REPORT

Foxton Wharf: Options Assessment

Prepared for

Horowhenua District Council

Prepared by

Tonkin & Taylor Ltd

Date

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Job Number

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Document Control

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1 Introduction

The Manawatu Marine Boating Club (MMBC) is located in Foxton Beach along the northern edge of the Manawatu River (refer Figure 1-1). The MMBC comprises a clubhouse, boat ramp and wharf structures. This report is specific to the western edge of the wharf structure (henceforth referred to as the Foxton Wharf) which has been damaged as a result of wave and current-induced erosion. The MMBC is under private ownership however due to the public usage of the wharf, Horowhenua District Council (HDC) have undertaken the initial steps in investigating remedial options.

Tonkin & Taylor Limited (T+T) have been engaged by HDC to:

a. Undertake a brief issues and options assessment and to develop a preferred concept option for replacing the existing, degraded gabion basket wall (Stage 1a);

b. Investigate consenting requirements for the preferred concept option (Stage 1b).

This report, in accordance with our engagement letter dating 30 January 2019, presents the results of Stage 1.

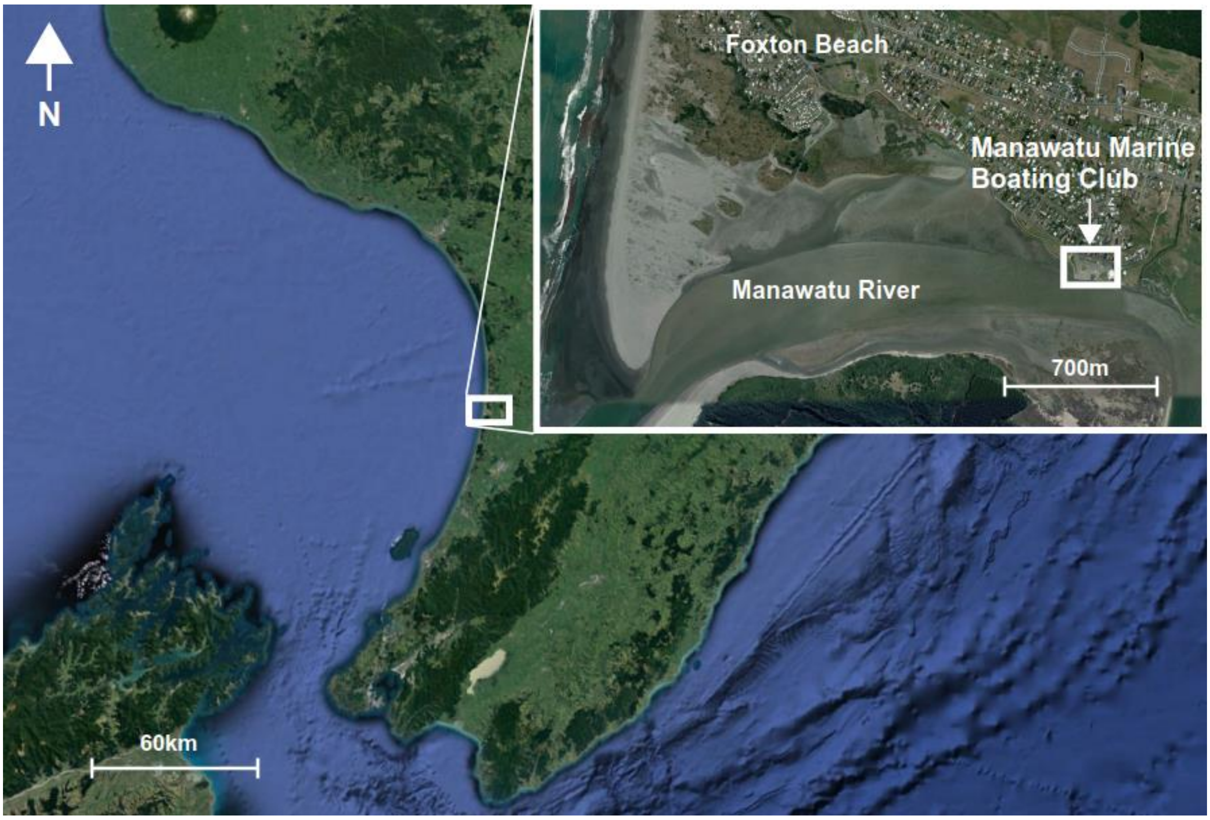


Figure 1.1: Manawatu Marine Boating Club location

2 Site background

Erosion at the western corner of Foxton Wharf resulting from waves and currents has resulted in loss of approximately 45m^2 of paved area adjacent (refer Figure right). This erosion has followed the removal of a timber jetty and replacement with a gabion basket wall along the seaward edge of the wharf area in 2014 (refer Figure right).

Figure 2.1: Aerial showing historic timber jetty prior to removal (left; January 2010, Google Earth) and erosion at the western corner of Foxton Wharf (right; July 2018, T+T)

The gabion basket wall was installed as a temporary measure to protect the exposed reclamation edge following removal of the timber jetty. The gabion basket wall has since degraded, the wire mesh has corroded in places resulting in loss of rock and the structure has been undermined leading to slumping at the southern end. The slumping of the wall has allowed greater volumes, and higher frequency, of wave overtopping to occur at this location leading to erosion of the pavement and reclamation fill. Figure 2.2 shows site photographs (19 July 2018) of the degraded gabion basket wall and eroded wharf area.

Figure 2.2: Site photographs taken on 19 July 2018 showing the degraded gabion basket wall (upper photographs) and the eroded wharf area (lower photographs)

3 Coastal processes

3.1 Topography and bathymetry

A site survey was carried out by HDC on 21 March and 3 May 2019, with a total of 106 elevation points surveyed. The survey data was provided by HDC with levels in terms of Wellington Vertical Datum 1953 (WVD-53). Figure 3.1 shows the locations of the survey points indicated with yellow dots and generated contours shown as white lines. The crest of the existing gabion basket structure was surveyed at several points, with the remaining survey points representative of the local bathymetry in the vicinity of the wharf.

