

## Waikato District Council

Sunset Beach Erosion Project

Okariha, Te Pūaha-o-Waikato

Sunset Beach Erosion Project

SFA 14/076

December 2014



# Table of contents

1.	Objective of the report .....	1
2.	Background Review .....	2
2.1	Current physical environment .....	2
2.2	Port Waikato Spit – a naturally changing environment.....	2
2.3	What is influencing erosion at Sunset Beach?.....	3
2.4	Risk of ongoing erosion .....	3
2.5	Changing use of the beach.....	8
3.	Site visit findings .....	10
4.	Stakeholder / Community views.....	16
4.1	Stakeholders consulted .....	16
4.2	Stakeholder feedback.....	16
5.	Options .....	19
5.1	Assumptions.....	19
5.2	Short term option for car parking.....	19
5.3	Option 1 - Do Nothing (Not Recommended).....	19
5.4	Option 2 – Defend (Not Recommended).....	20
5.5	Option 3 – Adapt (Recommended alongside option 4) .....	22
5.6	Option 4 – Retreat (Recommended) .....	25
6.	Options Analysis .....	31
6.1	Development of Analysis Method.....	31
7.	Recommendations .....	35
8.	References .....	37

# Table index

Table 1 Multi Criteria Analysis .....	32
Table 2 New Zealand Coastal Policy Statement – Relevant Sections .....	43
Table 3 Waikato Regional Plan – Relevant Sections.....	44
Table 4 Waikato District Plan – Relevant Sections.....	44

# Figure index

Figure 1: Methodology .....	1
Figure 2: Port Waikato Spit and shoreline change between 1879 & 1963 (Source: Tonkin & Taylor, 2006).....	1

Figure 3: Spit in 2014 (Source: Good Earth).....	1
Figure 4: Spit Breach in October 1960 (Source: Port Waikato Dairy).....	1
Figure 5: Aerials of Sunset Beach in 2002 vs 2012 (Source: Waikato District Council).....	2
Figure 6: Photos of Sunset Beach car park in 2002 and 2008 (Source: Google Street view) .....	2
Figure 7 : More recent trends in coastal erosion and accretion at Sunset beach .....	4
Figure 8: Coastal inundation modelling based on LIDAR Model (Source: Waikato District Council).....	5
Figure 9: Setback from the Existing shoreline .....	7
Figure 10: Port Waikato in 1970 looking north towards Port Waikato Township and the Surf Life Saving club (left of photo) (Source: Sunset Surf Life Saving Club).....	8
Figure 11: Port Waikato in 1984 looking east towards Port Waikato Township. (Source: Port Waikato. Whites Aviation Ltd Alexander Turnbull Library) .....	9
Figure 12: Site layout showing all community assets at risk. ....	10
Figure 13: Profile of rock wall design (Source: Previous project by GHD).....	21
Figure 14: Plan view of potential rock wall location .....	22
Figure 15: Wall design using geo fabric (Source: RST Solutions 2014) .....	22
Figure 16: Potential flexible vehicle or pedestrian dune ramp.....	23
Figure 17: Potential dune establishment option .....	24
Figure 18: Short term option for car parking with Dune planting .....	25
Figure 19: Map of Port Waikato indicating retreat locations reviewed.....	26
Figure 20: Options for car parking at 1-3 Centerway Road.....	28
Figure 21: Proposed layout for Ocean View Road .....	29
Figure 22: Photo of the potential site at 39 Ocean View Road.....	30
Figure 23: Diagram of Potential Beach nourishment at Port Waikato .....	40
Figure 24: Breakwater Example at Elmer, UK (courtesy of Wikipedia) .....	41
Figure 25 : Diagram of Potential Groins at Port Waikato .....	42

## Appendices

Appendix A – Car park options for Summer 2014

Appendix B – Additional ‘defence’ options considered but discounted.

Appendix C – Planning framework considered when assessing options

Appendix D – Full maps and Diagrams from previous investigations



# 1. Objective of the report

GHD Ltd (GHD) was engaged by Waikato District Council to undertake an assessment of options for managing issues resulting from erosion affecting Okariha (or Sunset Beach) in Port Waikato. This report presents long term management options with respect to erosion control, infrastructure maintenance, beach access, drainage, and stormwater runoff while considering existing recreation activities and the amenity and cultural values discussed with stakeholders.

The following methodology was agreed with Waikato District Council:

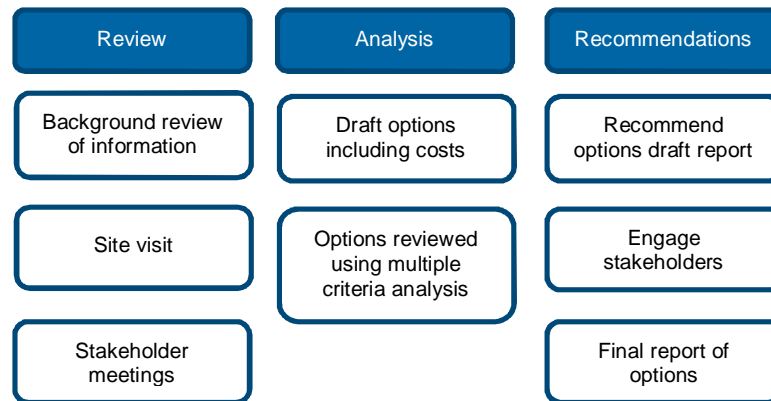


Figure 1: Methodology

## Review

- Review readily available information comprising previous studies, existing and historical aerial photography, climate change and inundation data;
- Undertake a site visit to confirm site characteristics, current condition of the foreshore, assets and infrastructure, and inspect the current ecological setting of the area. A site visit was undertaken by the project team on 7th and 8th of October 2014;
- Undertake discussions with local stakeholders and identify cultural and amenity issues and values that are likely to influence options. Stakeholder discussions were had on the 7th and 8th of October, see Section 4.

## Analysis

- Draft options to respond to erosion issues identified. Options centred around defend, adapt, retreat and do nothing;
- Review both construction and maintenance costs associated with remedial options; and
- Review options against multiple criteria identified during consultation with stakeholders.

## Recommendations

- Prepare a draft report with recommendations
- Seek feedback from stakeholders, including feedback from the Onewhero – Tuakau Community Board.
- Prepare and submit a final report to the Waikato District Council before the end of December 2014.

This is a draft report for discussion with the Onewhero – Tuakau Community Board. Feedback from Board members and stakeholders will be incorporated into a final report to be submitted to Waikato District Council.

No wave or current modelling, beach profiling over time, social, environmental or economic impact assessment has been undertaken.

Short term options for the car park, to provide access to the beach for the summer period, were presented to Onewhero - Tuakau Community Board on November 3<sup>rd</sup> 2014 as part of a separate project for Waikato District Council (see Appendix A).

## 2. Background Review

This section sets out findings from the review stage of the project. It describes what is known about the local environment and relevant historical information.

### 2.1 Current physical environment

Sunset Beach is located on the west coast of the North Island and forms a section of the 3km spit on the southern mouth of the Waikato River. Okariha is the name used by Ngāti Tīpā and Ngāti Tahinga to represent the spit. The name Okariha is also associated with Sunset beach to the southern end where a whale by the same name once frequented.

The existing foreshore dune systems of the Port Waikato Spit are mapped as mobile dune sands of the Karioitahi Group<sup>1</sup>. The dune system is vegetated in spinifex (*Spinifex sericeus* – also known as kowhangatara or silvery sand grass) and pingao (*Ficinia spiralis* – also known as golden sand sedge). These native species play a critical role in natural sand trapping and dune repair as well as preventing wind erosion. This natural foreshore dune system finishes approximately in line with the northern edge of the existing surf lifesaving tower as seen during site visits undertaken on the 7<sup>th</sup> and 8<sup>th</sup> October 2014.

The southern extent of Sunset Beach comprises Quaternary sandstone cliffs of the Awhitu Group which is underlain by siltstone, sandstone and conglomerate of the Apotu Group<sup>2</sup>.

The area at the base of the cliff is occupied by a public car parking area that is currently being eroded by wave action with areas of the asphalt breaking off and landing on the beach below. Public buildings to the north of the car park are also threatened with the surf life saving tower approximately 10m from the high tide mark (8<sup>th</sup> October 2014).

A small stream runs between the dune and cliffs at the southern end of the beach and the dune system to the north. Currently this stream is blocked at the beach, with ponded water accumulating at the foot of the hills, flushed infrequently by larger rainfall events.

A period of erosion began in approximately 2007 in the area of the car park with further erosion along the northern area of Sunset Beach. This is ongoing with minor periods of accretion during calmer weather.

### 2.2 Port Waikato Spit – a naturally changing environment

The Port Waikato spit is a constantly changing environment with natural processes and human activities influencing the shape and form of the beach and spit. Figure 2 shows the dramatic change in coastline from 1879 to 1963. Tonkin and Taylor (2007) noted general growth in the sand dune between 1877 and 2002 at an approximate rate of 2m per year.

---

<sup>1</sup> Edbrooke, S.W., 2001: Geology of the Auckland Area. Scale 1:250 000. Institute of Geological and Nuclear Sciences, Geological Map 3.

<sup>2</sup> Edbrooke, S.W., 2001: Geology of the Auckland Area. Scale 1:250 000. Institute of Geological and Nuclear Sciences, Geological Map 3.

More recent aerial and Google Street imagery from 2002 and 2012 shows that the foreshore directly in front of the existing car park at Sunset Beach has begun retreating (Figures 5 & 6). Throughout this period the surf lifesaving lookout tower has been relocated (in 2008), moving back approximately 20 metres from its original location. Both images also show the lower car park intact with vegetated embankment onto the beach. It can also be seen that new dune restoration planting had recently taken place at the northern end of the car park in 2008 but this has been washed away with further storm events.



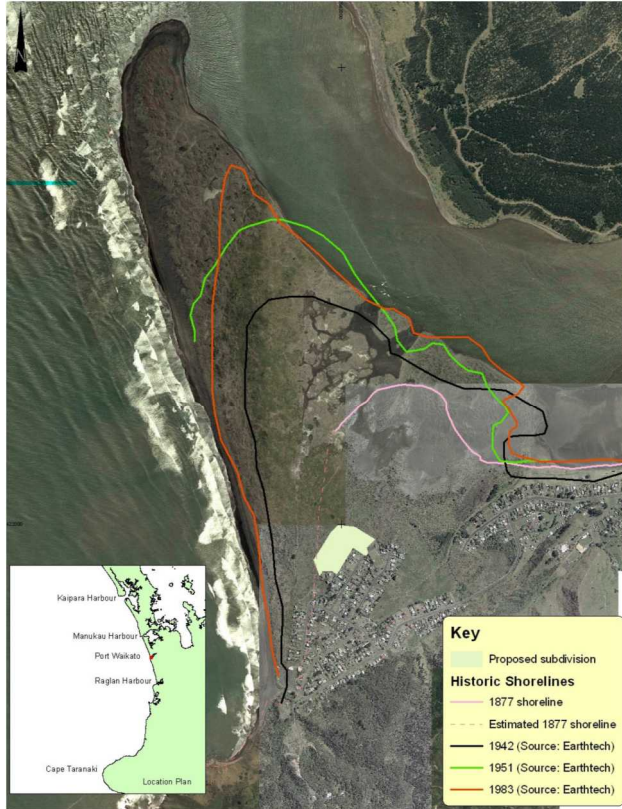


Figure 2: Port Waikato Spit and shoreline change between 1879 & 1963 (Source: Tonkin & Taylor, 2006)



Figure 3: Spit in 2014 (Source: Good Earth)



Figure 4: Spit Breach in October 1960 (Source: Port Waikato Dairy)





Figure 5: Aerials of Sunset Beach in 2002 vs 2012 (Source: Waikato District Council)



Figure 6: Photos of Sunset Beach car park in 2002 and 2008 (Source: Google Street view)

## 2.3 What is influencing erosion at Sunset Beach?

Coastal dunes occur along approximately 1100km of New Zealand's coast and about one quarter of New Zealand's coastline was eroding in 2007 therefore coastal erosion is not new to the New Zealand coastline (NZ Civil Defence, 2007).

Sunset Beach is part of an interconnected sand system that extends from Taranaki to North Cape. The beach sands along this coast are derived from erosion of andesitic volcanic materials in Taranaki. Prevailing westerly winds and the high energy waves experienced along the West Coast drive the transport of sands alongshore in a northerly direction (Environment Waikato, 2007).

It is believed that the amounts of sediment available within the immediate catchment area, which includes Sunset Beach, are constantly changing as sand deposits enter from the south and are then transported further north (Environment Waikato, 2007). The total volumes of sediment in the catchment at any given time (the sediment budget) can influence erosion and deposition cycles along the spit.

History also suggests that beaches naturally erode and accrete over time in response to natural climate and wave events. Climate and weather system cycles such as El Nino and La Nina could also influence longer term trends as will long term changes in sea level. The West Coast of New Zealand is a high wave energy environment with average wave heights exceeding 2 metres along the West Coast of the Waikato (Liefing et. al, 2007).

## 2.4 Risk of ongoing erosion

Figure 7 shows the level of erosion at Sunset Beach from 2002 to 2014, showing significant erosion between 2008 and 2014 after a period of accretion. If the more recent trend was to continue a further 20 to 50 meters of erosion inland over the next 10 years (2 to 5m per year) could be expected.

Sea levels have risen 0.016m per year on average between 1877 and 2002 (Hannah 2004). Sea levels are expected to continue to rise over the next century with the Ministry for the Environment (MfE 2008) expecting a rise in sea level of 0.5m by 2090 (relative to the 1980–1999 average) after findings of the updated Intergovernmental Panel for Climate Change (IPCC) in 2007<sup>3</sup>. MfE also recommends any development should consider a sea level rise of at least 0.8m as updated in their guidance note Coastal hazards and Climate Change: A guidance manual for local government in New Zealand 2004 (updated 2008).

The Waikato Regional Council, in partnership with City and District Councils in the region, have been modelling coastal hazards and inundation scenarios from a change in sea levels. Figure 8 shows modelled areas of inundation for Port Waikato based on varying levels of sea level rise up to 1 meter. Information presented in the maps show a change in sea level and does not include effects of wave action along the open coast. Due to the height of the dune system along the Port Waikato spit, a 1 metre rise in sea level is not expected to breach the existing dune system, even with significant wave heights or storm surges as the current heights of the dunes are 4.5m minimum (as measured during site visit on 8<sup>th</sup> October 2014). Inundation inland, through the mouth of the Waikato River into lowland areas is of higher risk for wider consideration of future development in Port Waikato.

---

<sup>3</sup> The Ministry for the Environment recommends allowing for 0.5 m of sea level rise over the next 100 years (MfE, 2004 and updated 2008). Since these guidelines were published updated IPCC predictions have been published in 2007 and 2014. A revision of previous guidance by the Ministry of the Environment (MfE) has been undertaken in 2008 but has not been updated since IPCC released their latest figures in 2014.



