

Kettle Park Coastal Landfill remediation Updates



Focus on: Kettle Park Remediation

Assessing environmental changes – need for change

Alignment of the options with social values

Identifying the risk

Identifying the solutions

Defining the socioeconomic impact

Assess the efficiency of the remediation options in reducing the natural hazard risk



Site description

Landfill extent and volumes:

One of the largest coastal landfills in NZ

Area covered: 48,000 m² east and 3000 m² west of Moana Rua Road

Volume: 50,000 m³ (capping material) + **245,000 m³** (landfill material) + 24,000 m³ (impacted sand)





Material at risk

Risk assessment

Risk
Solution
Impact

- Under **present storm conditions**, the estimated erosion potential can reach up to **20m** (P50%), putting at risk approximately **33,430 m³** of landfill material.
- With sea level rise (SSP4 8.5 M), these estimates are likely to increase to 91m and 176,320 m³ over the next 100 years

Table 3.6: Summary of ASCE distances (horizontal distance (m) from 2021 dune toe) along Kettle Park

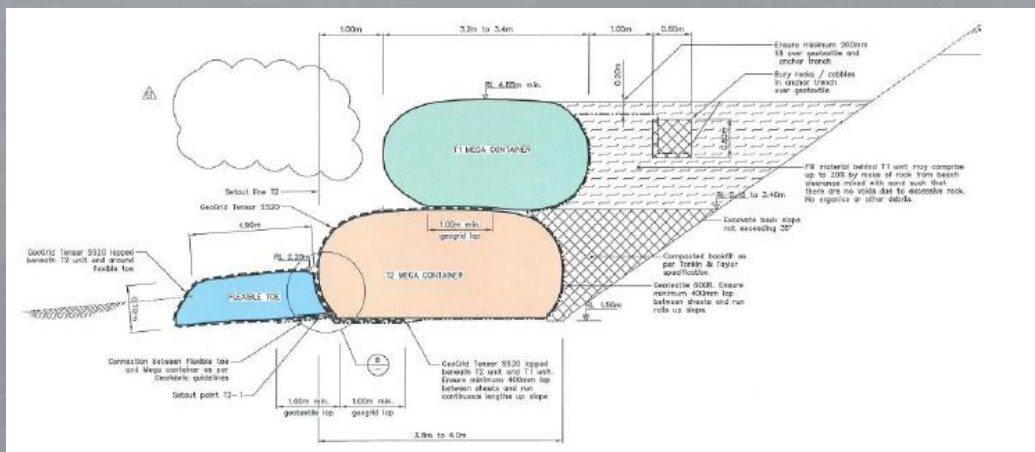
Timeframe	SLR scenario	West		East	
		P _{50%}	P _{5%}	P _{50%}	P _{5%}
2030 (0 to 10 years)	N/A	-20	-24	-19	-23
2040 (20 years)	SSP2 4.5 M	-28	-32	-25	-29
	SSP4 8.5 M	-28	-33	-25	-30
2070 (50 years)	SSP2 4.5 M	-46	-54	-37	-45
	SSP4 8.5 M	-49	-57	-40	-48
2120 (100 years)	SSP2 4.5 M	-79	-94	-60	-75
	SSP4 8.5 M	-91	-105	-72	-87

Table 3.7: Indicative volume of waste material assessed to be at risk to coastal erosion (based on P_{50%} ASCE)

Timeframe	SLR scenario	West (m ³)	East (m ³)	Total (m ³)
2030 (0 to 10 years)	N/A	12,750	20,680	33,430
2040 (10 to 20 years)	SSP2 4.5 M	15,050	32,800	47,850
	SSP4 8.5 M	15,060	32,800	47,860
2070 (20 to 50 years)	SSP2 4.5 M	19,190	61,900	81,090
	SSP4 8.5 M	19,880	69,180	89,060
2120 (50 to 100 years)	SSP2 4.5 M	26,780	117,680	144,460
	SSP4 8.5 M	29,540	146,780	176,320