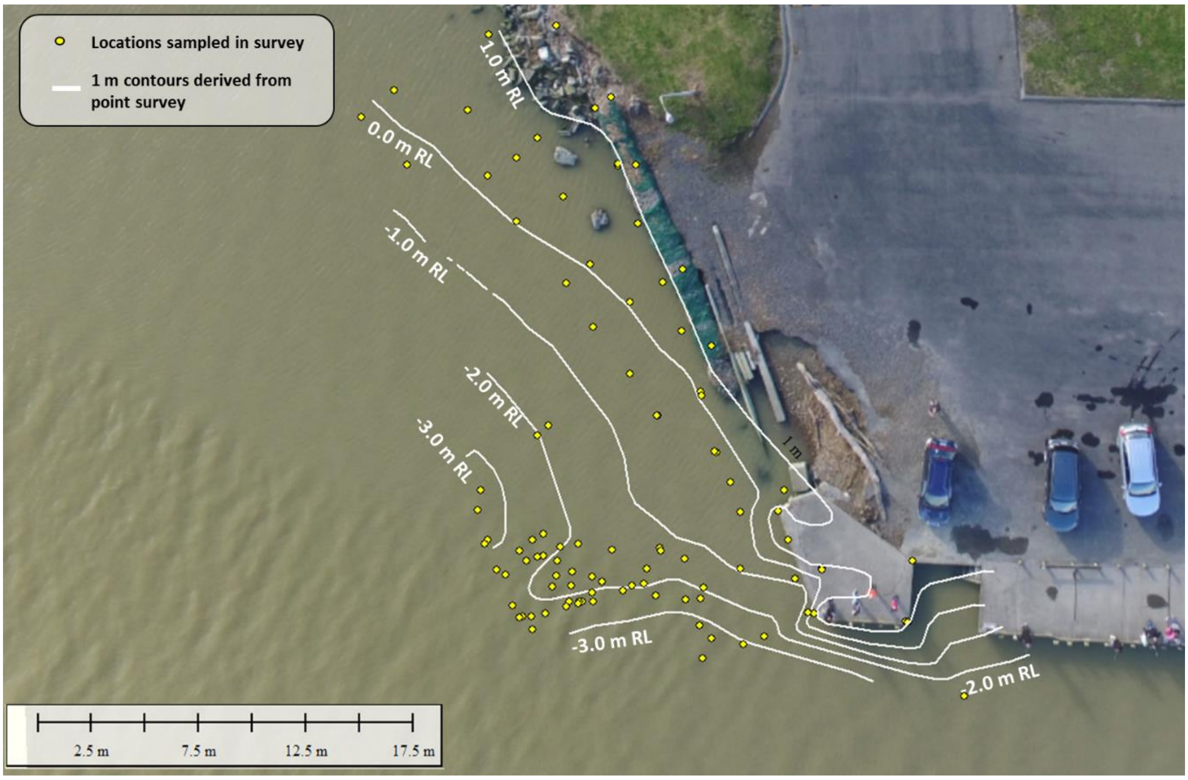


Figure 3.1: Site survey layout including surveyed points and resulting contours (source HDC, 2019), with July 2018 aerial (source: T+T)

The survey indicates the wharf levels to be between 1.76 and 1.80 m WVD-53, hereafter referred to as reduced level (RL). The crest level of the damaged gabion basket wall is between 0.32 (at the southern slumped end) and 1.86 m RL.

The seabed profile seaward of the gabion basket structure has a slope of approximately 1V:6H until around the -1.0 m RL contour. The seabed slope then increases to approximately 15˚ (1V:4H) offshore towards the -3.0 m RL contour. The survey did not capture bathymetry further out in to the harbour entrance channel.

3.2 Water levels

The water level at any coastal location varies across a range of timescales. Key components that determine coastal water level are:

- Mean sea level;
- Astronomical tides;
- Barometric and wind effects, generally referred to as storm surge;

- Long-term changes in sea level; and
- Wave breaking through wave set-up and run-up.

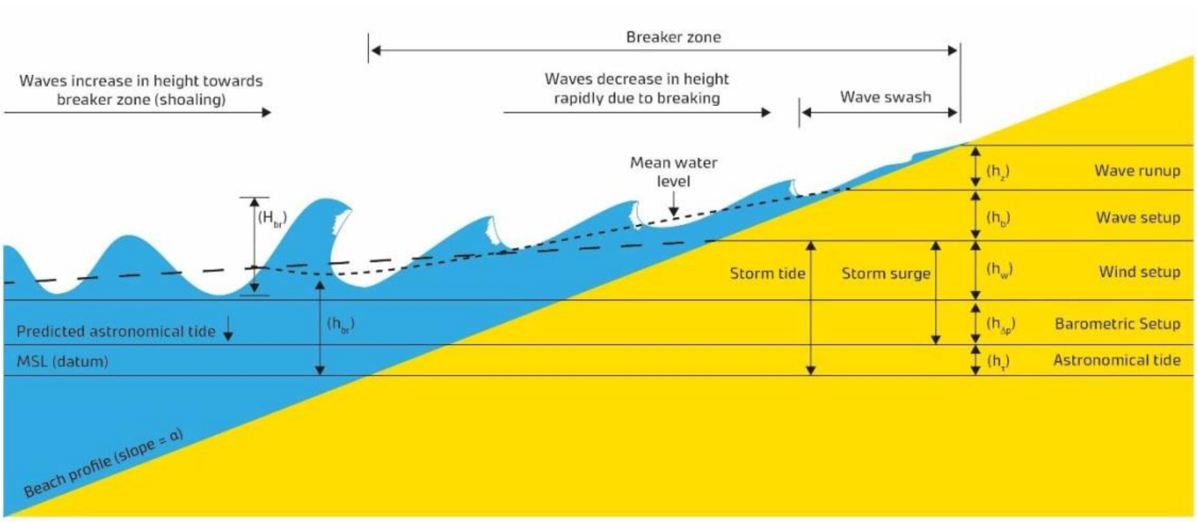


Figure 3.2: Key components that determine water level

3.2.1 Astronomical tides

Tide levels for the Manawatu River Entrance have been sourced from LINZ (2018) and are applicable to the Foxton Wharf. Tidal levels in terms of Chart Datum (CD) and WVD-53 are shown in Table 3.1. These show a spring tidal range of 2.2 m and a neap range of 0.9 m. The MHWS level is 0.71 m RL. Note that the MHWS in Bell (2015) is shown at 0.436 m WVD-53, which uses an inconsistent offset compared to the remaining tide levels, and is therefore considered incorrect.