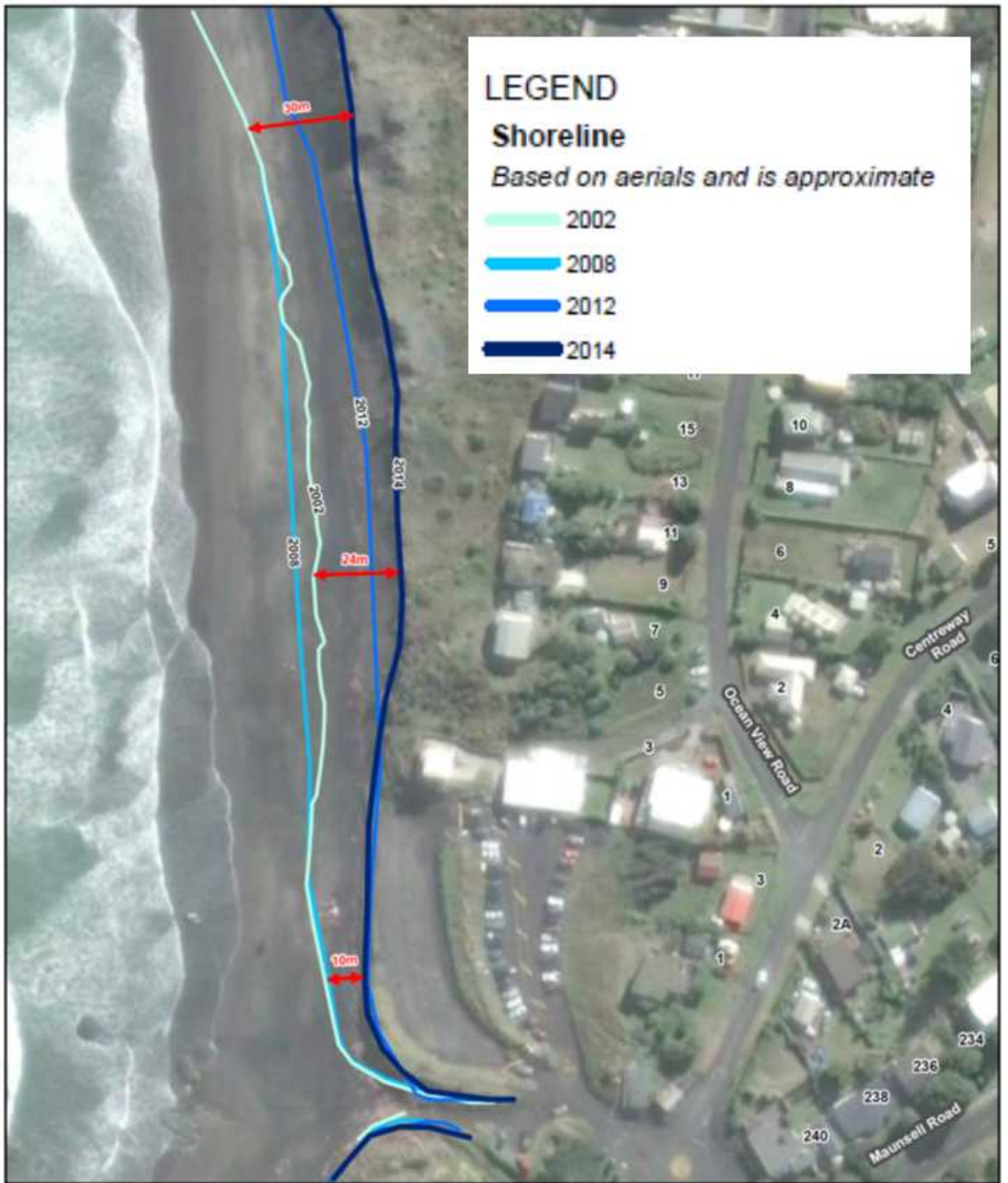


Figure 7 : More recent trends in coastal erosion and accretion at Sunset beach



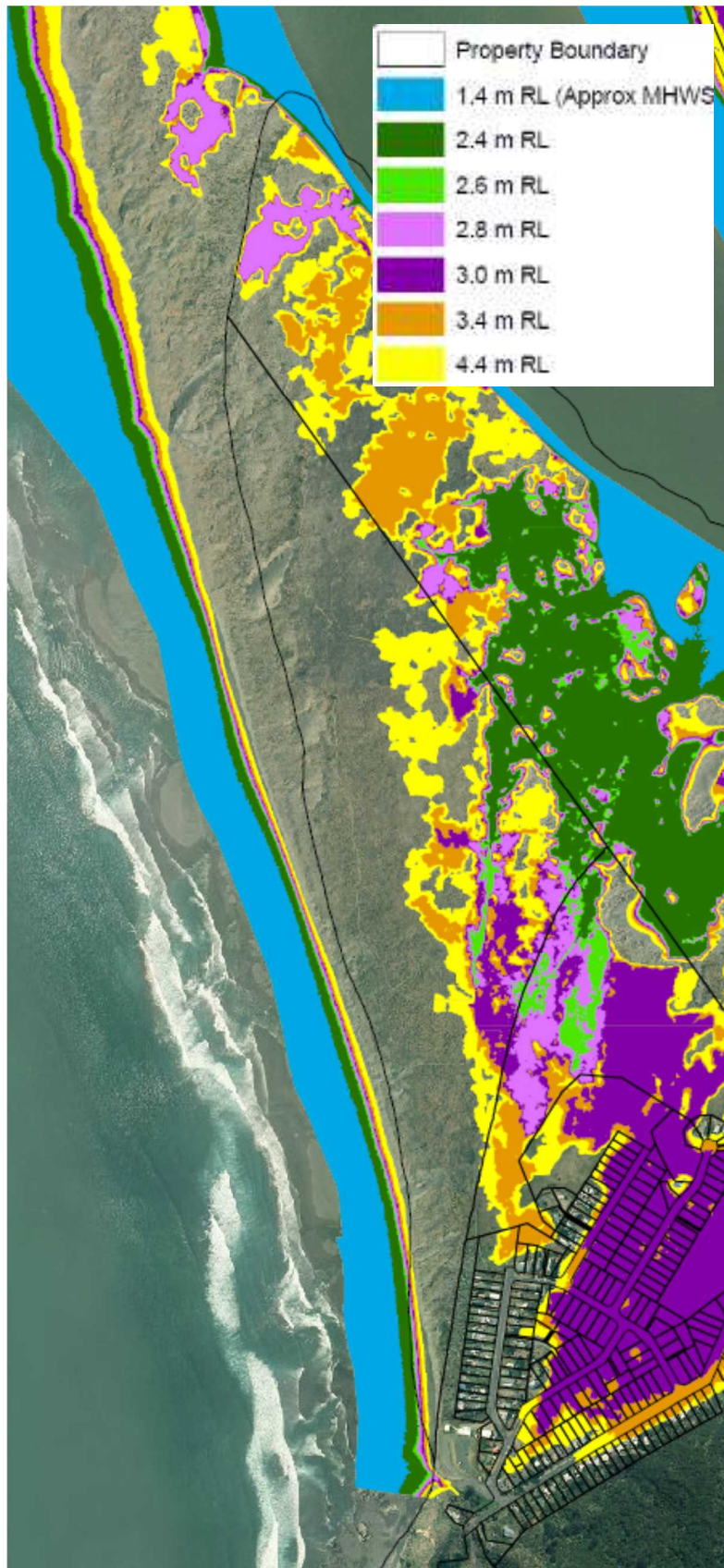


Figure 8: Coastal inundation modelling based on LIDAR Model (Source: Waikato District Council)

The risk of inundation over the dune system is not anticipated but a rise in sea level could exacerbate rates of erosion. Currently the most accepted way to calculate rates of shoreline erosion retreat from sea level rise is using the Bruun Rule. Using the Bruun rule, a recent report

by Tonkin & Taylor in 2007 calculated a 55 meter retreat at Port Waikato over the next 100 years. This calculation was undertaken in 2007 and was based on a sea level rise of 0.5 meters. ***This calculation has not been updated with the current MfE guidance (2007) of 0.8m or the updated report by the IPCC in 2014.***

It is likely that during rising sea levels, the erosion rate of the cliffs and associated sediment volume south of Port Waikato would increase at similar rates. The sediment eroded from the cliffs is then either transported off shore or along shore to increase the sediment budget for the region. This sediment could be transported back to the beach system with onshore winds. So increases in sea level at this location may not cause the amount of erosion predicted by the Bruun Rule.

Whilst predicting erosion from sea level rise is not an exact science it is recommended that a hazard zone be identified to aid 50+ year investment and development decisions. Based on historical trends, more recent rates of erosion as seen above in Figure 7 and calculated rates of erosion due to sea level rise (Tonkin and Taylor 2007) a 50 meter 'risk zone' is suggested. Figure 9 shows the zone that could be impacted should current erosion rates continue over the next 20 years. This would impact on the existing surf lifesaving tower, community hall, lower and upper level car park as well as private properties to the north of the surf lifesaving tower. It is recommended that a monitoring programme is established to review change in erosion and accretion rates over time to establish ongoing trends.

***This is a changing environment with periods of erosion and accretion continuing to affect the area. Recent trends, as shown in Figure 7, indicate that the beach is eroding at a rate of 2 to 5m per year. If the current rates of erosion persist community and private assets could be further impacted in the next 10 years. The erosion rates presented are based on available information. No additional monitoring or surveys have been undertaken. It is recommended that ongoing monitoring is undertaken to establish more definitive trends.***



Figure 9: Setback from the Existing shoreline

Recent trends suggest that the beach is eroding at a rate of 2 to 5m per year. If the current rates of erosion persist community and private assets could be further impacted in the next 10 years. It is recommend that additional investigations and monitoring be undertaken over a period of years to establish more definitive trends. It is also recommended that geotechnical investigations are undertaken in the area to establish the exact nature of bed rock material available for longer term protection should erosion continue.



## 2.5 Changing use of the beach

The area of Port Waikato is in important location for Maori history, especially as a site of significance during the New Zealand land wars of the 1860's. There are archaeological sites throughout the area including middens, historical tracks used by the Iwi of the area and whale burial areas along Sunset Beach.

The area has seen a very gradual increase in population of residents since the local town shop opened along Maunsell Road. The current population of the town is 1006 (Waikato District Council 2012) with a small projected growth going forward. While there is a small resident population, there is a larger visitor population with up to 1700 beach users a day during peak summer period in 2013 (Surf Life Saving Northern Region 2014). This is expected to grow further with the further urbanisation of nearby towns that will use Port Waikato as a primary recreation space on the coast.

The immediate beach area in front of the existing car park has been altered significantly over this time. Information received from stakeholder discussions, historical photographs and previous reports suggest the spit was, at one point, used for grazing cattle before the fore dunes at Sunset beach were turned into a car parking area for users of the beach (see Figure 10).

Several aerial images from 1984, sourced from the Alexander Turnbull Library, indicate that the lower car park was non-existent and there was a gradual gradient down the beach. There is an existing foreshore dune system north of the project area which suggests that in 1984 this area had been engineered for some purpose.

Over time fill, including soil, small rocks, wooden posts and disused concrete telephone poles have been used to provide a base for buildings, create and shape areas for car parking or to create barriers in an attempt to protect assets (see Figure 10). The fill under the existing car park will need to be taken into account when consider appropriate options for managing erosion in the future.



Figure 10: Port Waikato in 1970 looking north towards Port Waikato Township and the Surf Life Saving club (left of photo) (Source: Sunset Surf Life Saving Club)



Figure 11: Port Waikato in 1984 looking east towards Port Waikato Township.  
(Source: Port Waikato. Whites Aviation Ltd Alexander Turnbull Library)

### 3. Site visit findings

This section sets out the findings from site visits undertaken by the project team. It describes issues, risks and observations made whilst on site.

#### 3.1.1 Summary of existing assets

Sunset Beach comprises five key structures: the surf live saving lookout tower and the surf club; the community hall; the ablution block and the recycling station. Previously there were two car park areas, a lower and an upper car park. While the lower car park still exists it is no longer in use due to the risk of undercutting from erosion events. Separating the two car parks is a grassed embankment with the inclusion of tyres acting as a retaining feature.

A key feature of Sunset Beach is the boat ramp / access way from the Maunsell Road to the beach. This access way is flanked by cliffs on the southern side and a 'semi-retained', grassed embankment on the northern side. It is used extensively by recreational fishers, surf life savers, four-wheel drive users and anyone obtaining access the beach via vehicle or foot. A number of other assets are considered important and include storm water pipes; bench seats; rubbish bins; light poles; signage and an outdoor shower by the ablution block.

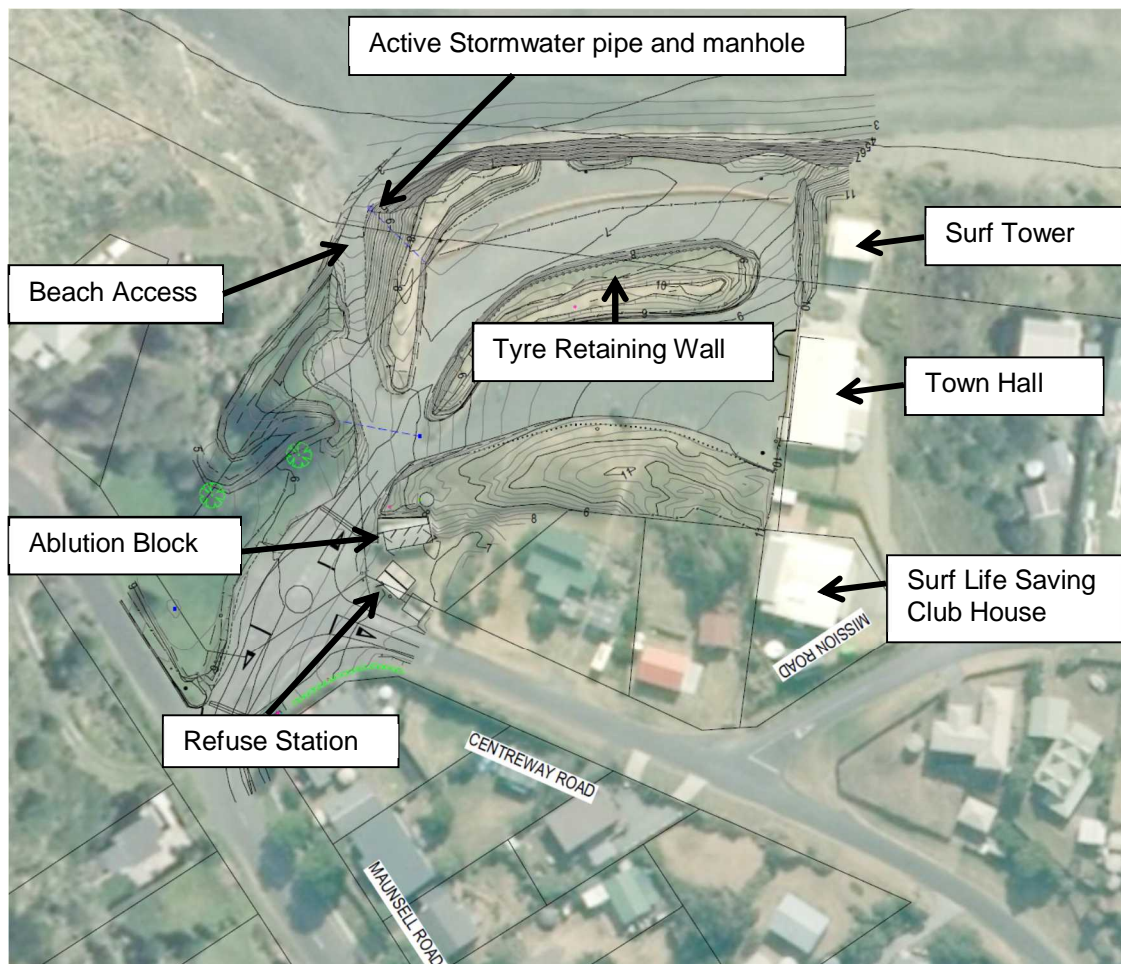


Figure 12: Site layout showing all community assets at risk.

