .	This rule is not applicable to the activity.
Rule 68 provides for any existing damming of water associated with a lawfully established dam, weir, or other barrier structure in, on, under, over the bed of a river, lake or artificial water course that is not provided for by Rule 67 as a controlled activity .	This rule is not applicable to the activity.
Rule 69 provides for river and lake bed activities that are not expressly regulated by other rules, being activities which cannot comply with the rules and which are not expressly regulated by other rules, as a discretionary activity .	As a result of the assessment of the activity against Rule 70 and 75 below, it is considered that the activity is likely to

File Note

Rule	Assessment
	require consent as a discretionary activity under Rule 69.
6.8.3 RIVER CONTROL & DRAINAGE WORKS & STRUCTURES	
<p>Rule 70 provides for river control and drainage works and structures, as described in the Hawke's Bay Regional Council Environmental Code of Practice for River Control and Drainage Works (1999), where these are carried out by a local authority exercising its powers, functions and duties under the Soil Conservation and Rivers Control Act 1941, the Land Drainage Act 1908, or the Local Government Act 1974, in relation to flood control and drainage that would otherwise contravene section 13 or section 14 of the RMA, or section 15 of the RMA in relation to the discharge of sediment, as a permitted activity providing the following conditions are complied with:</p> <ol style="list-style-type: none"> The activity or structure shall be undertaken in a manner that continues to provide for the existing passage of fish past the structure. The appropriate Fish and Game Council, iwi and Department of Conservation office, shall be notified at least 5 working days before any channel diversion is undertaken. There shall be no discharge of contaminants, other than sediment, arising from the use of machinery in the bed of any river or lake. The activity shall not adversely affect any wetland. All activities shall be undertaken in accordance with the Hawke's Bay Regional Council Environmental Code of Practice for River Control and Drainage Works, 1999. 	<p>The Environmental Code of Practice for River Control and Drainage Works provides for select construction and maintenance works in rivers and waterways within the region. In relation to the proposal, such activities include waterway maintenance, waterway upgrading, and minor diversions.</p> <p>In this case, it is considered that the proposed dredging will extend beyond the scope of the listed flood control and drainage works provided for under the Code of Practice. Accordingly, it is considered this rule is not applicable to the activity.</p>
<p>Rule 71 provides for activities affecting river control and drainage schemes where they are undertaken by persons other than the local authority (or persons acting on their behalf) within a land drainage or flood control scheme area, as a discretionary activity.</p>	<p>This rule is not applicable to the activity. It is unclear whether the full extent of the dredging activity will occur within a land drainage or flood control scheme area, however, the proposed works will be undertaken by the local authority or persons acting on their behalf.</p>
6.8.4 ERECTION & PLACEMENT OF OTHER STRUCTURES (INCLUDING ACCESS STRUCTURES)	
<p>Rule 72 provides for the erection and placement of any structure in, on, under, or over the bed of a river or lake, where this is not expressly regulated by other rules, as a permitted activity. Examples of structures include bridges, culverts and other access structures.</p>	<p>This rule is not applicable to the activity, as the proposed works do not involve the erection or placement of a structure in, on, under, or over the bed of the Wairoa River.</p>

File Note

Rule	Assessment
<p>Rule 73 provides for small scale extraction of sand, gravel or other material from the bed of any river or lake, and any associated disturbance of the bed, and any associated discharge of sediment, and any associated diversion of water as a permitted activity</p>	<p>This rule is not applicable to the activity, as the purpose of the activity is not for gravel extraction.</p>
<p>Rule 74 provides for large scale extraction of sand, gravel or other material from the bed of any river or lake, and any associated disturbance of the bed, and any associated discharge of sediment, and any associated diversion of water as a restricted discretionary activity.</p>	<p>This rule is not applicable to the activity, as the purpose of the activity is not for gravel extraction.</p>
<p>6.8.6 OTHER DISTURBANCES OF RIVER & LAKE BEDS</p>	
<p>Rule 75 provides for other disturbances of river and lake beds not provided for by other rules as a permitted activity providing the following conditions are complied with:</p> <ol style="list-style-type: none"> The maximum area of disturbance shall be no greater than 5m². The disturbance shall not change the natural course of any river or lake. Any release of sediment shall not cause any conspicuous change in the colour or visual clarity of water after reasonable mixing. There shall be no discharge of contaminants, other than sediment, into the river or lake. The activity shall be undertaken in a manner that continues to provide for the existing passage of fish past the structure. The disturbance shall not cause any increase in the risk of flooding or damage to any property during flood events, including the risk resulting from trapped debris. Any diversion of water for the purposes of carrying out the activity shall be for a period of no more than five consecutive days, and for no more than 12 hours, on any one day within those five days. The activity or structure shall not cause any erosion, scour or deposition beyond the area of disturbance or adversely affect any other lawfully established structure. All excess materials shall be removed from the bed by completion of the activity. There shall be no disturbance of any part of the bed covered by water from 1 May and 30 September (fish spawning season). 	<ol style="list-style-type: none"> Will not comply Expected to comply Likely will not comply Expected to comply Expected to comply Will comply Expected to comply Expected to comply Will comply Will comply <p>Where an activity cannot comply with all of the conditions of Rule 75, the activity defaults to a discretionary activity under Rule 69 for river activities that are not expressly regulated by other rules.</p>
<p>6.8.7 INTRODUCTION & PLANTING OF PLANTS</p>	
<p>Rule 76 provides for the introduction or planting of any plant or any part of any plant in, on, or under the bed of a river or lake, except as</p>	<p>This rule is not applicable to the activity.</p>

File Note

Rule	Assessment
<p>provided for by Rule 70, or Rule 71, as a permitted activity providing the following conditions are complied with:</p> <ul style="list-style-type: none">a. The planting shall not result in any reduction in the ability of the water body to convey flood flows or any impedance to the passage of debris.b. The activity shall not cause any significant erosion, scour or deposition.c. The activity shall be undertaken in a manner that continues to provide for the existing passage of fish.d. There shall be no disturbance of any part of the bed covered by water from 1 May to 30 September (fish spawning season).e. Plantings undertaken in accordance with this rule shall not cause disturbance, damage or destruction of existing indigenous vegetation in the bed of a lake or in the bed of the continuously flowing portion of a river.	