Table 3.1: Tidal levels given for the Manawatu River Entrance (LINZ, 2018)

Tide state	Chart Datum (m)	Wellington Vertical Datum 1953 (m RL)[1]
Mean High Water Springs (MHWS)	2.4	0.71
Mean High Water Neaps (MHWN)	1.8	0.11
Mean Sea Level (MSL)	1.3	-0.39
Mean Low Water Neaps (MLWN)	0.9	-0.79
Mean Low Water Springs (MLWS)	0.2	-1.49
Chart Datum (CD)	0	-1.69

[1]Wellington Vertical Datum 1953 is 1.694 m above Chart Datum based on Bell (2015).

3.2.2 Storm surge

Storm surge results from the combination of barometric setup from low atmospheric pressure and wind stress from winds blowing along or onshore, which elevates the water level above the predicted tide. The combined elevation of the predicted tide and storm surge is known as the storm tide.

Horizons Regional Council derived 'still water' design levels for Foxton Beach based on extreme sea level exceedance probabilities for Port Taranaki (Blackwood, 2007). The 1% AEP (Annual Exceedance Probability) storm surge component presented in the Blackwood report is 1.34 m, which is suggested to be added to the mean high water level (i.e. 2.05 m RL).

Lane et al. (2012) derived joint probability storm tide estimates for the Wellington Region. The nearest location in this study to the Foxton Wharf site is located at Otaki Beach approximately 30km to the south. The 1% AEP joint probability storm tide level (excluding wave setup) presented in this report is 1.96 m WVD-53.

A more recent study of coastal inundation hazard was carried out by Horizons for Himatangi Beach (approximately 10 km north of Foxton Beach) in which a storm surge component of 0.9 m was applied (Bell, 2015). The storm surge was added to the MHWS level to derive the total extreme water level.

For this assessment the latest study (i.e. Bell, 2015) is considered and therefore a present day extreme water level of 1.61 m RL (MHWS + storm surge) has been adopted.

3.2.3 Wave setup

Wave setup is a super-elevation of the water level as a result of breaking waves. The process of wave breaking is dependent on the nearshore bathymetry, with the resulting wave set-up compensating for the wave energy released during breaking. Wave set-up is typically developed over several wave lengths with water being pushed up the foreshore.

As the Manawatu River channel is relatively deep, wave breaking occurs relatively close to the wharf due to the shallow foreshore in the vicinity of the wharf. Wave setup is therefore unlikely being developed and is likely negligible. No allowance for wave set-up has been included for this assessment.

3.2.4 Long term changes in sea level

Historic sea level rise (SLR) in New Zealand has averaged 1.7 ± 0.1 mm/year (Hannah and Bell, 2012). However, ongoing changes in the global climate are predicted to result in acceleration of this sea level rise in coming decades. Current guidance on sea level rise (MfE, 2017)[1] recommends consideration of the four sea level rise scenarios presented for New Zealand for two planning horizons. These projections are presented in Table 3.2.

Table 3.2: Sea level rise projections from the 1986-2005 baseline for the four RCP[2] scenarios

Year	RCP 2.6M[1]	RCP 4.5M	RCP8.5M	RCP 83rd% (H+)
2070	0.32	0.36	0.45	0.61
2120	0.55	0.67	1.06	1.36

[1]M = median

For this case, the RCP[2]8.5 scenarios have been ignored as this project is not considered to have an extremely low risk tolerance, and the RCP4.5 scenario (0.36 m by 2070) has been adopted instead. Extreme water levels including sea level rise are presented in Table 3.2.

[1] *Coastal Hazards and Climate Change* Ministry for the Environment, Dec 2017 (MfE, 2017)

[2] Representative Concentration Pathways (RCP) are four possible greenhouse gas concentration trajectories adopted by the Intergovernmental Panel on Climate Change (IPCC) to quantify time-dependent projections of greenhouse gas emissions. These are used to predict the effects of climate change on factors such as global temperatures and sea levels.

3.2.5 Extreme water levels

Extreme levels have been assessed for this site as a combination of the MHWS, storm surge and potential sea level rise. The resulting extreme water levels for the present day and 2070 time frames are shown in Table 3.3.

Table 3.3: Extreme water levels for the Foxton Wharf

Water level component	Present day	2070
SLR allowance (m)	0	0.36
MHWS (m RL)	**0.71**	**1.07**
1% AEP storm surge (m)	0.9	0.9
1% AEP extreme water level (m RL)	**1.61**	**1.97**

3.3 Wave climate

The site is exposed to wind waves from the westerly quadrant with a maximum fetch length of 1.9 km to the west south-west (refer Figure 3.3). The height of wind-generated waves is dependent on water depth, fetch length, wind speed and duration.

Figure 3.3: Maximum fetch distance at Foxton Wharf site

Waves generated by wind from the west with a 1% AEP were assessed based on regional wind speeds outlined in AS/NZS1170.2:2011 and the Goda (2003) method for calculating wave heights. Table 3.4 shows the resultant wind-wave height (mean wave height of the highest one third of the waves) offshore of the seawall. The shallow foreshore along the northerly portion of the site is expected to result in wave breaking reducing wave heights as they approach the shoreline. However, the water depth increases rapidly towards the southern corner of the site and therefore the waves are unlikely to be depth limited at this location. These wave heights have been used for design and are outlined in Table 3.4.

Table 3.4: Significant wave heights for local wind-waves at Foxton Wharf

Wave location	H_s (significant wave height) for 1% AEP (100yr ARI) wind speed	T_p (peak wave period)
Nearshore (one wave length offshore of the wharf)	0.8 m	3.8 s

4 Design considerations

4.1 Design assumptions

A design life of at least 50 years has been adopted for the considered options for the replacement of the existing degraded gabion basket wall. This was adopted as we understand that HDC wishes to replace the existing, degraded wall with a permanent design solution.

Coastal protection structures are typically designed to 100 year return period storms. Therefore the 1% AEP wind and wave conditions in combination with high tide and extreme (i.e. 1% AEP) water level conditions have been adopted to review the seawall crest overtopping rates and potential seawall toe scour. As a 50 year design life was adopted we have included an allowance of 0.36 m of sea level rise using RCP4.5M.