Whilst the beach has been receding for some time, erosion at Sunset Beach has more recently threatening a number of community assets including the Surf Club, car park, stormwater pipes and community hall.

The photo series below provide an indication of the site conditions observed during the site visits on the 7<sup>th</sup> and 8<sup>th</sup> October 2014. During the site visit the following was identified:

- a) Erosion was ongoing with high wave energies continuing to erode both the dune face along the spit as well as undermining the lower car park, confirming that the recent period of erosion continues to impact on assets.



Photograph 1: Hightide waves at Sunset Beach (looking north) hitting the sand dunes.

- b) Any further erosion would put the existing surf lifesaving tower at extreme risk.
- c) The lower car park was first closed in the winter of 2013. An assessment by a GHD senior geologist has recommended that the lower car park not be reopened to public access due to the instability of the shoreline.
- d) Erosion has resulted in fill and pavement material periodically falling into the beach and washing into the surf zone. This is considered to be a safety risk for swimmers and recreational users of the beach.



Photograph 2: Debris from the car park on the beach. Surf tower in back ground (looking north).



Photograph 3: Debris from the car park on the beach (looking south).

- e) Noted were a second level defence with a tyre wall and vegetated bank and then 3<sup>rd</sup> level of defence with a ridge of planting behind the upper car park.





Photograph 4: The lower car park with tyre retaining wall at the rear.



Photograph 5: Lower car park (looking north) with tyre retaining wall to the right of the photo.

- f) There was no access to the beach from in front of the car park. Visitors would continue to make their own way down the vertical cuts which is considered a hazard and safety risk to visitors. It is recommended that access is closed and signage pointing to agreed access points is installed.



Photograph 6: Failing car park edge looking south (low tide). No pedestrian access to the beach available from this car park now.



Photograph 7: Failing car park edge looking south (high tide). No pedestrian access to the beach available from this car park now.

- g) Sand was being deposited by strong onshore winds on the upper car park and on the barriers in place. Westerly facing walls should be avoided when looking to create additional space for car parking unless this extra weight is designed for. Planting along such walls could also help to establish a further dune system.





Photograph 8: Sand being deposited against temporary concrete barriers in the middle of the upper and lower car park, northern end. Looking east toward the community hall.



Photograph 9: Sand being deposited against temporary concrete barriers in the middle of the upper and lower car park, southern end. Looking towards the beach access.

- h) Pedestrians were using the vehicle access to the beach. This introduces a risk, particularly when vehicles are taking a run up to gain sufficient speed to navigate the vehicle access. It is recommend that vehicle and pedestrian access ways are separated and clearly marked.
- i) There is limited turning area for vehicles entering or exiting the beach.
- j) There is limited or no parking for boat trailers. This presents an opportunity to design trailer parking into new options.
- k) There is the potential to use the area currently occupied by recycling facilities more efficiently for car or trailer parking.



Photograph 10: Large area of paving currently used for road roundabout that could be more efficiently utilised. Recycling facilities behind round about.

- l) There is an opportunity to provide a number of clearly marked car and boat trailer parking bays adjacent to the main intersection.
- m) The existing upper car park can be reconfigured to provide for better management of vehicles however, earthworks are required to significantly increase the number of car parks. An updated design for immediate implementation to provide car parking in the vicinity has been submitted to the Local Board and Waikato District Council. This will alleviate this severe shortfall in car parking for the upcoming busy summer period. A configuration has

been developed that will require a small amount of earthworks and will provide 50 car parks and an area for motorcycle parks.

- n) The river next to the vehicle access was blocked. This appeared to be caused by the deposition of storm material.



Photograph 11: Natural stream at the base of the southern cliffs looking east, blocked with debris.

A storm water pipe connecting the culvert at the base of the vehicle access way with the stream has been removed or covered in sand. The culvert appears to be operating with no records or information available on where stormwater is derived. In the past the pipe has been exposed, preventing vehicle access. It is recommended that the culvert and storm water pipe under the car park would need to be removed or reinstated to discharge into the stream in the future.



Photograph 12: Site visit in 2014 showing stormwater culvert being covered by further sand.



Photograph 13: Photo from 2011 showing connecting pipe that has been removed.

- o) Fill used (including concrete telephone poles) to raise the car park will constrain establishment of native dune species. Should dune revegetation be desired existing fill will need to be removed.



Photograph 14: Concrete telephone poles showing through eroded areas of sand dune below the car park



Photograph 15: Vehicle access to the beach at the southern end covered in debris washed in from storms.

- p) The vehicle access to the beach was limited due to debris (wood and debris from the car park) and sand. A decision is required on the provision of vehicle access to the beach in the future. Emergency vehicle use is required and the majority of stakeholders wanted to retain vehicle access. Should the vehicle access way be kept at this location it is recommended to include grid matting, timber or some form of base to help reinforce the road.
- q) The surf tower and the Community Hall are located in an extremely exposed position. It is noted that the surf tower is designed to be moved and replaced on new foundations in the event of further erosion. Options to relocate the community hall may need to be considered should erosion continue.
- r) The septic system for the ablution block is large and provides a solid planted barrier with trees that screen the area to the east from strong onshore winds.
- s) The green space opposite the ablution block is sheltered and provide for wider recreational use.



Photograph 16: Sheltered green space to the east of the beach with septic filtration area in the foreground to the right.

## 4. Stakeholder / Community views

This section reports on discussions had with stakeholders and members of the Port Waikato Community. It summarises what is important to stakeholders when deciding on options in response to erosion issues. Themes identified have been used to help identify preferred options in sections 5 & 6.

### 4.1 Stakeholders consulted

To help inform the review of options the project team felt it was important to engage stakeholders at the early stage of the project. Potential stakeholders were discussed with Waikato District Council and meetings were held with the following stakeholders:

- Sunset Beach Surf Life Saving Club: Malcolm Beattie – President and Tim Jago – Muriwai SLSC President
- Port Waikato Citizens and Rate Payers: John Carr – Chairman, Glennis Paton and Monique Haines, Members
- Huakina Development Trust: Rangī Mahuta and Sally Koia
- Port Waikato Ngati Karewa Ngati Tahinga Trust: Richard Tiki O Te Rangī Thompson and Sam Karaka
- Bird Protection Society and Port Waikato Beach Restoration: Karen Opie - Member
- Waikato District Council Beach Care; Sam Stephens - Waikato Regional Council
- Port Waikato Local Board: Fiona Gower – Local Board Rep (Delegated by Local Board Vice Chairman Noel Miller) and Phone conversations with Noel Miller, Jacqui Church and Rosemary Costar (Local Board Members)
- Waikato Regional Council; Rick Liefing, Coastal Hazard Management

Discussions centred on what is important to the community, historical and future use of the area, lessons learnt from the past, and feedback on different options when responding to erosion.

A number of other stakeholders were identified during discussions that should be considered for consultation before any options are taken forward. These include:

- Department of Conservation
- Port Waikato Yacht and Motor Boat Club
- Port Waikato Fishing Club

### 4.2 Stakeholder feedback

Stakeholder discussions had identified the following themes:

#### **Safe use of the beach**

Sunset Beach is a high energy and high hazard environment for swimmers and recreational users. There is general consensus that there should only be one focal point (parking and community facilities) for both the community and visitors.

It was felt that opening up multiple car parks or facilities along the beach would spread users along the beach making it difficult for the Surf Life Saving club to patrol the beach. This



included boat users who can currently be monitored and supported by the club when launching at the south end of the beach.

### **Vehicle access to the beach**

Stakeholders agree that both vehicular and pedestrian access for the Surf Lifesaving Club to the beach is important to perform their duties. While this does not necessarily need to be a separate access that is restricted from public use there are concerns about the conflicts that can occur on busy days with lifeguards needing access to the beach with access restricted by other vehicles parked or using the current access or pedestrians also using the only remaining access.

While the stakeholders agree that having public vehicle access to the beach is valued by the community and beach goers, there were discussions around the appropriateness of continued access for private vehicles. This is due to the potential damage to dunes and access ways, safety of beach goers and pollution of the beach environment from leaking fuel and abandoned/lost vehicles that were not suitably equipped to drive along this changing surface.

If vehicle access was to remain the south end of the beach is considered a safer area to launch boats in Port Waikato with the northern spit and river mouth being of higher risk.

### **Pedestrian access to the beach**

Recent erosion has limited pedestrian access from the existing car park to the beach. Stakeholders would like to see safe access ways reinstated, helping to separate pedestrians from vehicle access ways.

It was noted that wherever access is more formalised beach goers will frequent and congregate in these areas and usually swim close to access ways, especially where car parking is nearby. Currently having the main public access and parking area at the southern end of the beach is preferable as the headland can provide shelter during larger swells and is sometimes safer for swimming than the more open areas of the beach.

### **Parking is important**

Stakeholders would like to have good car park facilities to facilitate easy access to the beach for the local community and visitors. The loss of car parks within the main car park due to erosion has resulted in overspill of parked cars along road corridors. Trailer parking is also seen as important with limited spaces currently available. Trailers are parked in areas that take up further parking or restrict access for other vehicles to access the beach.

Stakeholders are expecting a growth in numbers of beach goers due to the nearby towns of Pukekohe, Tuakau and Pokeno growing over recent years. The number of parks required is expected to grow or parking issues are expected to get worse if further parking is not provided and access ways are not clearly defined.

It was noted by a number of stakeholders that there is a lot of wasted land around the Maunsell Road / Centreway Road intersection that includes a painted roundabout. This includes the 'drive by' access to recycling facilities. While the recycling area is seen as positive there is the potential to provide further space for parking with a reallocation of this space in the future.

### **Protection of Land use and infrastructure**

Stakeholders agree that protecting the availability of land for necessary public facilities is important however many also agree that these facilities don't necessarily need to be located directly next to the beach.

Having the surf life saving observation tower in a location where surf life guards can see the length of the beach is important but having the club lodgings and gear shed within 50m of the beach is not imperative with the availability of quad bikes to transport gear for patrols. Car

parking for beach goers is also important and having formal access to the beach to direct beach goers is useful but this can be set back further from the beach front if formal accesses can be provided.

Stakeholders acknowledged that the public ablution block is well used during summer months due to its location next to the public parking and vicinity to the beach.

There is a possible change to curb side recycling in the future and therefore it not expected that moving the recycling facilities in the meantime will be supported due to unnecessary costs involved. The high profile of the refuse area for the township is considered by some to be important as the placement in a high use area is considered to further promote its use.

The community hall was once part of the surf lifesaving facilities and was gifted to the community for use. This asset is also well used by the community however nobody GHD spoke to considered it imperative that the hall continue to be located so close to the shore line, with a number of alternative locations suggested including next to the existing library or rugby club.

Stakeholders all agreed that while this work is primarily aimed at protecting public assets, any changes to the public spaces needs to also take into account any effects on the adjacent private properties.

### **Cultural and Historical context of the area**

There is a strong presence of Maori history in the area, with all stakeholders acknowledging the importance of cultural heritage when looking at options. Preservation and continued protection of historical features within the surrounding area such as middens, walkways, burial sites along the beach (for whales and human remains) is important. Using plants and vegetation that is native to the area will also help to preserve links to the community's history.

### **Protection of the Natural Environment and Amenity Values**

Port Waikato is described by stakeholders as a wild natural environment that is important to the community. The falling debris, construction material deposits and pollution on the beach are contributing to a negative experience for beach goers and detracting from this.

Stakeholders are aware that walking and driving over the natural dune system and dune vegetation is negatively affecting the dunes and exacerbating the erosion issues. Stakeholders were aware of efforts to reinstate natural dune systems for coastal protection and many highlighted the importance of the dunes in the context of 'making Port Waikato special and beautiful'.

Stakeholders raised concerns about rubbish on the beach and in the sand dunes. Some areas of the dunes have previously been used as dumping areas. A fire in the dunes once uncovered a large amount of non-biodegradable rubbish including a car wreck. This dumping has effects on the flora and fauna in the area and restricting dumping is seen as important to the community. The community has held community working days for collecting rubbish in the dunes which have been successful.

### **Acknowledging the potential Future Growth of the area**

Supplying car parking for the further increase in beach goers and residents and further areas of recreation for visitors will be important as nearby towns grow and their residents keep visiting this beach. While there is a small resident population, the town population grows significantly during the summer months and it is important to protect and supply areas for community and business use which help to ensure the vitality of the town during quieter seasons. Stakeholders are working with the Council to develop the new district plan and other planning documents for the area. It is therefore important that any options acknowledge the local and wider planning and iwi management plans to ensure any development is in line with these.

# 5. Options

This section sets out options in response to erosion at Sunset Beach. Estimated costs for each option are presented. The impact of each option are presented including recommendations for suitable options for the high energy wave environment of Sunset Beach.

Many examples of previous attempts to deal with coastal erosion are available, with varying levels of success. New Zealand Civil Defence has investigated coastal erosion and options to address this risk including defend options (structural protection and beach nourishment); adapt options (dune planting and changes to use); retreating and doing nothing. These and other examples have been drawn on to help provide context to each option or when ruling out options for Sunset Beach.

## 5.1 Assumptions

In a high energy wave and longshore current environment there are many risk factors that could significantly alter the viability of each option. As such the following assumptions and considerations have been made:

- Sunset Beach is a changing environment with periods of erosion and accretion continuing to affect the area. Recent trends, as shown in Figure 7, indicate that the beach is eroding at a rate of 2 to 5m per year. The erosion rates presented in this report are based on available information. No additional monitoring or surveys have been undertaken. It is recommended that ongoing monitoring is undertaken to establish more definitive trends and monitor the impact of any measures put in place.
- Erosion is affecting the entire spit at Port Waikato and any solution should acknowledge potential impact on the wider environment.
- At any time Port Waikato could experience a major storm event (e.g. a greater than 1 in a 100 year event). Common practice is to design and build for a 1 in 100 year flood event as a guide for minimum floor levels. There is not sufficient information and certainty available to futureproof any options for this type of event.
- No wave or offshore modelling has been undertaken. Detailed modelling and information gathering is recommended before any investment is made on options to defend (e.g. sea walls) the existing shoreline to ensure the predicted rise in sea level and expected increased storm swells will be adequately designed for.

## 5.2 Short term option for car parking

Options for car parking over the summer period have been presented to the Onewhero-Tuakau Community Board meeting in early November 2014. An option for approximately 50 car parks has been agreed, with works being undertaken as soon as possible. Drawings for the approved option are included in Appendix A.

The short term option proposes to reconfigure existing car parking and loading in the current location at the southern end of Sunset beach, adjacent to the Community Hall and Surf Life Saving facilities, to provide for more car parks and access for vehicles through the car park to reduce congestion.

## 5.3 Option 1 - Do Nothing (Not Recommended)

This option involves no further changes after the initial implementation of short term options proposed to Waikato District Council in November 2014.

The 'do nothing' approach assumes that assets are left to fall into the sea. This approach is often unacceptable to the individuals and communities involved and can create further risks with debris in the water and on the beach.

While no works will be undertaken there are risks and associated costs involved in 'doing nothing' namely the possible loss of further public amenities and buildings. Further unmitigated erosion may result in the loss of the surf lifesaving tower, community hall, car parking area, vehicle and pedestrian beach access and existing underground services. Wider spread effects also include the loss of private beach front land and natural habitat for local fauna and flora.

This option is expected to cost in order of \$2 million. Costs of doing nothing are generally higher than a planned retreat as a planned retreat can take advantage of early land purchases or protect existing council owned land from other development that would restrict future use. Emergency works to relocate facilities typically costs more than planned works.

Doing nothing is not recommended. The minimum action recommended would include:

- a) Removing existing debris from the beach.
- b) Remove hard surfaces that are at immediate risk of being eroded and becoming a safety risk. At least 2 meters of car park surface is recommended, although this may only be a short term solution.
- c) Move the surf live saving tower to a position outside of the identified zone of risk, for example moving the tower behind the existing car park and next to the existing surf lifesaving club.

#### 5.4 Option 2 – Defend (Not Recommended)

Option 2 is to defend the land with a sea bank or wall. A number of other options were also considered in the defend scenario, including beach nourishment, breakwaters and groins but were not considered to be suitable or economically viable for a high energy environment like Sunset Beach (see Appendix B for further discussion on this).

Bank protection such as block walls, gabion baskets or geotextile barriers do not control surf zone, currents or longshore drift. They are designed to armour the beach to dissipate the incoming wave energy. Construction of a 90 meter bank revetment (see figures 13 & 14) using rocks supplied from a local quarry is estimated at \$900,000 to \$1 million. This is made up of:

- \$760,000 to supply, transport and install 3200 tons or 1600m<sup>3</sup> of rocks.
- \$39,000 for 1300m<sup>2</sup> of geotextile for reinforcing
- \$64,000 for excavation and preparation costs (800m<sup>3</sup>)
- \$90,000 design and consenting

Alternative materials such as a non-biodegradable geo textile reinforcement can provide a bank that can be vegetated (see figure 15). Most plant types can be integrated into such a system and can provide further reinforcement to a natural dune system while allowing native plants to also catch windblown sand and accrete sand over time. The cost of a geotextile bank is estimated by RST Solutions (2014) to be \$600 per square meter. The total cost for a 360m<sup>2</sup> bank at Sunset Beach would be \$220,000 for the wall and a further \$124,000 for excavation, preparation and consenting (total estimate between \$400,000 to 600,000). Whilst the overall cost of using geotextile is less, geotextile has not been used in the New Zealand in the coastal environment using native dune vegetation. To date geotextile has only been used successfully along river beds with grass and other soil grown plants.

Bank revetments of this type would not control ongoing erosion to the north or south of the car park and immediate community assets. As a result this might only be a temporary measure as



any further erosion to the north or south of the proposed structure would eventually cut into and erode behind the structure. The alternative is to wall the entire spit which is not considered to be practical or economically viable as this would require a wall of approximately 3km (the above costs are for a wall of only 90m) that would also be affected by the entrance to the Waikato River.

While sea walls are sometimes necessary in order to protect land, they are not generally promoted within local and national planning policies and plans due to their potential effects on surrounding environments, detraction from the natural environment systems and high costs for implementation and renewal. For the reasons outlined above, Option 2 – Defend, is not recommended.

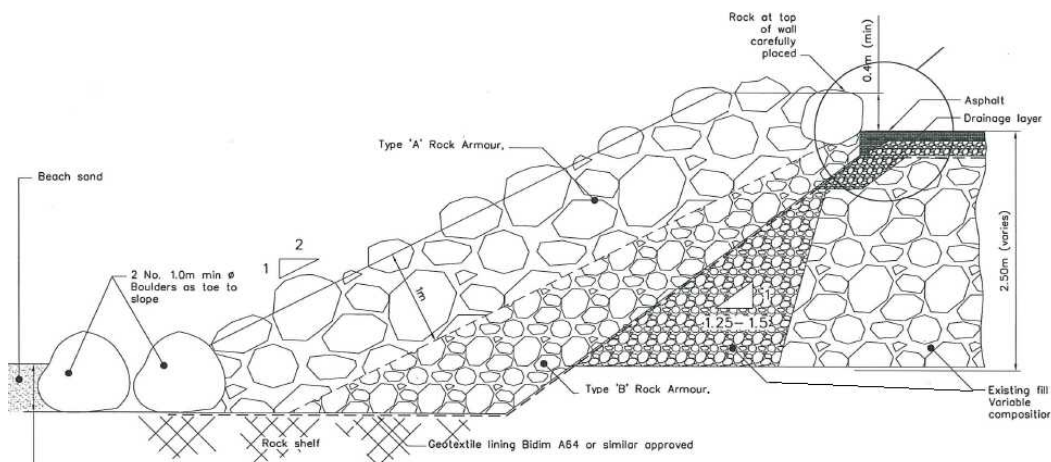


Figure 13: Profile of rock wall design (Source: Previous project by GHD)



Figure 14: Plan view of potential rock wall location

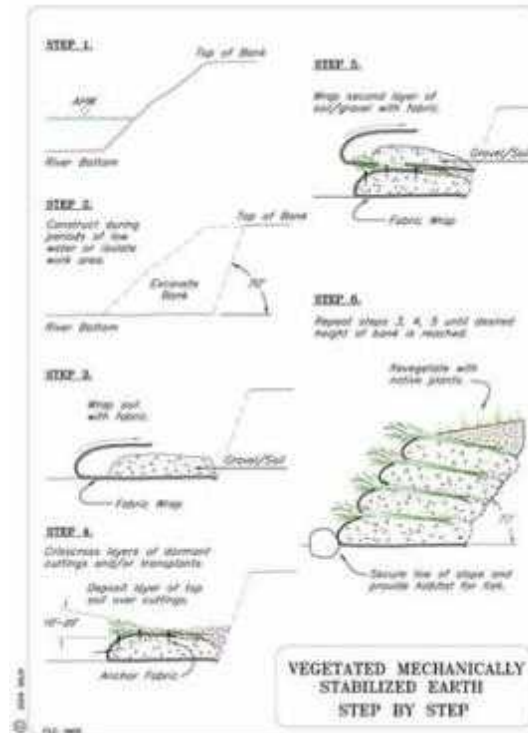


Figure 15: Wall design using geo fabric (Source: RST Solutions 2014)

### 5.5 Option 3 – Adapt (Recommended alongside option 4)

Option 3 is to remove existing car park and fill materials that could potential contaminate the beach and restore the risk zone back to a natural dune system. Dunes are a natural store of sediment, providing a buffer between the sea and land. Dunes naturally erode and accrete over time. And whilst there is no guarantee that a dune system will offer long term protection of community assets or housing, the importance of natural dunes for protection is becoming more recognised (see examples below). An appropriately vegetated dune system will naturally bind, capture sand and build. The key ingredients to a functioning dune are sand and the right dune species. Any foreign fill or dirt will encourage weeds or other forms of vegetation that are not suited to capturing and binding sand.

Implementation of a dune restoration project in front of the car park area and surf lifesaving tower will provide a natural buffer against wave action. However, any dune system is at risk of erosion from high energy storm events. It is noted that this has been attempted previously at Port Waikato at the top of the bank to the lower car park in 2008 (see Figure 6) and was unsuccessful in establishing a strong dune. While GHD is unable to comment on the exact factors that contributed to this particular failure of dune restoration, generally high winds and periods of erosion are an ongoing challenge to establishing a vegetated system and maintenance and secondary plantings should be planned for. Moreover foreign fill such as that present in the car park will hinder the ability of the sand dunes to establish as dune plants have to compete with other plants and weeds.

To give this option the best chance of success it is recommended that seaward side of the lower car park remains in place whilst a back dune system is established. This will give the planting time to establish with protection from immediate erosion from the remaining portion of the car park. The dune restatement could be staged over time starting in the lower car park area with the option to move back into the upper car park as required (see figure 16). Protection of the planted dune from damage, further maintenance and continued monitoring and replanting will

be necessary to ensure the dunes have the best chance to fully establish and continue to regenerate after periods of erosion should these areas be effected.

New Zealand native, salt-tolerant species that have a proven sand accretion effect such as Spinifex and Pingao should be used. Fill from the car park will have to be excavated and replaced with sand.

While vehicles including motorbikes will still be able to access the beach from the southern vehicle access and at Ocean View Road they should be restricted to specified paths within the dune systems as they potentially enhance the erosion process and prevent the establishment of dune plants. It is recommended that the vehicle and pedestrian accessed be formalised with flexible dune ramps (see Figure 16) with wooden railings along the edges of these to prevent pedestrians and vehicles damaging the dunes and restricting pedestrians from walking along the sides of these ramps in the dunes. Wood ramps do require ongoing maintenance so would not be recommended for single use pedestrian access. Pedestrian routes should be sand based with vegetated walls oriented at an 45 to 90 degree angle from predominant winds are recommended as to reduce the risk of 'blow out' from wind erosion. The location of these potential access ways are shown on Figure 18.

A new pedestrian access may require access over Department of Conservation (DOC) land. Furthermore the removal of fill is likely to require consent due to the extent of earthworks within the coastal environment and access over protected DOC land.

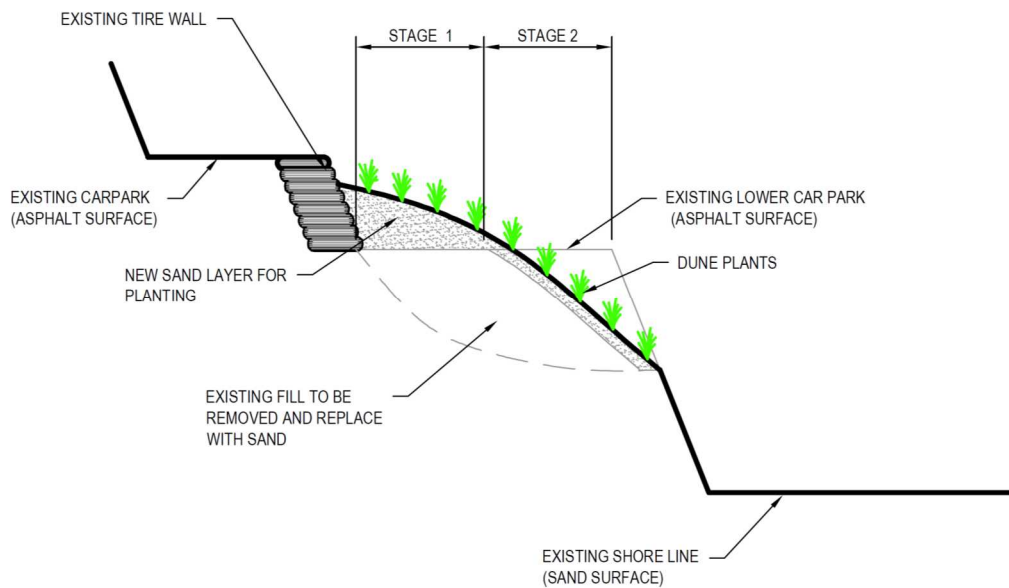


Figure 16: Potential flexible vehicle or pedestrian dune ramp

The existing stormwater outlet at the base of the lower car park is recommended to be moved in this option. Investigations of the stormwater pipe show this pipe is still in use (see Figure 18) however it is in a damaged state. In its current location it may become a focal point for wave energy and exacerbate erosion in this area with the new dune planting. Moreover, as the pipe was once connected through to the stream to the south of the car park (Council records cannot confirm if this is currently the case) this outlet acted as one stream of outflowing water during rain events. It is recommended to divert the stormwater from the remaining upper car park so that this can flow with the natural stream to the south of the car park and vehicle access at one location. This will reduce the effect this stream and stormwater flows have on the adjacent vehicle access.

Initial cost estimates for planting of the lower car park area over a length of 90m is calculated at \$250,000 including removal and disposal of existing surfaces, sand replenishment, allowance for paths, planting foredune and back dune plants, plant delivery, fertiliser, and planting labour. A period of intense maintenance of the dune system would be required for the first 18 months whilst the system gets established with ongoing monitoring and maintenance each year. Much

of the monitoring and maintenance can be undertaken by local volunteer initiatives which will help to reduce costs with further investment required for further plants and upgrading paths.



**Figure 17: Potential dune establishment option**

Examples of successful dune revegetation can be seen at Papamoa Beach and Mount Maunganui on the east coast in the Bay of Plenty.

Papamoa was suffering coastal erosion in 1995 that was threatening to adversely affect the viability of the Surf Life Saving Club and adjacent reserve. Planting of native dune species in 1995 and 1996, and redirecting casual pedestrians has reversed earlier, ongoing erosion problems. Sand supplied by natural processes is being accumulated by the colonising dune plants (i.e. Spinifex & Pingao), burying fences, dramatically improving the dune buffer and beach width. The location was reassessed in June 2012 and the area has accreted more than 80cm (vertically) of new sand since 2008 and is now 15m wider than the area planted in 1995<sup>4</sup>. What's more, according to modelling undertaken by Greg Jenks and Dr Peter Kouwenhoven, this dune planting is expected to off-set the serious effects of sea level rise of 2100 completely. The plants used are considered to be salt tolerant, sand-trapping and indigenous to New Zealand<sup>5</sup>.

In 1965 much of the natural dune system at Mount Maunganui Beach in the Bay of Plenty was destroyed by dune bulldozing, poor management and pedestrian use. In 2004 the fore dune was planted with New Zealand native, salt tolerant, sand trapping halophyte dune plants. This has resulted in a dune that is over 25m wider in 2014 than in 2004<sup>6</sup>.

Generally native vegetation is promoted by New Zealand coastal policies and plans. This option also acknowledges the communities desire to preserve or reinstate a more natural state at Sunset Beach where possible.

Option 3 – Adapt is recommended as an option to be considered alongside option 4 (below). Remediating the lower carpark (and if required the upper carpark over time) will also remove foreign fill and car park material that is currently contaminating and introducing hazards to the beach area used by public.

<sup>4</sup> Dune Restoration, Greg Jenks and Dr Peter Kouwenhoven, CLIMsystems, Hamilton, New Zealand

<sup>5</sup> Dune Transformation and Climate Change: Greg Jenks, Coastal Restoration Specialist, CLIMsystems Associate, International Global Change Institute foundation member.