4.2 Wave overtopping

Wave overtopping occurs when the crest of a seawall is not sufficiently high, allowing waves to run-up and wash over the seawall crest. Overtopping is affected by the seawall face angle, crest height and permeability of materials in the seawall. Overtopping flows return to the foreshore over, through or beneath the structure, often taking sediment resulting in erosion behind the structure. Overtopping at the wharf is an important consideration for user safety, backshore protection and vehicle parking during large storms. With climate change predictions estimating the average sea level to be approximately 0.36 m higher likely over the next 50 years, wave overtopping of the seawall is likely to become greater concern.

Wave overtopping flows have been assessed for the present day and in 50 years for both typical conditions and extreme conditions. We have estimated average overtopping flows for typical conditions using the MHWS water level and 1% AEP wave height, and for extreme conditions using a 1% AEP storm tide with 1% AEP wave conditions. For the future sea levels (taken to be 2070) include an allowance of sea level rise of 0.36 m.

Three types of structures have been assessed: an upgraded version of the existing gabion basket structure (i.e. assuming no slumping), a sloping (2H:1V) permeable rock structure and an impermeable vertical wall, which is consistent with the options presented in Section 5.

The empirical formulas included in EurOtop (2018) were used to assess overtopping rates. The resulting design overtopping rates (mean + standard deviation) for the present day and 2070 typical and extreme conditions are shown in Table 4.1.

The results shown in Table 4.1 show that during typical conditions the sloping permeable rock seawall option gives the lowest rates of overtopping, 0.6 l/s/m for the present day and 4.7 l/s/m allowing for 0.36 m SLR. Both the gabion basket wall and impermeable vertical options result in similar overtopping rates during typical conditions, with 4.4-4.9 l/s/m for the present day and 10-12 l/s/m allowing for 0.36 m SLR. The overtopping rates are similar for each option during extreme events, with 66-75 l/s/m at present day and >200 l/s/m allowing for 0.36 m SLR. However, it should be noted that during an extreme event in 2070 the extreme water level (1.97 m RL) exceeds the existing wharf crest level (1.8 m RL) and static inundation occurs. The overtopping rate of >200 l/s/m is an estimation based on 0 m freeboard and is indicative only.

Table 4.1: Predicted mean overtopping rates (l/s/m) for present day and future timeframes typical and extreme conditions

Protection Structure	Present-day typical conditions[1] (l/s/m)	2070 typical conditions incl. 0.36 m SLR (l/s/m)	Present-day extreme event[2] (l/s/m)	2070 extreme event incl. 0.36 m SLR (l/s/m)
Gabion basket wall	4.4	10	67	>200[3]
Sloping permeable rock seawall	0.6	4.7	66	>200[3]
Impermeable vertical seawall	4.9	12	75	>200[3]

[1] MHWS water level + 1% AEP wave height
[2] 1% AEP water level + 1% AEP wave height
[3]Static inundation occurs, overtopping rate is indicative only.

EurOtop (2018) presents guidance on acceptable overtopping limits for pedestrians and backshore damage. With a design significant wave height of approximately 1 m, the relevant recommended mean values of safe overtopping flows for the Foxton Wharf are:

- People at the seawall crest, with clear view of the sea, q = 10-20 l/s/m;
- Grass covered crest and landward slope for $H_{m0=}$ < 1m, q = 5-10 l/s/m; and
- No damage to paved or armoured promenade behind seawall; q < 200 l/s/m.

4.3 Based on design toe scour

It is likely that some scouring may occur in front of the northern portion of the wall during erosive periods and therefore it is important to account for future scour events during the seawall design. The toe of the rock revetment or the embedment depth of a vertical wall needs to be designed to be sufficiently keyed into the beach to mitigate potential toe undermining in the event of a large storm. This assessment can be undertaken during concept design, however for this mitigation options assessment, an embedment depth of 1.0 m below existing beach levels (i.e. to approximately -1.5 m RL for a vertical wall and between -2 m RL and -3 m RL for a revetment at the southern end of the existing gabion basket wall) is assumed.

5 Mitigation options

Mitigation options have been investigated for replacement of the degraded length of gabion baskets at the southern corner of the Foxton Wharf. Key considerations in this options assessment are protection of the wharf from further erosion, overtopping, undermining and cost. The following mitigation options have been assessed:

1. Do nothing;
2. Remove gabion baskets, install rock revetment through damaged section of wharf and tie in to existing rubble to the north;
3. Remove gabion baskets, install sheetpile wall along damaged section of wharf; and
4. Remove gabion baskets, install concrete pile and panel wall along damaged section of wharf.

Larger scale plans of these options are included in Appendix A.

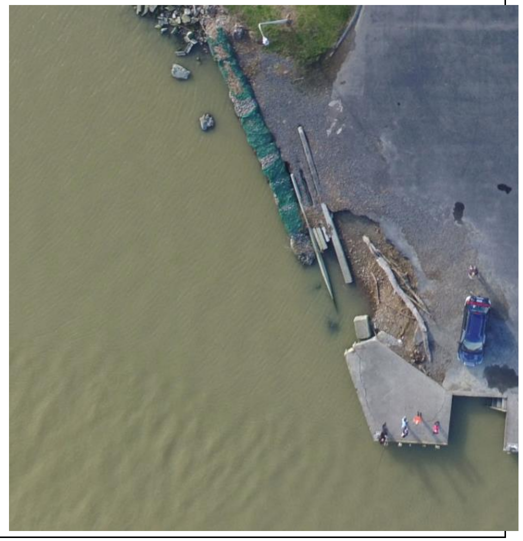
A brief description of each option along with the advantages and disadvantages of each have been outlined in Table 5.1. Considerations in this assessment include:

- Effectiveness of protection measures in mitigating future erosion;
- Ongoing works likely required following initial construction;
- Construction difficulty/imported material requirement;
- Aesthetics; and
- Cost level (low, medium, high).

Due to the high level concepts, uncertainties in material and contractor availability costings have not been provided. In the current market we are finding construction estimates to vary significantly from pre-concept to detailed design.

A detailed cost estimate will be provided for the preferred option during the detailed design phase.

Table 5.1: Mitigation options assessment

Option #	Option and description	Cost level	Advantages	Disadvantages/Risks	Diagram
1	**Do nothing**	No cost	-No upfront cost.	- Ongoing erosion to backshore pavement. - Likely to continue undermining the adjacent concrete wharf structure.	