<sup>6</sup> Greg Jenks, Coastal Restoration Specialist, Presentation material April 2014



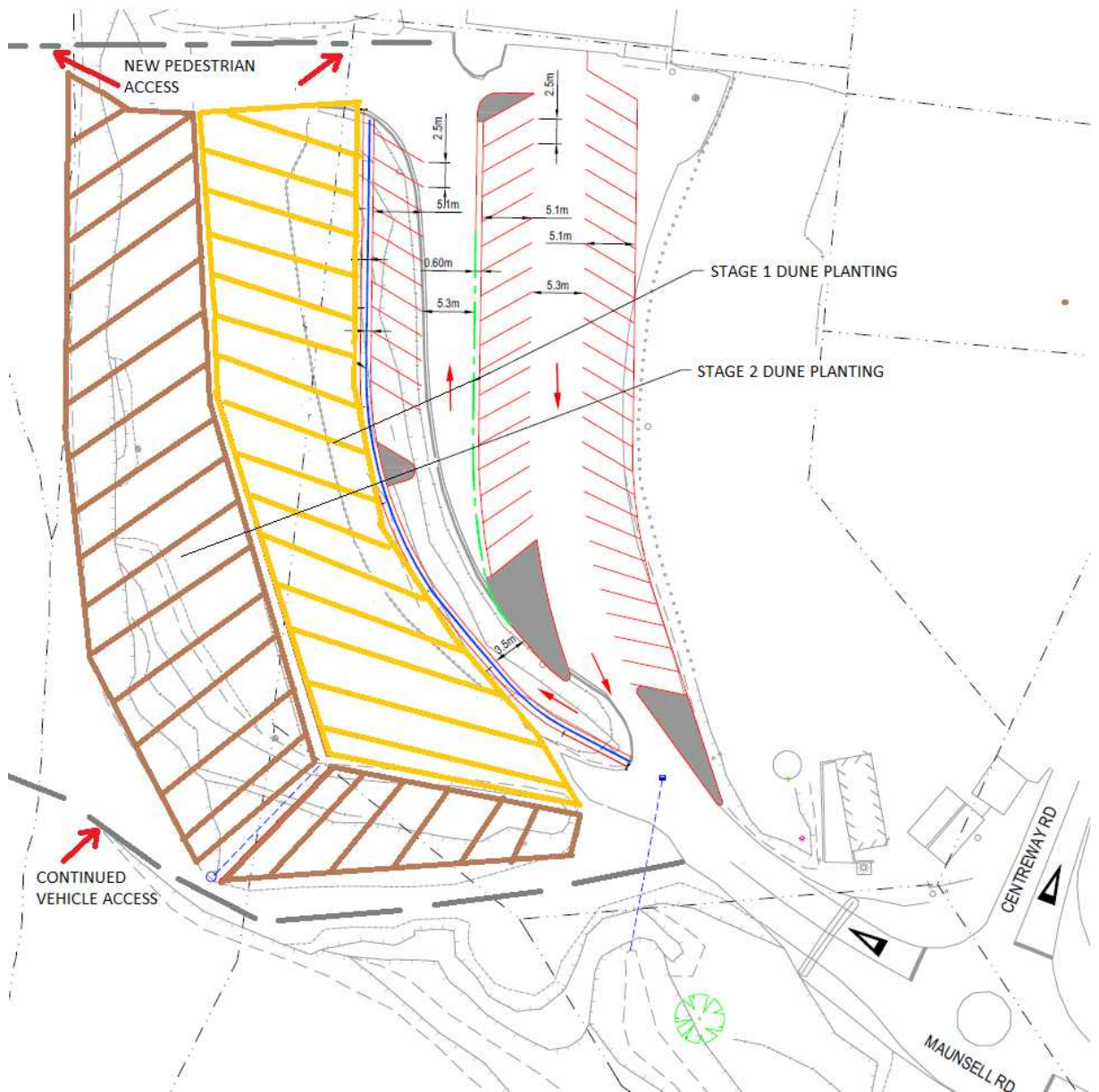


Figure 18: Short term option for car parking with Dune planting

Diagram shows staged dune planting of the closed lower car park and pedestrian and vehicle access through the proposed dune revegetation. It is proposed to first remediate the lower carpark in two stages. Further remediation of the upper carpark may also be required over time.

## 5.6 Option 4 – Retreat (Recommended)

Option 4 is to retreat, by moving the car park and community facilities to a location outside of the identified hazard zone. Four alternative locations have been reviewed (see Figure 18):

- a) Back from the existing location, requiring the purchase of numbers 1 and 3 Centreway Road (Option a on Figure 19).
- b) Council land adjacent to number 39 Ocean View Road (Option b on Figure 19).
- c) The area adjacent to and including the rugby club on the main road into Port Waikato and Sunset Beach along Tuakau Bridge-Port Waikato Rd (Option c on Figure 19).

d) Adjacent to 19 Cordyline Road (Option d on Figure 19) was also considered and has been scoped to accommodate the community hall.

The rugby park and Cordyline Road were quickly dismissed as options to locate car parking due to distance from the Beach.



Figure 19: Map of Port Waikato indicating retreat locations reviewed

### Centreway Road

To maintain access to the beach at the current location number's 1 and 3 Centreway Road would be required to be purchased by Council. This would enable the area to be redeveloped as a car park. Depending on the configuration chosen and whether Centreway Road continued



to operate as a through road then between 60 and 70 car parks could be constructed in this area (Figure 20). In this option it is proposed that the surf club would remain with the option to move the tower behind the existing upper car park if required. The community hall would be moved into the new car park area or to an alternative location e.g. adjacent to Cordyline Road.

Cost estimates for this option are between \$900,000 and \$1.5 million that include removal/demolition of at risk buildings; earthworks and removal of paving, inclusion of foundations and underground services where necessary; purchase of land for provided space for public amenity (the current CV for the purchase of land is approximately \$500,000); design, consenting and construction of infrastructure and buildings in new locations.

The advantages of this option include:

- Moves all community assets outside of the suggested hazard area.
- Increased numbers of car parks in the interim if combined with the existing upper car park. This would create up to 68 new car parks available to cope with expected increases in visitor numbers.
- The surf lifesaving club could remain in its current position, with the option of relocating the tower as required.
- The further option to close Centreway Road to through traffic would create room for additional car parks or commercial properties.
- Parking remains close to the preferred location for launching of boats and swimming.

### **Ocean View Road**

39 Ocean View Road, an area currently owned by Council provides an alternative location that could accommodate 107 car parks alongside the surf club (see Figure 21). In this scenario the community hall is also relocated to the site adjacent to 19 Cordyline Road. Should this location be considered it is recommended that the surf club should also move to support this location and the current location and beach access closed. Views received from stakeholders strongly support only having one main access point to the beach to ensure recreational users are only located in one area of the beach to support surf patrols.

Moving to the northern Council owned site and developing this for car parking and as a public area is expected to have similar costs to the Centreway Road option. While the site is already owned by Council this area is completely untouched and would require further work to make accessible of public parking and amenities. As pedestrian access would cross Department of Conservation land discussions and consent would be required before confirming this option. It is recommended in this option that vehicle access to the beach remain in its current location due to the step grade of the sand dunes that would otherwise require flattening to gain adequate vehicle access, thus reducing the protection these dunes currently afford the site.

Relocating the access to the north will:

- Move all community assets further outside of the predicted hazard area.
- Increase the amount of car parking available to approximately 107 car parks.
- Allow for the opportunity to separate public and private vehicle access to the beach.
- The tower location for the surf patrol could be moved or retained depending on the needs of the surf life saving club to do their duties and the integrity of the dunes.
- Assumes the community hall is moved to Cordyline Road or combined with the Surf Live Saving club.



Figure 20: Options for car parking at 1-3 Centerway Road





Figure 21: Proposed layout for Ocean View Road



Figure 22: Photo of the potential site at 39 Ocean View Road

Generally the current planning framework supports set-backs from the coast as the best way to reduce risk from coastal inundation and erosion in undeveloped areas. This represents a shift away from managing beaches to managing human activity.

Retreat has been used as an option at Muriwai Beach on the west coast north of Port Waikato. Auckland Regional Council and Rodney District Council were involved in a participatory coastal management process at Muriwai Beach where public buildings and parking facilities were threatened by erosion. This led the community working towards options to retreat. After more than a decade of negotiations amongst the community, and with the councils, the relocation of the surf-lifesaving building back from the coastline was agreed upon and parts of the previous car parking area was reinstated as dunes.

Muriwai combined retreat with revitalisation of the dune system with signs asking people to use walkways rather than walk over the dunes. With funds from an Environment Initiatives grant and local fundraising efforts the community planted spinifex plants as part of the restoration efforts.

Option 4 – Retreat is recommended alongside option 3. It is recommended that purchasing properties on Centreway Road be considered for future community use and growth to accommodate the predicted rise in visitor numbers alongside growth and development in the region.

# 6. Options Analysis

This section reviews options against multiple criteria identified during stakeholder discussions, costs and planning requirements.

## 6.1 Development of Analysis Method

As a way to assess these options a set of criteria have been developed, informed by the discussions held with stakeholders. This form of analysis is called Multi Criteria Analysis. Within Multi Criteria Analysis all the options are assessed against the various criteria and given a rating of Red, Amber or Green with Red being a negative outcome and Green being a positive outcome. This gives the decisions makers the opportunity to see the effect each option will have on each criteria individually and overall.

The discussions with stakeholders have brought through a number of criteria that are highly valued by the community. These have been included alongside cost, planning considerations, constructability and ongoing sustainability of the design.

The planning framework in which the options will be assessed is centred on the following documents:

- The New Zealand Coastal Policy Statement (NZCPS)
- New Zealand Foreshore and Seabed Act
- The Waikato Regional Coastal Policy Statement
- The Waikato District Plan
- Iwi Management Plans

Relevant details of each have been provided in Appendix C. In summary the current planning framework contains the above documents that provide guidance to dealing with coastal erosion. Generally the current planning framework supports set-backs from the coast as the best way to reduce risk from coastal inundation and erosion in undeveloped areas. This represents a shift away from managing beaches to managing human activity.

<b>Key to Multi Criteria Analysis (Table 1)</b>
Mostly negative effects - Not Viable
Some positive and some Negative effects - Maybe Viable
Positive effects - Recommended Option

**Table 1 Multi Criteria Analysis**

Criteria	Do Nothing	Defend	Adapt	Retreat
Safety of beach goers	Continued erosion of car park with debris left on the beach. Trip/fall hazards on beach and in car park.  Continued location at the safer end of the beach.	Removes risk of falling debris.  Changes hard infrastructure has the potential to change beach dynamics and currents for swimmers.	Removing risk of falling debris.	Moves surveillance area for lifeguards as people will take shortest distance to beach to swim and potentially splits main surveillance area into two.
Access to beach by all	Hazardous for pedestrian and vehicle access. Potential loss of access with erosion.	Beach access can be designed into structures.	Designs of access can allow continued access however risks of further erosion may further limit access for some.	Access can be designed, consideration of distance to beach impacts some options
Parking for all beach users	Further car parking is at risk of being lost to further erosion.	Car parking will be provided however no allowance made for possible future increase in demand.	Car parking will be provided however no allowance made for possible future increase in demand.	Further car parking can be provided to accommodate growth.
Protection of land use and infrastructure	Loss of existing infrastructure imminent.	Solid protection of existing infrastructure.	Soft protection of existing infrastructure. Risks of further erosion and potential loss.	Provision of new infrastructure to be incorporated.
Protection of the natural environment	Potential for further contamination of beach environment from failing infrastructure.	High level of human intervention. Loss of further natural environment for all options except geotextile retaining as this will present a natural façade.	Provides a natural buffer with native planting. Minimal intervention with natural processes. Options to retain or remove public vehicle access	Would still need to manage existing assets to manage potential for beach contamination from falling objects.
Impact on amenity values	Views of lost infrastructure and potentially buildings, on top of loss of public amenity space could adversely affect amenity values held dear to some.	Loss of rugged natural coast line and natural zone for beach use	Increase natural amenity after initial planting. Protection of highly held rugged west coast amenity feel.	Changes in site location can be designed so that more natural elements can be preserved in surrounding areas.



Criteria	Do Nothing	Defend	Adapt	Retreat
Impact on cultural and heritage values	Loss of buildings and small pieces of history of the town.	Potential for further disturbing sites of significance to the community.	Natural mitigation and soft landscaping expected to have less than minor effect on the heritage values of the area.	Potential loss of buildings and small pieces of history of the town if buildings need to be relocated or replaced.
Acknowledging the Future Growth of the Area	Loss of existing car parking and other public infrastructure that is already nearing capacity.	Existing car parking will be provided. No plans for further allocation of space for increases in visitor population.	Existing car parking will be provided. No plans for further allocation of space for increases in visitor population. Potential for further loss of parking.	Potential to future proof new location of public infrastructure.
Alignment with Planning Framework	Policies support allowing nature to take its course however the potential for gross pollutants from failing infrastructure and buildings is detrimental to the coastal environment and therefore against the purpose of the policies. No resource consents required until removal is necessary.	Policies do not support these sorts of human interventions for many reasons. Regional resource consent would be required for new structures in the coastal environment and for earthworks within the coastal environment and potential discharge to the sea.	Policies support natural protection against coastal erosion. Regional consent may be required for earthworks to remove fill along the coast when reverting the existing site back to natural dunes. Removal of structures in the coastal area is a permitted activity under the Regional Coastal Plan.	Policies support allowing natural systems to take their course with little intervention from humans. District resource consent would be required for activities to occur within 1000m of Mean High water springs. Regional resource consent would be required for earthworks within the coastal environment. Introduction of indigenous plant species is a permitted activity under the Regional Coastal Plan.
Likelihood of protecting existing assets	Would continue to loose assets.	Would protect immediate assets for a time. Would eventually undermine or go around if current rate of erosion continued.	This provides little opposition against continued erosion at current rates.	Moving outside identified hazard zone so assets protected
Cost*	Greater than \$2 million	\$900,000 to 1 million	\$250,000 for the lower car park area only	\$900,000 to \$1.5 million

Criteria	Do Nothing	Defend	Adapt	Retreat
Constructability and lifetime	No construction requirements. Buildings may survive in current locations depending on erosion.	Design and engineering is required to build any of these options. While these options have been tested at other locations around the world there are still risks due to the high energy waves at Port Waikato and potential for failure over time. Design life can be upwards of 50 years however longer lifetimes will result in higher design and build costs.	Initial works require experts however community can be involved in carrying out this option. Potential for ongoing maintenance or re-planting if coastal erosion continues. Potential that the entire dune system may fail if storm events and coastal erosion continue.	New sites further from at risk areas allow for better long term viability. Clean slate sites allow for constructability.
Ongoing maintenance costs	Cost to manage hazards e.g. contamination of beach from debris. Future cost to provide facilities.	Continued monitoring required. Large maintenance/replacement costs at end of life.	Will require ongoing maintenance of vegetation and access ways to the beach.	Maintenance required of remedial options for the dune system. Similar maintenance costs as current location with reduced risk of loss of infrastructure.
Wider effects and long term effects	Potential for large adverse effects long term in regards to loss of infrastructure, land and private buildings.	Impact on areas outside of the wall expected.	Best case scenarios involved coastal accretion. Worst case scenarios include further loss of land.	Purpose built site that can accommodate adequate long term risks and infrastructure.
<b>Overall</b>	<b>Not Recommended</b>	<b>Not Recommended</b>	<b>Recommended short term solution alongside Retreat</b>	<b>Recommended long term solution</b>

\* Costs are approximated based on available information. Detailed economic analyses of cost including opportunity costs to the community have not been undertaken. A detailed social, environmental and economic impact assessment would be recommended before investing in any options.

## 7. Recommendations

Future proofing the Port Waikato area will be important in the event that significant erosion continues. More work is suggested to confirm the area of hazard, but if recent trends persist community and private assets within 20 to 50 meters of the current shoreline are at risk.