Option #	Option and description	Cost level	Advantages	Disadvantages/Risks	Diagram
2	**Rock Revetment** Remove gabion baskets, prepare subgrade, install rock revetment (rock armour D_{50}=600mm) along 25m damaged length.	Low	-Lowest cost. -Straight forward construction methodology. -Lower overtopping volumes than vertical structure due to permeability dissipating wave energy. -Flexible structure able to tolerate some undermining and settlement with easier repair. -50yr+ design life.	-Greatest footprint extent. -Will lose approximately 50m^2 of existing paved area to ensure seabed is not too deep at revetment toe location. -Will require excavation at toe to embed rock, may prove difficult below water. -Different aesthetic to adjacent wharf structure. - Uncertainty on price due to availability of rock materials.	

Option #	Option and description	Cost level	Advantages	Disadvantages/Risks	Diagram
3	**Sheetpile (PVC) wall** Remove gabion baskets, install sheetpile wall (PVC) along seaward edge of paved area in line with existing wharf structure. Backfill behind wall and reinstall pavement.	Medium (approx. 2 times Option 1)	-Moderate cost. -Minimal excavation below water level required. -PVC sheetpiles are relatively low cost, efficient material. -Driving sheetpiles is a relatively quick construction method. -50yr manufacturer's warranty available for PVC materials. -Minimal footprint when compared with a rock revetment. - Minimal water quality impact/disturbance when compared to revetment and concrete wall structure.	-A less used material with limited use in New Zealand. -Contractor with track record in, and equipment for, PVC sheetpile installation likely required, may limit options, and increase construction costs. -Potential impact damage risk, difficult to repair if damaged. -Higher overtopping volumes than rock revetment options (although capping beam will likely mitigate some overtopping flows) -Lower stiffness than alternate materials (timber/concrete) and therefore likely to undergo greater creep over time. -Material degradation (UV, impact) over time may lead to deformation. -Dense ground conditions and obstructions can prove problematic for installation, geotechnical investigation would be required at detailed design.	

Option #	Option and description	Cost level	Advantages	Disadvantages/Risks	Diagram
4	**Concrete pile and panel wall** Remove gabion baskets, install concrete H-pile and panel wall along seaward edge of paved area in line with existing wharf structure. Backfill behind wall and reinstall pavement.	Medium/ High (approx. 2 to 3 times Option 1)	-Robust, durable construction elements -Common material usage, large number of contractor options -50yr+ design life -Minimal footprint when compared with rock revetment -Similar aesthetic to adjacent concrete wharf structure	-High cost -Higher overtopping volumes than rock revetment options (although capping beam will likely mitigate some overtopping flows) -Includes steel reinforcing, vulnerable to corrosion if exposed through cracks etc., maintenance required if/as cracks develop. -Dense ground conditions and obstructions can prove problematic for installation (less so than PVC), geotechnical investigation would be required at detailed design.	

6 Resource consent considerations

We have undertaken a provisional scoping of the resource consents required for each of the options. A summary is provided below and the complete assessment is contained in Appendix B. It should be noted that the consent assessment did not include possible construction related resource consents that may be required (e.g. temporary structures and dewatering) or an assessment of building consent requirements. The final consenting requirements will be confirmed in detailed design and consents obtained as required.

6.1 Consent requirement summary

Subject to design, the following resource consents may be required for all three options:

Horizons Regional Council –

- Construction of a structure within the CMA (Rule 18-44) – Discretionary activity; and
- Earthworks above MHWS (Rule 13-7) – Discretionary activity.

Horowhenua District Council –

- Construction of a structure above MHWS, including associated earthworks and removal of the existing gabion (Rule 20.4) – Discretionary activity.

6.2 Consenting risks and opportunities

6.2.1 Horizons Regional Council

Under the Horizons One Plan (Schedule I), the Manawatu Estuary is a River Protection Activity Management Area. This notes the estuary is a nationally important nursery for estuarine species, an internationally important site for migratory bird species and is internationally recognised as a wetland of international importance under the RAMSAR Convention, among others (refer to Appendix B for the complete list of values).

Given the significance of the site, and to obtain the required resource consents, it will need to be clearly demonstrated as to how the adverse effects on the Manawatu estuary will be avoided, remedied or mitigated. It is possible that the resource consent application will be notified and a hearing required. The application may be declined if the effects are significant and/or the proposal is inconsistent with the objectives and policies of the plan.

Also due the significance of the site, a number of parties will likely be interested in the proposal, including, interest groups (e.g. Forest & Bird), the Department of Conservation (DoC) and mana whenua. Therefore, consultation with DoC and mana whenua should occur as a minimum. Additionally, consultation may be required with mana whenua under the Marine and Coastal Area (Takutai Moana) Act 2011 if there are customary marine title applications for the Manawatu estuary.

6.2.2 Horowhenua District Council

All three options require a discretionary activity consent under the HDC operative District Plan. The discretionary activity status allows HDC to assess matters at their discretion which will generally include effects on public access, amenity and natural character. Given that the site is already modified by the existing wharf, the proposed structure(s) will likely have limited effects on the points of concern for HDC and the consent pathway can be expected to be of low complexity.

7 Conclusions and recommended next steps

HDC are looking at options for remediation of the degraded gabion basket and backshore erosion at the south-western corner of the Foxton Wharf. T+T has assessed the issues associated with the current situation, proposed four mitigation options to be considered and investigated the associated consenting implications of these options.

Doing nothing presents the lowest immediate cost, however it would allow continued erosion of the backshore pavement and undermining of the adjacent concrete wharf structure. Considering these effects, doing nothing could end up being the most expensive option in the longer term.

From a preliminary assessment of overtopping, a rock revetment best would provide the most cost effective protection against wave overtopping with the knock-on effect of minimising damage to and erosion of the backshore pavement. As a somewhat flexible structure, a revetment would also be able to tolerate undermining and settlement with easy repair.

While more costly than a revetment, vertical walls would occupy a significantly smaller footprint (both in the marine area and in their occupation of the backshore pavement) and would be more aesthetically cohesive. A sheetpile wall (medium cost) would require minimal excavation below water level with relatively quick construction, at the expense of durability. A concrete pile and panel wall (medium/high cost) would be more robust with durable and easily sourced construction elements.

It should be noted that depending on the design life (and therefore the magnitude of sea level rise considered), Options 2 through 4 will all require crest levels above that of the existing gabion structure and backshore pavement.