Ultimately retreat will be the most appropriate option should erosion continue at the rates witnessed over the last 6 years. It is recommended that the Port Waikato Community and Waikato District Council plan for retreat of the car park, surf lifesaving tower and community hall. A number of options for retreat have been presented in this report. This retreat should be undertaken alongside option 3 to convert the lower car park to a natural system so that this dune system might provide and grow a natural store of sediment over time.

It is the recommendation of this report that purchasing properties on Centreway Road be considered for future community use and growth to accommodate the predicted rise in visitor numbers alongside growth and development in the region.

Planning and saving for retreat could take some time. It could also be anywhere between 6 and 50 years before full retreat is required from the top car park and community building when looking at current trends and previous reports on the predicted erosion rates. In the interim it is recommended that the lower car park is reverted back to a natural dune system to help to provide a natural barrier between the sea and the upper car park. A proposed approach to revert this area back to dunes and cost has been presented. This should include removing the stormwater culvert below the southern extent of the lower car park, formalising the vehicle access and creating a separate pedestrian access along the northern edge of the car park that restricts access to the dune areas. The lifetime of the dune system is highly changeable with risks of failure due to potential for continued erosion and storm events. For this reason this adapt option is recommended in conjunction with preparing for retreat.

The upper car park can remain in place whilst efforts to maintain a functional natural dune system are monitored. Reverting the upper car park to dunes may have to be undertaken in the future should erosion continue.

***Sunset Beach a changing environment with periods of erosion and accretion continuing to affect the area. The estimations and recommendations contained within this report are based on available information. No additional monitoring or surveying have been undertaken. It is recommend that ongoing monitoring is undertaken to establish more definitive trends over time and to monitor the impact of any measures put in place. It is also recommended that geotech investigations are undertaken to establish the exact nature of bed rock material available for longer term protection.***

A number of short term immediate actions are also recommended regardless of the option chosen to take forward. These include:

- Keep the lower car park closed for vehicle access.
- Removal of car park debris and fill from the beach and surf zone to remove this safety risk from recreational users.
- Removal of the culvert and relocation of the storm water pipe when undertaking remedial works or when seeking to reinstate the dune system to divert into the stream or other more eastern outlet.
- Include some form of reinforcing on the vehicle access way to provide a safer access way.

- Clearly define the access way with restriction to the ramp area to stop further areas of the dune system being damaged by vehicles.
- Separate the current access way into pedestrian and vehicle areas if space allows.
- Look at a more efficient use for the area currently occupied by waste and recycling facilities. This could include using some of this space for boat trailer parking.
- Provide clear parking bays for the area opposite the waste recycling facility and next to the green.
- Provide signage and formalise pedestrian walkways that also promote protection of the sand dunes from being walked over by the public along Sunset Beach.



## 8. References

- Blakett, Paula. (2010) Exploring the social context of coastal erosion
- Davis, M. and Meurk, C. (2001) *Protecting and restoring our natural heritage – a practical guide*. Department of Conservation, Christchurch.
- Dune Restoration Trust of New Zealand. (2014) *Technical Handbook Article No. 2.4 – succession and zonation on coastal sand dunes*.
- Dune Restoration Trust of New Zealand. (2014) *Technical Handbook Article No. 2.3 – Shoreline Changes at river and tidal entrances*.
- Dune Restoration Trust of New Zealand. (2014) *Technical Article No. 10.1 – Human Modification of New Zealand coastal dune ecosystems*.
- Environment Waikato. (2007). *West Coast Hazard Project*. Hamilton, New Zealand: Prepared by Tonkin and Taylor.
- Evans, B. (compiler) (1983) *The revegetation manual*. A guide to revegetation using New Zealand native plants. Queen Elizabeth II National Trust, Wellington.
- Jenks, Greg (2014) (*Various Presentations*) *The Good(ish), The Bad, the Ugly – And the contrasting Dune Management Options*.
- Jenks, Greg (2014) *Dune Transformation and Climate Change*.
- Liefiting, Rick. (2007). *Port Waikato Coastal Hazard Assessment*. Hamilton, New Zealand: Prepared by Tonkin and Taylor.
- Port Waikato Possible Coastal Inundation Extents. Map created by Waikato Regional Council.
- Ministry for the Environment (2014) Adapting to sea Level Rise. Website: <http://www.mfe.govt.nz/climate-change/adapting-climate-change/adapting-sea-level-rise>
- Ministry for the Environment (unknown date). *Coast Care Bay of Plenty Dune Restoration*.
- Officials' Committee for Domestic and External Security Coordination (2007). *National Hazards Scrape Report*. Officials' Committee for Domestic and External Security Coordination. Wellington New Zealand.
- Pollock, K.M. (1986) *Plant Materials, Handbook for Soil Conservation. Volume 3: Native Plants*. Water and Soil Miscellaneous Publication No. 95. Ministry of Work and Development. Wellington.
- Porteus, T. (1993) *Native forest restoration. A practical guide for Landowners*. Queen Elizabeth II National Trust. Wellington.
- RST Environmental Solutions website <http://www.rst.co.nz/retaining-walls.html>
- Surf Life Saving Northern Region (2014) *Patrolling Statistics*
- Tilsley, R. (2008) *Geotechnical Assessment Sunset Road, Port Waikato*, Mainframe Construction Limited. Tilsley Engineering. Pukekohe.
- Waikato Regional Council. (2013). *Port Waikato Sandspit*. Map created by Waikato Regional Council.

# Appendices

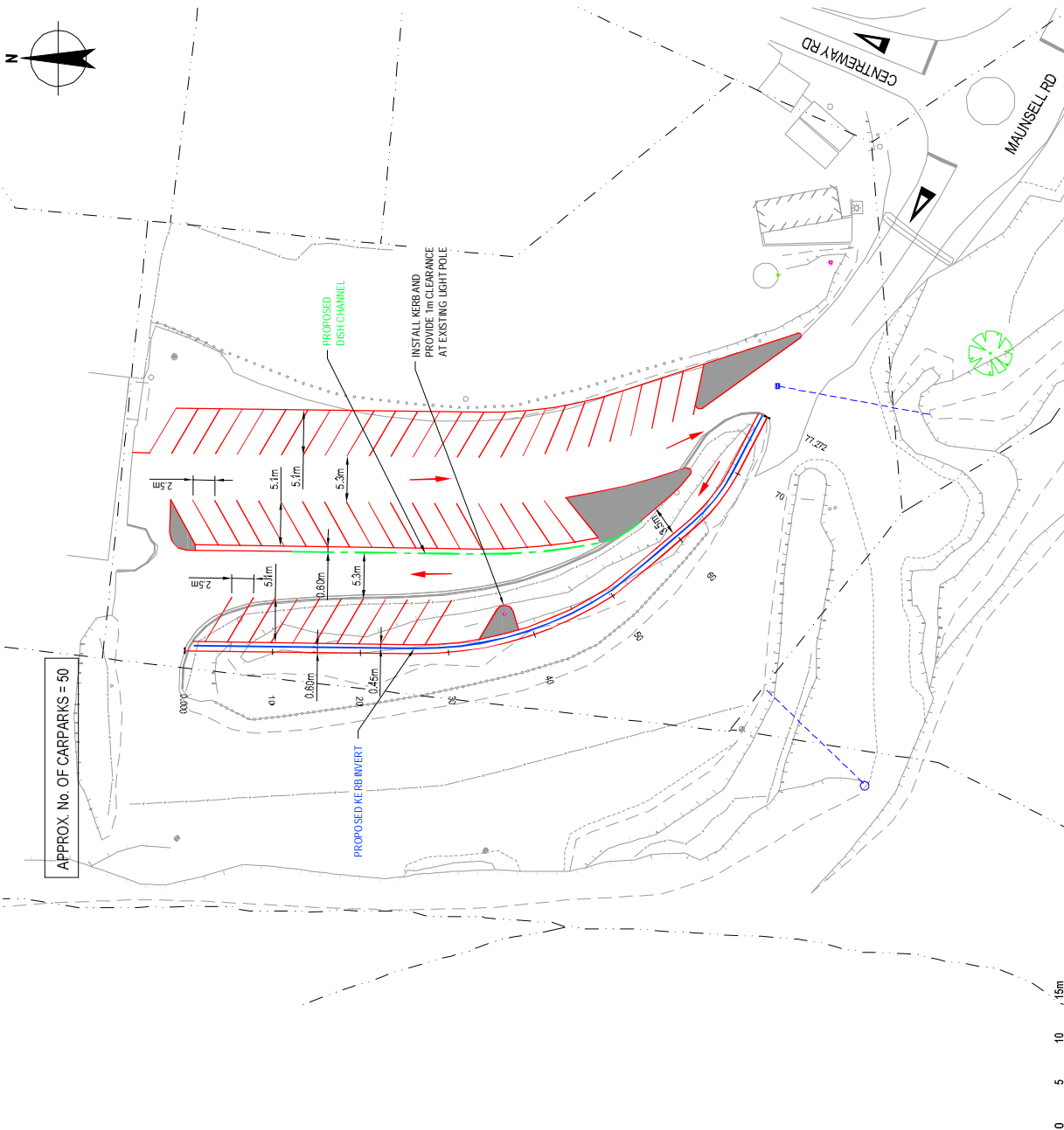
# Appendix A – Car park options for Summer 2014

**IMPORTANT SERVICES NOTE**

THE CONTRACTOR IS RESPONSIBLE FOR ENSURING ALL SERVICES ARE LOCATED/MARKED BY THE APPROPRIATE SERVICE AUTHORITY, OR THEIR OWN STAFF, PRIOR TO ANY SITE WORKS, AND FOR PROTECTING THESE SERVICES FOR THE DURATION OF THE SITE CONTRACT.

**GENERAL CONSTRUCTION NOTES**

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ALL WORKS INCLUDING SET OUT TO BE CONFIRMED WITH WAIKATO DISTRICT COUNCIL ENGINEER PRIOR TO CONSTRUCTION.
3. SURFACES WHICH LIE OUTSIDE THE GENERAL LIMITS OF WORKS AND WHICH ARE DISTURBED ARE TO BE RESTORED AT LEAST TO THEIR PRE-CONSTRUCTION CONDITION BY THE CONTRACTOR.
4. THE CONTRACTOR SHALL TAKE ALL MEASURES TO MINIMISE EROSION AND SEDIMENTATION DURING CONSTRUCTION.
5. CONTRACTOR TO PROVIDE TRAFFIC MANAGEMENT AT ALL TIMES FOR THE DURATION OF THE WORKS.
6. ALL WASTE MATERIAL IS TO BE DISPOSED OFF SITE AT THE CONTRACTOR'S EXPENSE TO AN APPROVED SITE.



<p><b>DO NOT SCALE</b></p> <p>GHD Limited This document may only be used by the client and any other person who has been authorised in writing for the purpose for which it was prepared and for no other purpose.</p>		<p><b>Client:</b> WAIKATO DISTRICT COUNCIL <b>Project:</b> PORT WAIKATO SUNSET BEACH CARPARK CARPARK LAYOUT OPTION D4</p>
<p><b>Drawn:</b> A. PORTERUS <b>Checked:</b> A. RAJAN <b>Approved:</b> L. MCCARTHY <b>Date:</b> 7/1/14</p>	<p><b>Designer:</b> J. UNSERWOOD <b>Design:</b> L. MCCARTHY <b>Project:</b> L. MCCARTHY <b>Date:</b> 7/1/14</p>	<p><b>Scale:</b> 1:500 <b>Sheet No.:</b> A3 <b>Drawing No.:</b> 51-32840-C101</p>
<p><b>Waikato DISTRICT COUNCIL</b></p> <p>Level 5, T.E.O. Building 148 Ararua Street, Hamilton, 3204 New Zealand E: terrym@ghd.com W: www.ghd.com</p>		<p><b>Revised:</b> 7 November 2014 - 12:21 pm <b>Drawn:</b> AKR <b>Project:</b> LM <b>Date:</b> 7/1/14</p>



## Appendix B – Additional ‘defence’ options considered but discounted.

Defend means putting measures in place to defend the existing position and assets. There are many coastal defence techniques that have been used. The most common options reviewed for Sunset Beach include beach nourishment, offshore breakwaters, groins and sea walls (or bank revetments).

Central government has not provided subsidies for structural protection of the coast since 1971 and local authorities only provide protection of public assets. Structural bank protection can be expensive to build and maintain and is therefore becoming a less desirable option for coastal erosion management (as noted in the National Hazardscape Report 2007). A sea wall built at St Clair beach in Dunedin was built in 2004 at the cost of \$5.7 million and replaced the existing 80-year-old sea wall. In Hastings a sea bank was built in 1976 to prevent further inundation, but erosion continued with 20 residents evacuating homes in 2002 as the shoreline continued to retreat by 0.3 to 0.7 metres each year.

Beach Nourishment, breakwaters and groins are not considered economically viable for Sunset Beach. Breakwaters and groins would also significantly alter the natural environment. Additional information is provided below on each option.

### B.1. Beach Nourishment

Berm nourishment or profile nourishment (figure 21) involves bringing in sand from external sources and placing either above or below the water line to provide a temporary net benefit in sand accumulation. Beach nourishment has been used with little success on low energy beaches like Orewa Beach, Mission Bay in Auckland and Oriental Parade in Wellington (National Hazardscape Report 2007). On a high energy beach like Sunset Beach this option is not considered to be not feasible. High energies, longshore drift and northerly currents would take and introduced sands out of the immediate catchment.



Figure 23: Diagram of Potential Beach nourishment at Port Waikato

### B.2. Offshore segmented offshore breakwaters

Segmented offshore breakwater structures (figure 22) can allow a constant portion of wave energy reaching the protected area. Breakwaters have been used in other parts of the world such as America and the UK and are typically used for marinas and lower energy beaches.

Segmented offshore breakwaters can be designed to allow the beach to accrete enough sediment to provide an erodible buffer during storms and still maintain the natural transport rates on and off shore during normal wave condition. The accretion however can have negative downstream effects with a lack of sand in the budget for the adjacent beaches and potential for further erosion in these areas.

The amount of wave energy reaching the beach is controlled by the width of the gap between breakwaters and the wave diffraction through the gaps. Offshore breakwaters need to be constructed at sea and due to the high energy waves at Sunset Beach the construction process would be complicated and extremely expensive.



Figure 24: Breakwater Example at Elmer, UK (courtesy of Wikipedia)

### B.3. T-Groins and Terminating T-Groins

The groins are structures designed to trap longshore drift for building a protective beach, slowing erosion of an existing beach and preventing longshore drift from reaching downstream point such as a harbor or inlet.

Since the longshore drift builds up on the updrift side of a groin, thereby creating a fillet. The downdrift side is deprived of the sediment and thereby usually causing erosion. For effective functioning of the groins system in reducing downstream adverse effect the groins are required to construct with reducing length and require beach nourishment on the terminating groin.

Construction will be easier for T-groins facilitating land base operations while its cost will be almost double that of offshore breakwaters. In terms of functionality both types of structures will achieve the same protection of the coast. Since the head structures are not located very far from the shoreline the tail arm of T-groins are not significant at all in producing diffracting effects.

T-groins have more downstream adverse effects than offshore breakwater as the T-groins restrict the movement of littoral drift causing erosion at the downstream. It is therefore required to extend the T-groins further in the downstream and will require protective measure such as beach nourishment at the down coast.

The aesthetic of the beach goes might also be hampered similar to offshore breakwater and it will be expensive for construction. Therefore, it may not be feasible for this beach.



Figure 25 : Diagram of Potential Groins at Port Waikato

# Appendix C – Planning framework considered when assessing options

## C.1. New Zealand Coastal Policy Statement (NZCPS);

On a national level the only mandatory guiding policy regarding natural coastal hazards is the New Zealand Coastal Policy Statement (NZCPS). A summary of the provisions is provided in Table 2 below.

Table 2 New Zealand Coastal Policy Statement – Relevant Sections

Section	Relevance to Natural Hazards
s8.7	Regard to be had to the susceptibility of the coastal environment to the effects of natural hazards.
Policy 3.2.1	Policy statements & plans should define what form of subdivision, use and development would be appropriate in the coastal environment, and where it would be appropriate.
Policy 3.2.2	Avoid adverse effects of subdivision, use or development in the coastal.
Policy 3.4.1	Identify areas in the coastal environment where natural hazards exist.
Policy 3.4.2	Recognise the possibility of a rise in sea level.
Policy 3.4.3	Recognise the ability of natural features to protect subdivision, use, or development.
Policy 3.4.4	Recognise that in relation to future subdivision, use and development, some natural features may migrate inland.
Policy 3.4.5	Locate and design new subdivision, use and development to avoid the need for hazard protection works.
Policy 3.4.6	Coastal protection works permitted only where they are the best option. <sup>7</sup>

The Resource Management Act 1991 requires any regional and district policies to be in line with the NZCPS. The NZCPS focuses on avoiding coastal hazards, avoiding the need for structural protection and promoting 'soft options' such as dune planting and restoration. The NZCPS also promotes a precautionary approach to activities within the coastal marine area especially where there is a lack of understanding of the potential effects of proposed activities or coastal processes.

As noted in the New Zealand Hazardscape report, the NZCPS was reviewed in 2004 for its ability to address coastal issues and effectiveness in proposing sustainable coastal hazard management. The report recommended that more specific coastal hazard policies to reinforce more sustainable coastal management.

<sup>7</sup> Tonkin and Taylor, 2007



## C.2. New Zealand Foreshore and Seabed Act

The Foreshore and Seabed Act 2004 says that:

- The Crown is the owner of the foreshore and seabed (except for the privately owned parts)
- The public has the right of access over the foreshore for recreation and over the foreshore and seabed for navigating boats
- Customary activities that people have been doing since 1840, were protected
- People who owned dry land next to the foreshore, and who had been using part of the foreshore and seabed since 1840 could claim territorial customary rights and apply to the Crown for redress.

Therefore the Foreshore and Seabed Act only gives a right of access for recreation. This right of access only applies to the area between mean high water springs and mean low water springs. Therefore any development would then require access over the Queens Chain or purchase of property in order to access the beach over dunes or beach-front from the end of a legal road to the mean high water springs mark.

## C.3. Waikato Regional Coastal Plan

Environment Waikato has an operative Regional Coastal Plan (WRCP) that contains objectives, policies and rules and other implementation methods that specifically address natural hazards within the coastal marine area (CMA). By law these are required to be in line with the New Zealand Coastal Policy Statement as discussed above.

Section 8.1 of the WRCP sets the objective to avoid and mitigate natural hazard risk to people and property and presents the following policies:

**Table 3 Waikato Regional Plan – Relevant Sections**

Section	Relevance to Natural Hazards
8.1.1	Identification and integrated management of hazard areas.
8.1.2	Adopt a precautionary approach in the assessment of coastal hazard risk.
8.1.3	Promote the protection of natural features that provide a buffer against natural hazards.
8.1.4	Ensure coastal erosion structures are necessary and avoid or mitigate any adverse effect on coastal processes and natural character.

## C.4. Waikato District Plan

The Waikato District Plan (WDP) also sets out specific objectives in relation to dealing with coastal erosion. Objective 5.2.1 of the WDP aims for risks from natural hazards to health, safety and property, resulting from use, development or protection of land, are minimised by implementing the following specific policies. These policies are also very much in line with the objectives of the NZCPS and aim to protect the natural environment as far as possible.

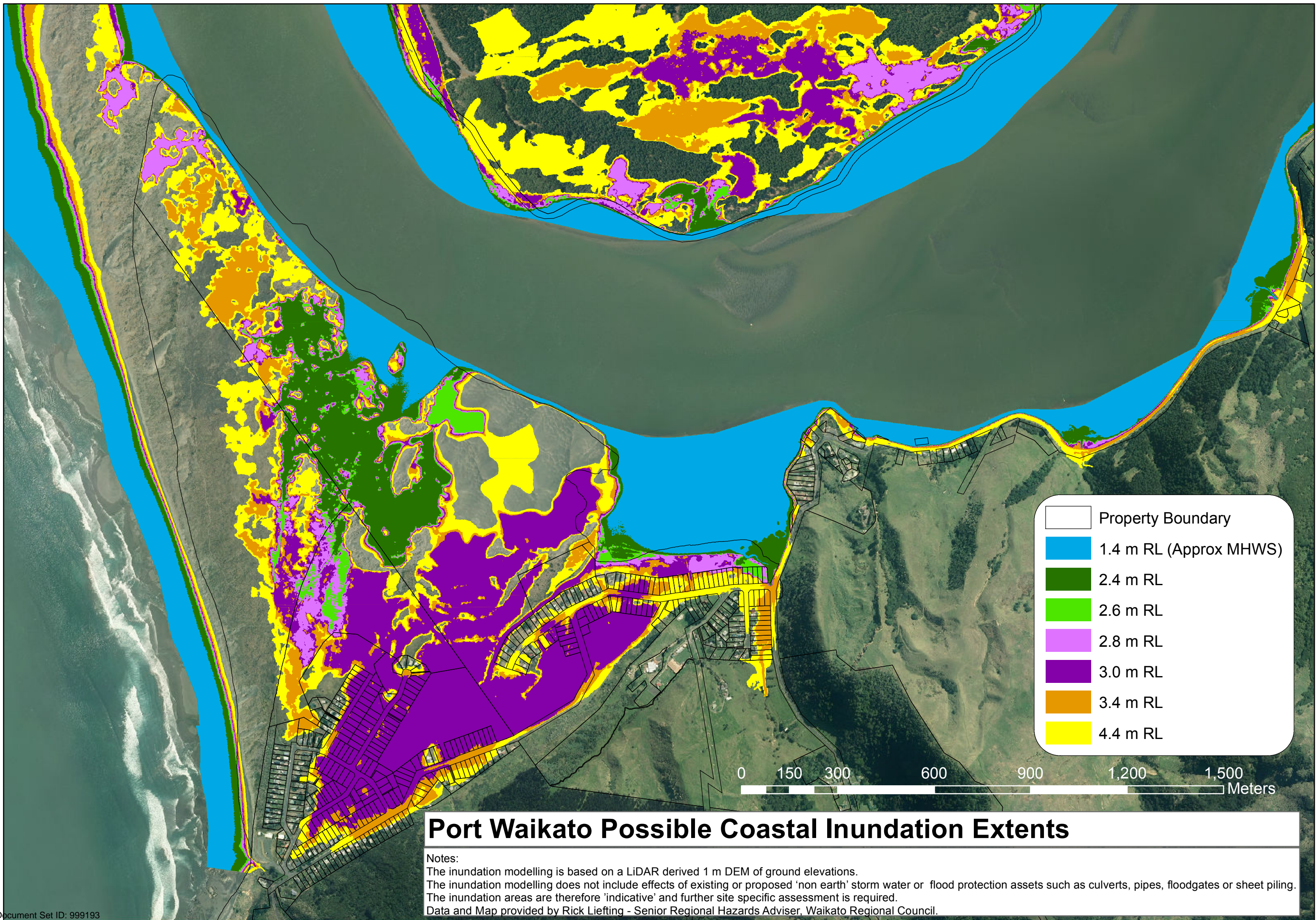
**Table 4 Waikato District Plan – Relevant Sections**

Policies	
5.2.2	Use or development of land subject to significant natural hazards should be avoided.
5.2.2A	Use or development of other land subject to natural hazards should be required to mitigate the related risks to health, safety and property.

5.2.3	Use, development or protection of land should not increase the adverse effects of natural hazards, or compromise natural processes.
5.2.4	Construction or alteration of a building should not take place on land that in the event of a 0.5m sea-level rise would be: (a) below mean high water springs, or (b) subject to inundation by storm surges, or (c) subject to coastal erosion.
5.2.5	Development should minimise impervious surfaces, provide adequate stormwater drainage, and mitigate the off-site effects of stormwater drained from the site.
5.2.8	Natural buffers against the effects of natural hazards should be used, maintained, or enhanced.
5.2.9	Development should be designed and located to avoid or mitigate the predicted effects of global climate change on natural hazards, especially increased flooding, erosion, fire, and storms. Where there is incomplete information, a precautionary approach should be taken.

# Appendix D – Full maps and Diagrams from previous investigations





## Port Waikato Possible Coastal Inundation Extents

**Notes:**  
 The inundation modelling is based on a LiDAR derived 1 m DEM of ground elevations.  
 The inundation modelling does not include effects of existing or proposed 'non earth' storm water or flood protection assets such as culverts, pipes, floodgates or sheet piling.  
 The inundation areas are therefore 'indicative' and further site specific assessment is required.  
 Data and Map provided by Rick Liefing - Senior Regional Hazards Adviser, Waikato Regional Council.





**Legend**

- Property\_ID
- Archaeological Site (Midden/Oven)
- Maori Trust
- Private
- Public Conservation
- Waikato District Council

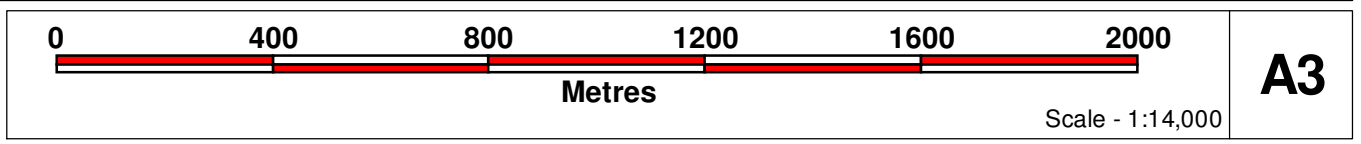
ID	VALUATION_ID	AREA (ha)	LEGAL DESCRIPTION	OWNER
1	06340/334/08	4.96	LOT 4 DPS 8872 LOT 54 Sunset Beach Car Park and Reserve DPS 8872 LOT 57 DPS 4598 LOT 57 DPS 8872 LOT 58 DPS 4598	WAIKATO DISTRICT COUNCIL
2	06340/236/42	45.22	ALLT 33 Putataka SD	DEPARTMENT OF CONSERVATION
3	06340/328/01	0.48	LOT 10 Ocean View Road Reserve DPS 17714 LOT 40 DPS 17714	WAIKATO DISTRICT COUNCIL
4	06340/262/24	3.16	LOT 1 DPS 47446	TASMAN DUNES LIMITED
5	06340/262/03	15.43	LOT 1 DPS 27544	DEPARTMENT OF CONSERVATION
6	06340/236/01	100.18	LOT 1 Maunsell Swamp Verge DPS 26557	NGATI KAREWA NGATI TAHINGA TRUST
7	06340/329/09	0.71	LOT 41 DPS 26669 LOT 42 DPS 26669 LOT 43 Phillips Reserve DPS 26669	WAIKATO DISTRICT COUNCIL
8	06340/262/02	6.29	LOT 9 DPS 23881 PT LOT 1 Albie Phillips Memorial Reserve DPS 3625	WAIKATO DISTRICT COUNCIL
9	06340/240/27	2.63	LOT 27 DPS 23883	WAIKATO DISTRICT COUNCIL
10	06340/240/28	0.1	LOT 28 DPS 23883	WAIKATO DISTRICT COUNCIL
11	06340/189/00	4.5	LOT 12 DPS 1186 LOT 13 Maraetai Bay Reserve Beach Front DPS 1186	WAIKATO DISTRICT COUNCIL

**Port Waikato Sandspit**

Created by: HCE  
 Projection: NZTM  
 Date: 15th Feb 2013

Status: Final  
 Request No.: 24924  
 File name:  
 S:\GISWork\BIOSEC\Biodiversity\  
 24924\_Port Waikato Sandspit

**For Waikato Regional Council staff only**



Imagery sourced from New Zealand Aerial Mapping Ltd (NZAM) and is the property of NZAM and the Waikato Regional Aerial Photography Syndicate (WRAPS) 2012. Copyright Reserved.

Archaeological site data supplied by New Zealand Archaeological Association from the Site Recording Scheme.

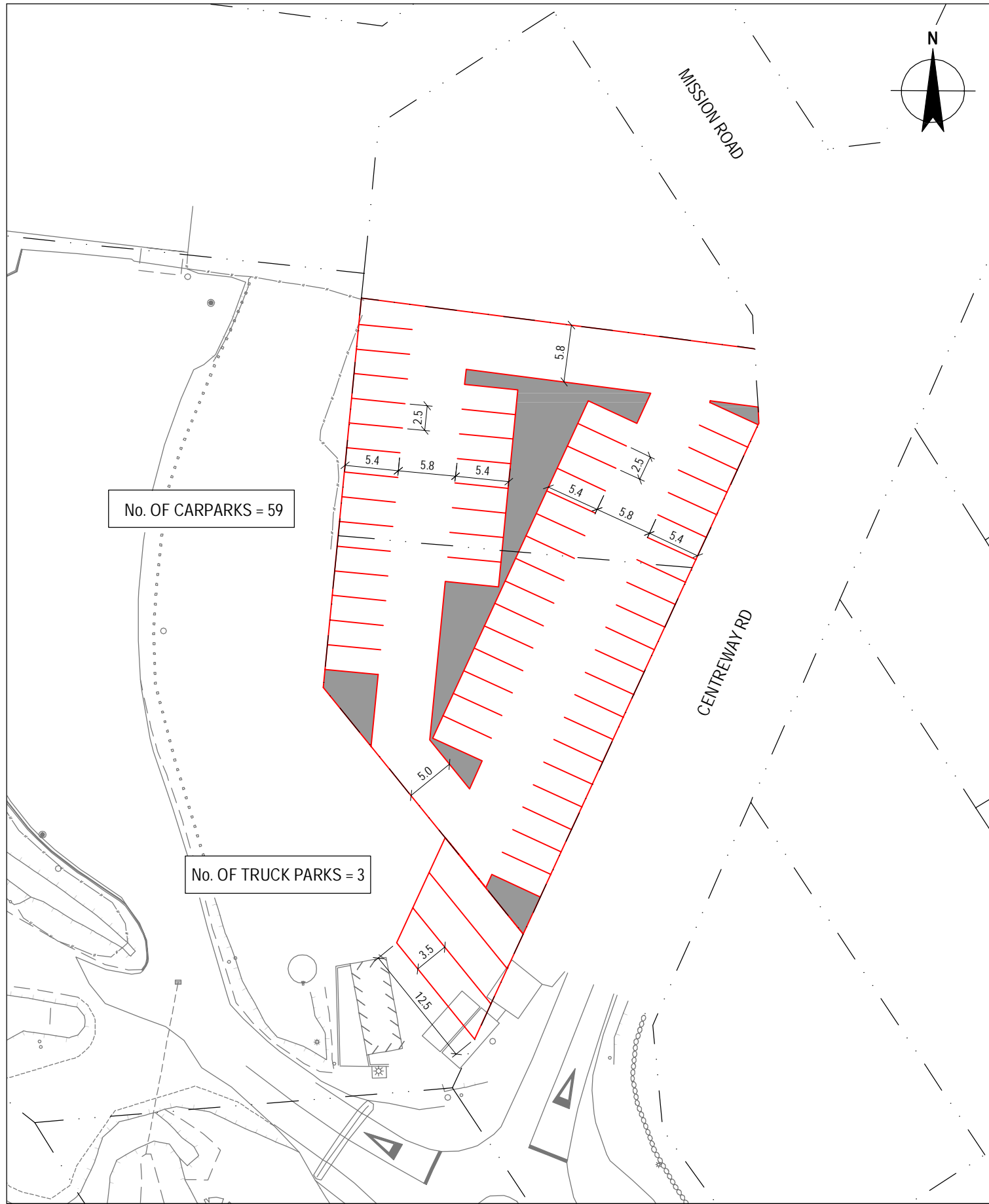
The data is provided on the strict understanding that the NZAA shall not be held liable in the respect of any errors or omissions in the data provided. While reasonable care has been taken in compiling the data and maintaining it, NZAA makes no warranty or representation, express or implied, with regards to the accuracy, completeness, or utility of the data. NZAA explicitly disclaims any responsibility for any loss or damage incurred due to any use made of the information.