To progress this project, the following further works are likely to be required:

- HDC undertake in-house discussions and stakeholder liaison to determine which of the presented options, if any, are to be taken forward to concept design. The concept design will provide a more accurate price estimate to be prepared for a final investment decision;
- T+T undertake consent-level design and preparation of the resource consent application for the preferred option. The consent-level design will enable evaluation of impacts for the resource consent application. This is also likely to require evidence of stakeholder liaison and include a pre-application meeting with Horizons Regional Council; and
- T+T can undertake detailed design, tender and construction administration following selection of the preferred option if required by HDC.

8 Applicability

This report has been prepared for the exclusive use of our client Horowhenua District Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

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Technical Review for Tonkin + Taylor by: Tom Shand and Alia Cederman

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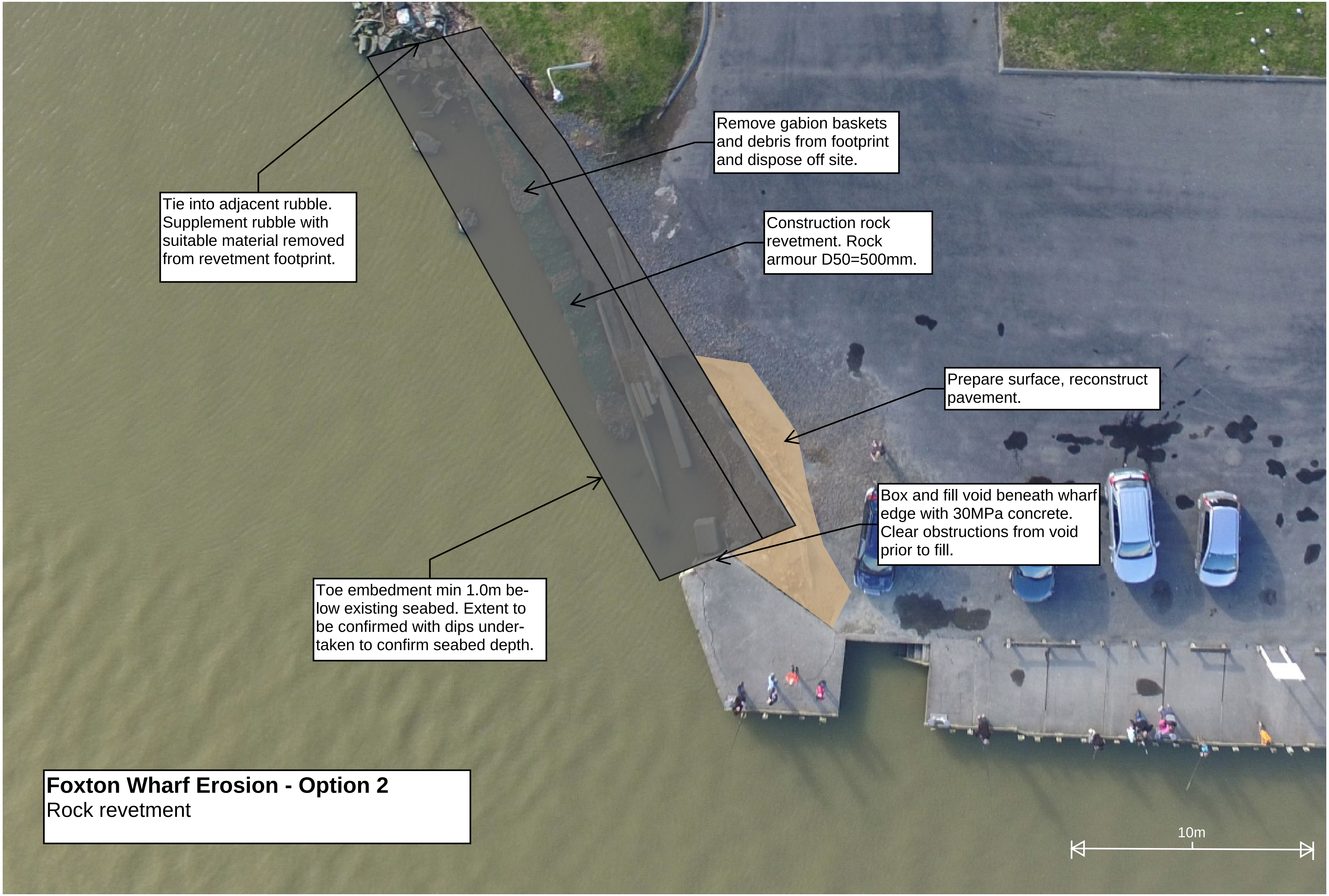
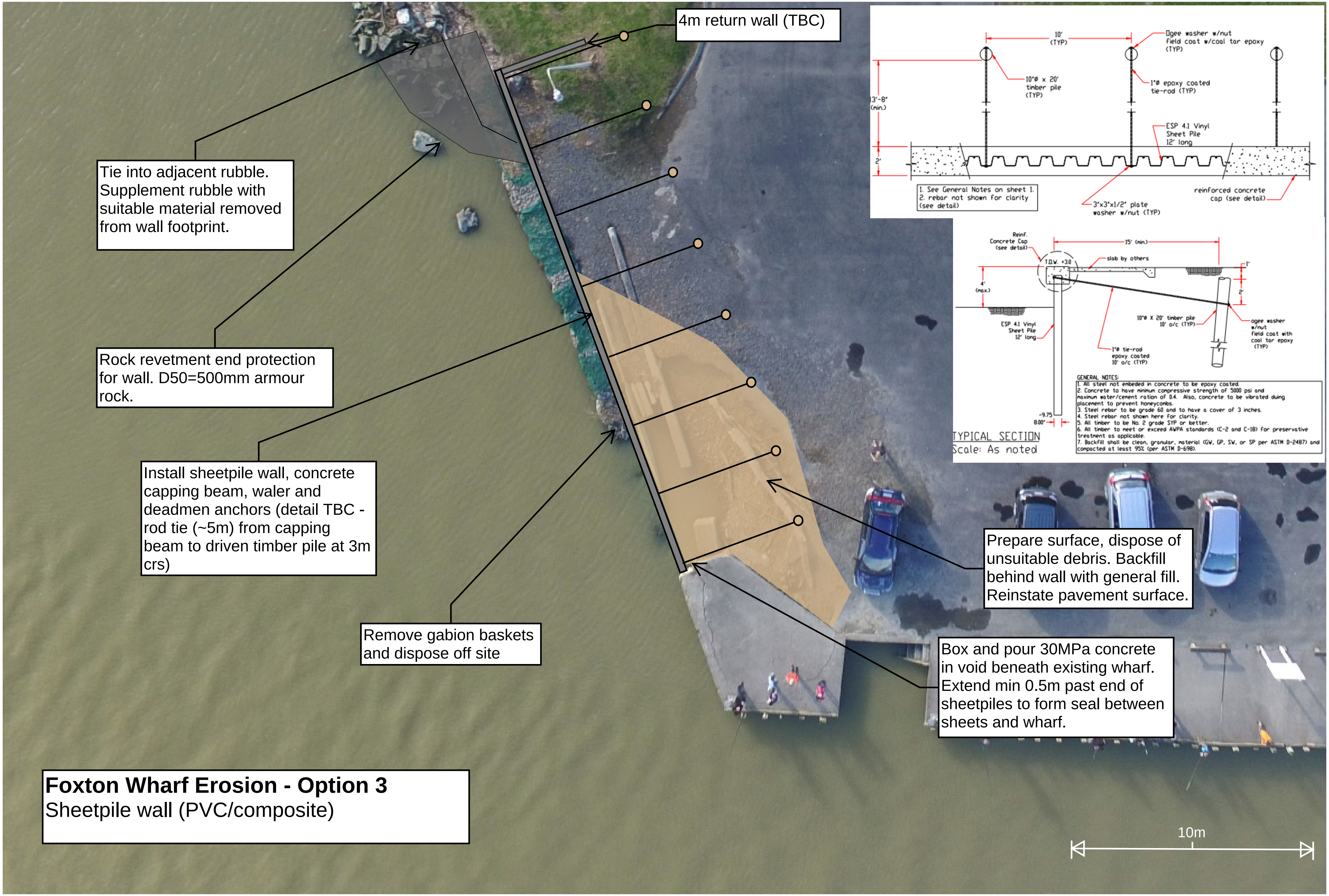
Appendix A: Options sketches