Cadastral information derived from Land Information New Zealand's Landonline Cadastral Database. CROWN COPYRIGHT RESERVED.

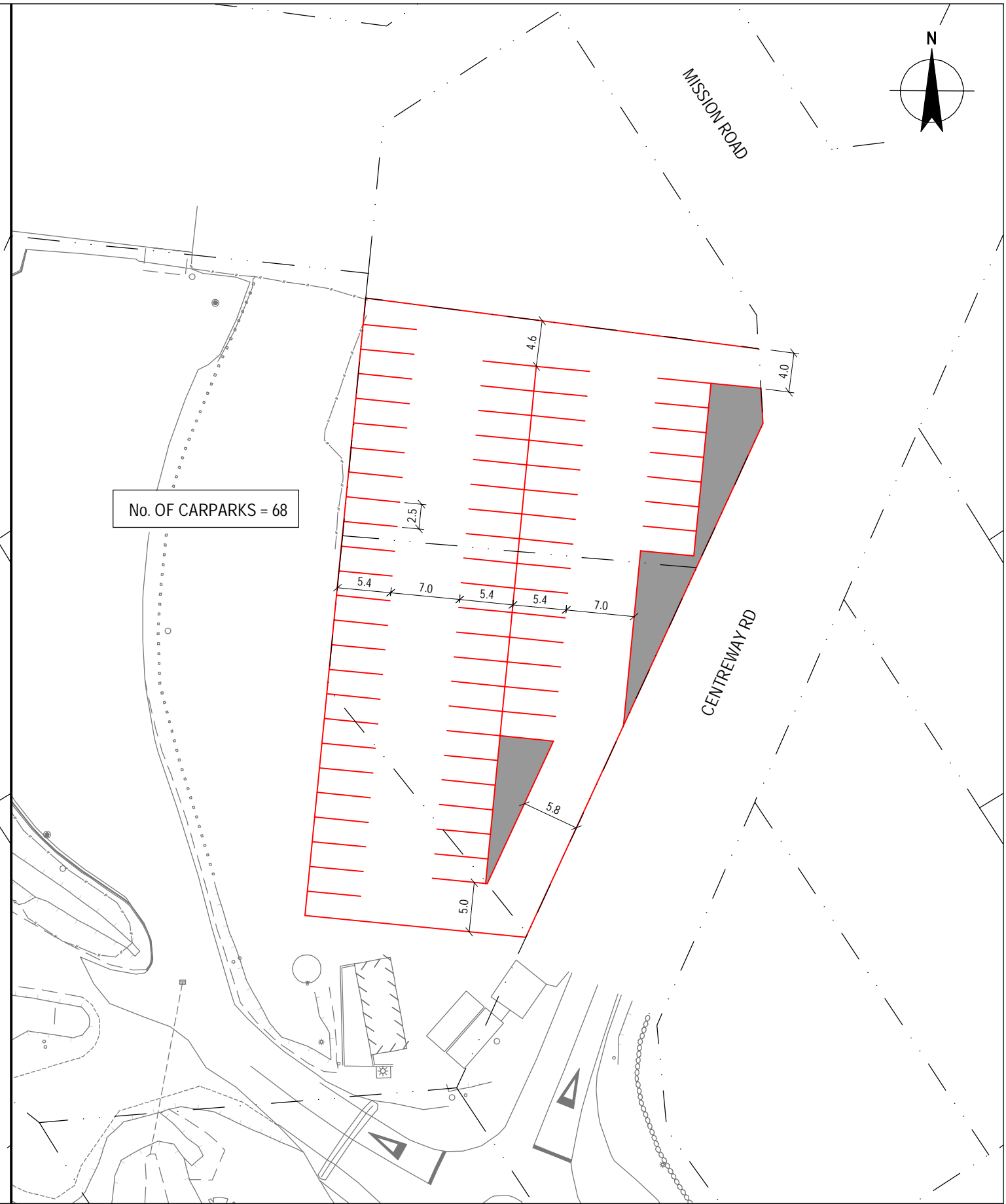
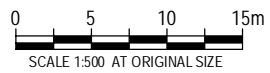
Valuation Data Sourced from Territorial Authority District Valuation Roll.







CARPARK LAYOUT OPTION A WITH TRUCK PARKING



CARPARK LAYOUT OPTION B

PRELIMINARY

A PRELIMINARY		ALP	
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Date
Drawn	Job Manager	Project Director	Date



Level 3, T & G Building  
149 Alexandra Street, Hamilton, 3204 New Zealand  
T 64 7 834 7900 F 64 7 839 4278  
E hnmmail@ghd.com W www.ghd.com

**DO NOT SCALE**

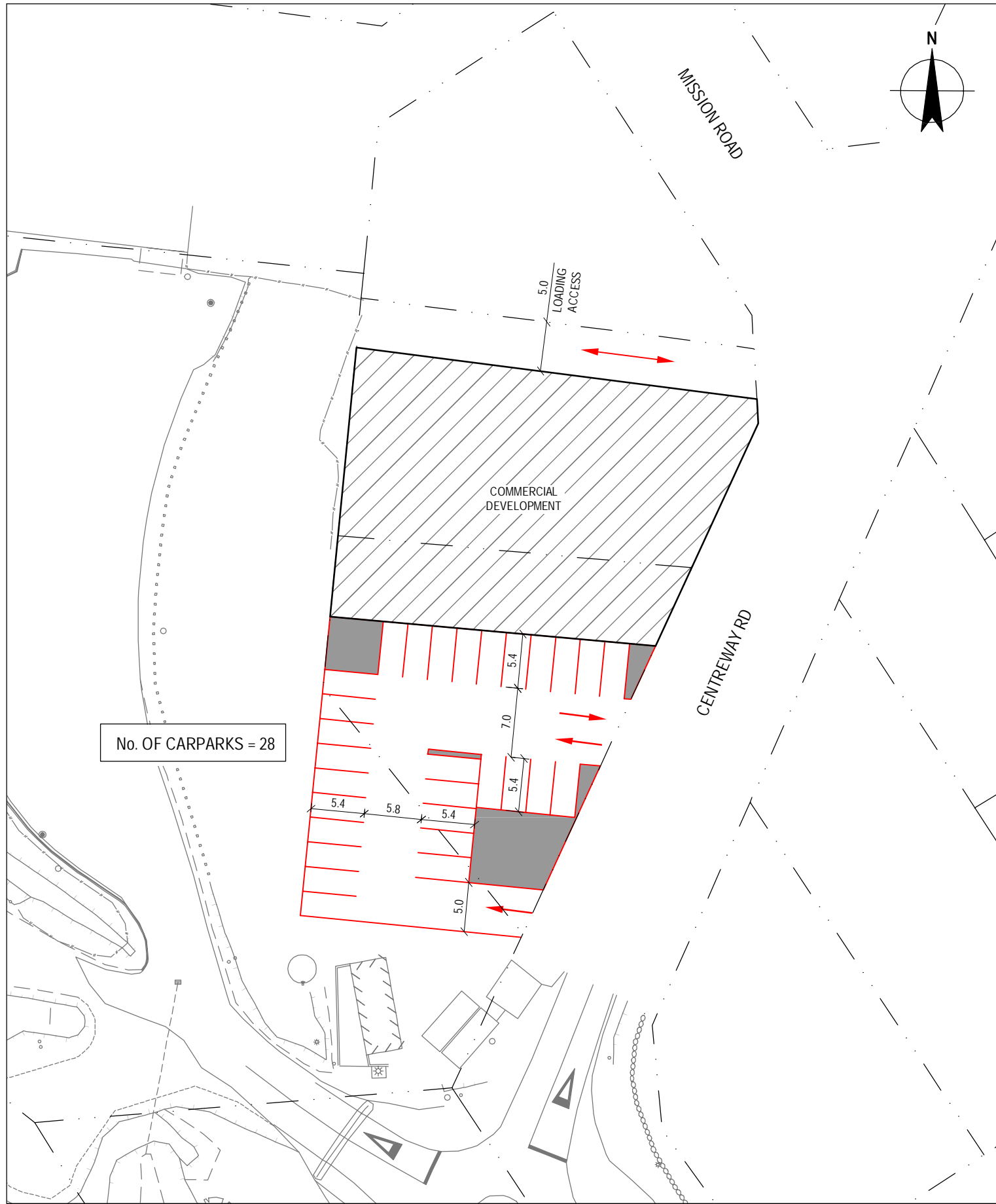
GHD Limited  
Conditions of Use.  
This document may only be used by  
GHD's client (and any other person who  
GHD has agreed can use this document)  
for the purpose for which it was prepared  
and must not be used by any other  
person or for any other purpose.

Drawn	A. PORTEOUS	Designer	J. UNDERWOOD
Drafting Check		Design Check	
Approved (Project Director)			
Date			
Scale	1:500		

Client **WAIKATO DISTRICT COUNCIL**  
Project **SUNSET BEACH EROSION CONTROL OPTIONS**  
Title **LONGTERM PARKING OPTIONS**  
**OPTIONS A & B**

Original Size **A3** Drawing No: **51-32796-SK001**

Rev: A



No. OF CARPARKS = 28

**CARPARK LAYOUT OPTION C**



**PRELIMINARY**

A PRELIMINARY		ALP			
No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director
					Date



Level 3, T & G Building  
149 Alexandra Street, Hamilton, 3204 New Zealand  
T 64 7 834 7900 F 64 7 839 4278  
E himm@ghd.com W www.ghd.com

<b>DO NOT SCALE</b> GHD Limited Conditions of Use. This document may only be used by GHD's client (and any other person who GHD has agreed can use this document) for the purpose for which it was prepared and must not be used by any other person or for any other purpose.	Drawn A. PORTEOUS	Designer J. UNDERWOOD
	Drafting Check	Design Check
	Approved (Project Director)	Date
Scale 1:500	This Drawing must not be used for Construction unless signed as Approved	

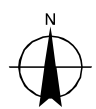
Client	<b>WAIKATO DISTRICT COUNCIL</b>
Project	<b>SUNSET BEACH EROSION CONTROL OPTIONS</b>
Title	<b>LONGTERM PARKING OPTIONS OPTION C</b>
Original Size	<b>A3</b>
Drawing No:	<b>51-32796-SK001</b>
Rev:	<b>A</b>



**LEGEND**

- 2014 Shoreline (approximate)
- ➔ Setback from Existing Shoreline

Paper Size A4  
 0 5 10 20 30 40  
 Metres  
 Map Projection: Transverse Mercator  
 Horizontal Datum: NZGD 2000  
 Grid: NZGD2000 New Zealand Transverse Mercator 2000



Waikato District Council  
 Coastal Erosion at Sunset Beach

Job Number 51-32796  
 Revision 1  
 Date 12 Dec 2014

**Coastal Erosion  
 2014 Shoreline with Setback**

**Figure 2**

G:\5132796\GIS\Maps\Mxd\5132796\_G003\_Rev1\_Figure 2\_2014\_shoreline\_with\_setback.mxd GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E ak@mail@ghd.com W www.ghd.com  
 © 2014. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.  
 Data source: LINZ (CC-by): Roads, Addresses - Oct. 2014; GoogleEarth: Aerial - Taken Mar 2014. GHD: Shorelines, setbacks - Dec 2014. Created by:jhchen



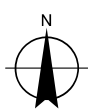
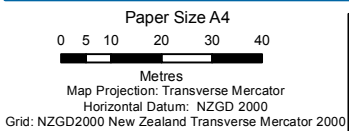


**LEGEND**

**Shoreline**

Based on aerials and is approximate

- 2002
- 2008
- 2012
- 2014



Waikato District Council  
Coastal Erosion at Sunset Beach

Job Number | 51-32796  
Revision | 0  
Date | 14 Nov 2014

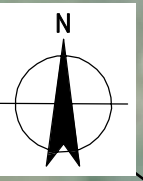
Coastal Erosion  
2002-2014 Shoreline

**Figure 1**

G:\51\32796\GIS\Maps\Mxd\5132796\_G002\_Rev0\_Figure 1\_Erosion\_2002-2014.mxd GHD Centre, Level 3, 27 Napier Street Freemans Bay Auckland 1011 New Zealand T 64 9 307 7373 F 64 9307 7300 E akmail@ghd.com W www.ghd.com

© 2014. Whilst every care has been taken to prepare this map, GHD (and DATA CUSTODIAN) make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.





No. OF CARPARKS =107



0 5 10 15m  
SCALE 1:500 AT ORIGINAL SIZE

**PRELIMINARY**

No	Revision	Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Job Manager	Project Director	Date
A	PRELIMINARY		ALP			



**GHD**  
Level 3, T & G Building  
149 Alexandra Street, Hamilton, 3204 New Zealand  
T 64 7 834 7900 F 64 7 839 4278  
E hnm@mail@ghd.com W www.ghd.com

<b>DO NOT SCALE</b>	Drawn A. PORTEOUS	Designer J. UNDERWOOD
GHD Limited Conditions of Use. This document may only be used by GHD's client (and any other person who GHD has agreed can use this document) for the purpose for which it was prepared and must not be used by any other person or for any other purpose.	Drafting Check	Design Check
	Approved (Project Director)	Date
	Scale 1:500	This Drawing must not be used for Construction unless signed as Approved

Client	<b>WAIKATO DISTRICT COUNCIL</b>
Project	<b>SUNSET BEACH EROSION CONTROL OPTIONS</b>
Title	<b>ALTERNATIVE LOCATION LAYOUT</b>
Original Size	<b>A3</b>
Drawing No:	<b>51-32796-SK011</b>
Rev:	<b>A</b>

GHD

Level 3, 27 Napier Street  
Freemans Bay

T: 64 9 370 8000 F: 64 9 370 8001 E: akmail@ghd.co.nz

© GHD Limited 2014

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

G:\51\32796\Technical\Report\Port Waikato Sunset Beach Erosion Options Allenie version.docx

Document Status

Rev No.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date

[www.ghd.com](http://www.ghd.com)