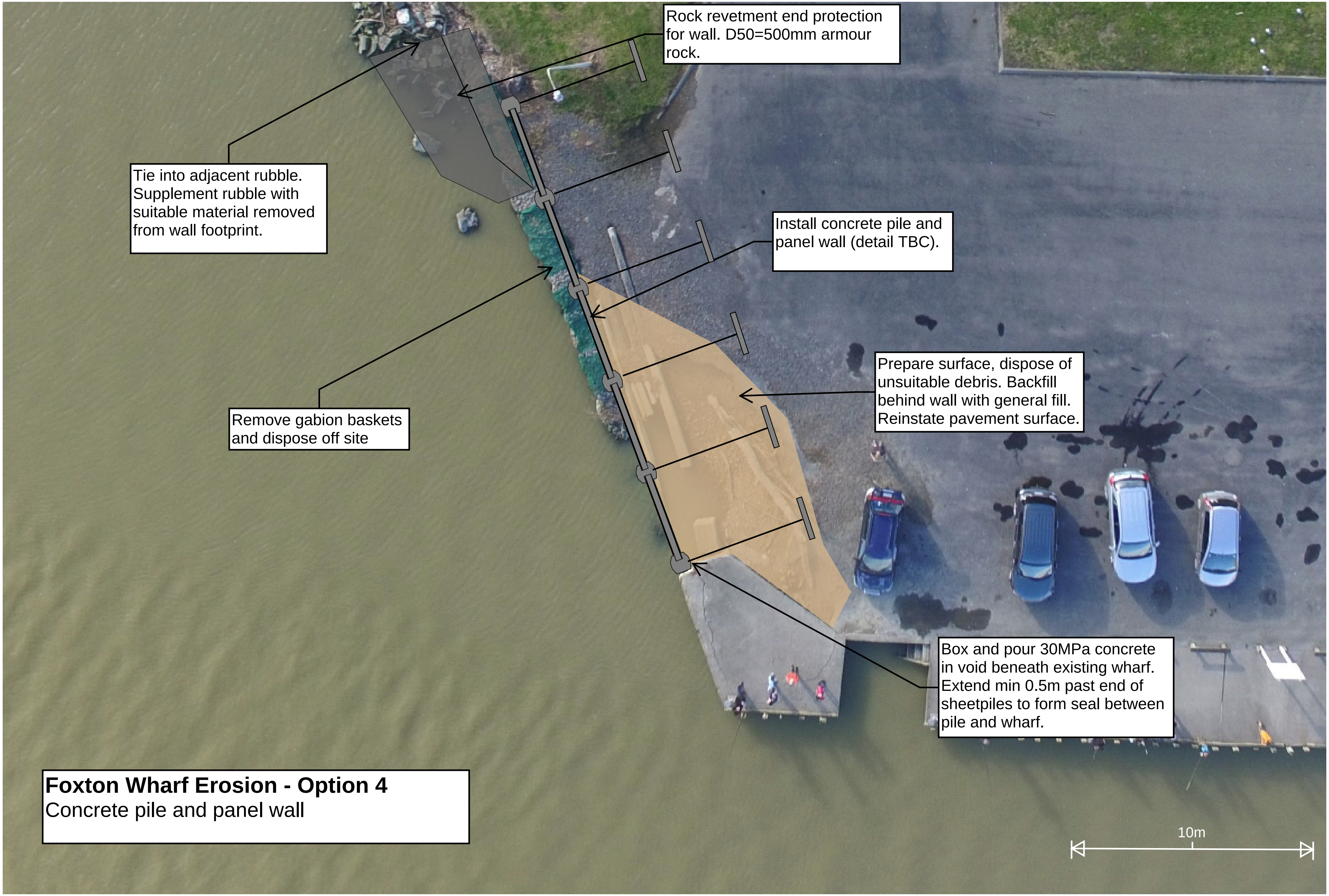
Foxton Wharf Erosion - Option 1
Do nothing



Foxton Wharf Erosion - Option 2
Rock revetment

Foxton Wharf Erosion - Option 3
Sheetpile wall (PVC/composite)




Rock revetment end protection for wall. D50=500mm armour rock.
Tie into adjacent rubble. Supplement rubble with suitable material removed from wall footprint.
Install concrete pile and panel wall (detail TBC).
Remove gabion baskets and dispose off site
Prepare surface, dispose of unsuitable debris. Backfill behind wall with general fill. Reinstate pavement surface.
Box and pour 30MPa concrete in void beneath existing wharf. Extend min 0.5m past end of sheetpiles to form seal between pile and wharf.
Foxton Wharf Erosion - Option 4
Concrete pile and panel wall
10m

Appendix B: Resource consent assessment

We have undertaken a provisional scoping of the resource consents required for each of the three options. For all options it has been assumed that the works will occur both above and below MHWS and therefore, will be within the jurisdictional areas of both Horizons Regional Council (HRC) and Horowhenua District Council (HDC).

Each option below has been considered in isolation and the consent assessment below does not include possible construction related resource consents that may be required (e.g. temporary structures and dewatering). The final consenting requirements will be confirmed in detailed design and consents obtained as required.

The notations and values attributed to the site under the HRC One Plan and HDC District Plan are outlined in Table 9.1 and Table 9.2 below. An assessment of the potential resource consent requirements for the three options is provided below in Table 9.3 and Table 9.4.

Table 9.1: Regional plan notations and values

Plan notation	Value
Manawatu estuary water management subzone (Schedule I)	• Life supporting capacity: Lowland mixed; • Site of significance – Riparian; • Inanga spawning; • Whitebait migration; • Contact recreation; • Amenity; • Mauri; • Sites of significance – Cultural; • Industrial abstraction; • Capacity to assimilate pollution; and • Existing infrastructure.
Manawatu river protection activity management area (Schedule I)	• Nationally important as a nursery for freshwater and estuarine species; • Internationally important strategic site for migratory bird species; • Provides habitat for rare and threatened bird species; • Important roosting and feeding area for wading birds; • Contains regionally important plant species; • Internationally recognised as a wetland of international importance under the RAMSAR Convention; and • Regionally important for its high degree of naturalness and diversity.

Table 9.2: District plan notations

Location within plan	Plan notation
Planning map 13	Coastal Natural Character and Hazard Area
	Open space zone

Table 9.3: Horizons Regional Council One Plan assessment

Activity	Rule	Activity status	Comment
Maintenance of existing structures	The maintenance (excluding removal or demolition) of any lawfully established structure located in, on, under or over the foreshore or seabed pursuant to s12(1) RMA and any ancillary: a) Disturbance of the foreshore or seabed pursuant to s12(1) RMA. b) Deposition of natural marine substances on the foreshore or seabed pursuant to s12(1) RMA. c) Discharge of water or contaminants into the CMA pursuant to s15(1) RMA.	Permitted	The proposal is for three new structures to be installed. These are not considered to be maintenance of the existing structure and therefore, this rule is not relevant.
Removal of the existing gabion from the CMA	**Rule 18-7:** The removal or demolition of a structure or any part of a structure located in, on, under or over the foreshore or seabed pursuant to s12(1) RMA and any ancillary: a) Disturbance of the foreshore or seabed pursuant to s12(1) RMA. b) Deposition of natural marine substances on the foreshore or seabed pursuant to s12(1) RMA. c) Discharge of water or contaminants into the CMA pursuant to s15(1) RMA. d) Damming or diversion of water in the CMA pursuant to s14(1) or s14(2) RMA.	Permitted	The removal of the gabion can likely be undertaken as a permitted activity, provided the conditions within Table 18.1 are met. However, based on the information available at this time, it cannot be confirmed if all these conditions will be met.
Construction of new rock revetment within the CMA	**Rule 18-44:** Any activity that either: a) is subject to s12(1), s12(2), s14(1), s14(2), s15(1) or s15(2) RMA and is not addressed by any other rule in this chapter; or b) Does not comply with one or more conditions, standards or terms of a permitted activity or controlled activity rule in this chapter, and which is not expressly classified as a discretionary activity, non-complying activity or prohibited activity.	Discretionary	The erosion protection structures are not specifically provided for as a permitted, controlled or restricted discretionary activity under the One Plan. Therefore, they default to a discretionary activity and resource consent is required.
Construction of sheetpile (PVC) wall within the CMA			
Construction of concrete pile and panel wall within the CMA			
Structures in a Protection Activity Management Area	**Rule 18-16:** Any activity within a Protection Activity Management Area shown in Schedule I, which involves the erection of any of the following structures pursuant to s12(1) RMA: a) a structure for the storage or containment of petroleum products or contaminants.	Prohibited	The site is within the Manawatu river protection activity management area and the proposed erosion protection structures will form part of the existing wharf. However, they are not a

Activity	Rule	Activity status	Comment
	b) a structure which will impound or effectively contain 4 ha or more of the CMA. c) a wharf, marina, boat shed, aquaculture structure.		new wharf, and therefore, this rule is not considered relevant.
Earthwork above MHWS	**Rule 13-1:** Except as regulated by Rules 13-6, 13-8 and 13-9, any land disturbance pursuant to s9(2) RMA of a total area up to 2500 m^2 per property per 12-month period and any ancillary: a) Diversion of water pursuant to s14(2) RMA on the land where the land disturbance is undertaken, or b) Discharge of sediment into water pursuant to s15(1) RMA resulting from the land disturbance.	Permitted	The site is within the coastal foredune area, being *'the strip of land between the coastal marine area and a line roughly parallel with the beach, extending 200 metres inland of the first line of vegetation'.* Therefore, earthworks above MHWS will not meet permitted activity rule 13-1 and will likely require resource consent under discretionary activity rule 13-7
	Rule 13-7: Vegetation clearance, land disturbance, cultivation or forestry that does not comply with Rules 13-1 to 13-6	Discretionary	

Table 9.4: Horowhenua District Council district plan assessment

Activity	Rule	Activity status	Comment
Construction of new rock revetment above MHWS	**Rule 20.4:** The following activities shall be discretionary activities in the Open Space Zone: (g) Any buildings, structures and the subdivision of land (excluding boundary adjustments) in the Coastal Natural Character and Hazards Overlay Area identified on Planning Maps.	Discretionary	The site is within the Coastal Natural Character and Hazards Overlay and therefore, resource consent is required for the new structures, including associated earthworks and the removal of the existing gabion. *Note: it has been assumed that all three options meet the definition of a building under the HDC district plan.*
Construction of sheetpile (PVC) wall above MHWS			
Construction of concrete pile and panel wall above MHWS			