Impact



DUNEDIN | kaunihera
CITY COUNCIL | a-rohe o
Ōtēpoti



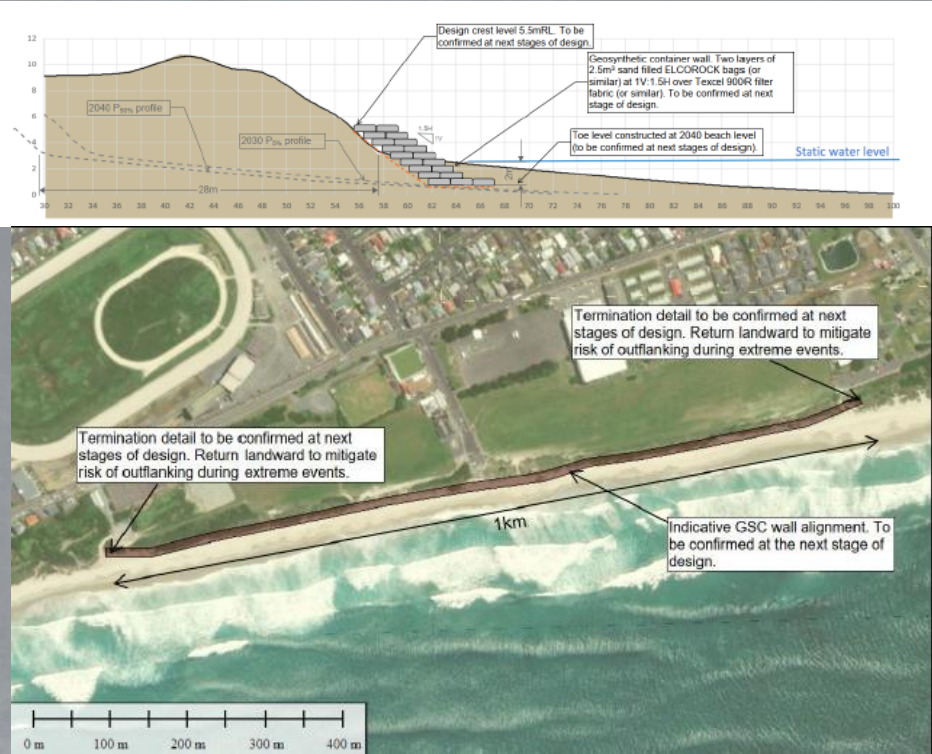
Risk mitigation option assessment

Remediation options – Refined geobags design (analogue to seawall option)

Risk

Solution

Impact



Advantages	Disadvantages
- Stabilises the back dune where the landfill hotspots are located, reducing the risk of exposure. - Serves as sediment storage on the upper beach that can easily be released during decommission - Provides better public access than provided by the present design	- Presents a form of landfill 'capping'/ encapsulation. No landfill remediation. - Will result in beach lowering and end-of-the-wall effect if left too long. - Affects the natural aspect of the beach - Will likely require continuous sand top-up and maintenance - Reduces wind-blown sand during storms, naturally storing sediments on the upper dune face.
Lifespan	Cost
20 years	9,327,000\$ - 16,578,000\$



Risk mitigation option assessment

Remediation options – Backstop Wall

Risk

Solution

Impact

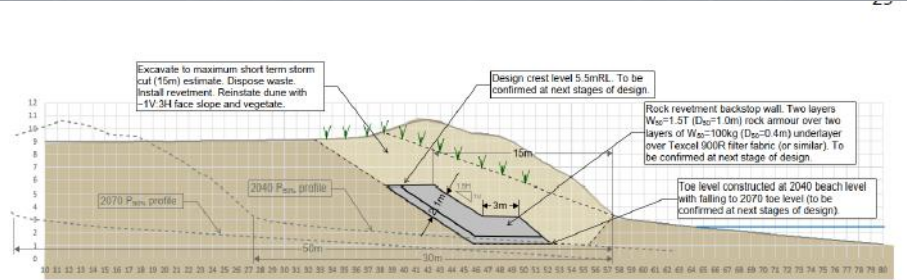


Figure 4-7: Concept sketch of backstop rock revetment.



Advantages	Disadvantages
- Stabilise the back dune where the landfill hotspots are located, reducing the risk of exposure. - Partial landfill remediation (in the dunes) - Buried structure with minimal impact on natural aspect of the dune. - Provide a fixed physical barrier to wave assailing force	- Reduces the capacity of the dune to reach dynamic equilibrium (Brunn’s rule) - Will eventually become exposed due to and will enhance reflection, beach lowering and end of the wall effect while reducing wind blow sand (natural storage of sediment up the dune face). - Affect the natural aspect of the beach - Will likely require continuous sand top-up - Will require decommission once exposed to mitigate the negative effects listed above, decommission cost will likely exceed implementation costs.
Lifespan	Cost
50 years	33,201,000\$ - 39,842,000\$ (Implementation only)



Risk mitigation option assessment

Preferred option – Dune reprofiling

Risk
Solution
Impact

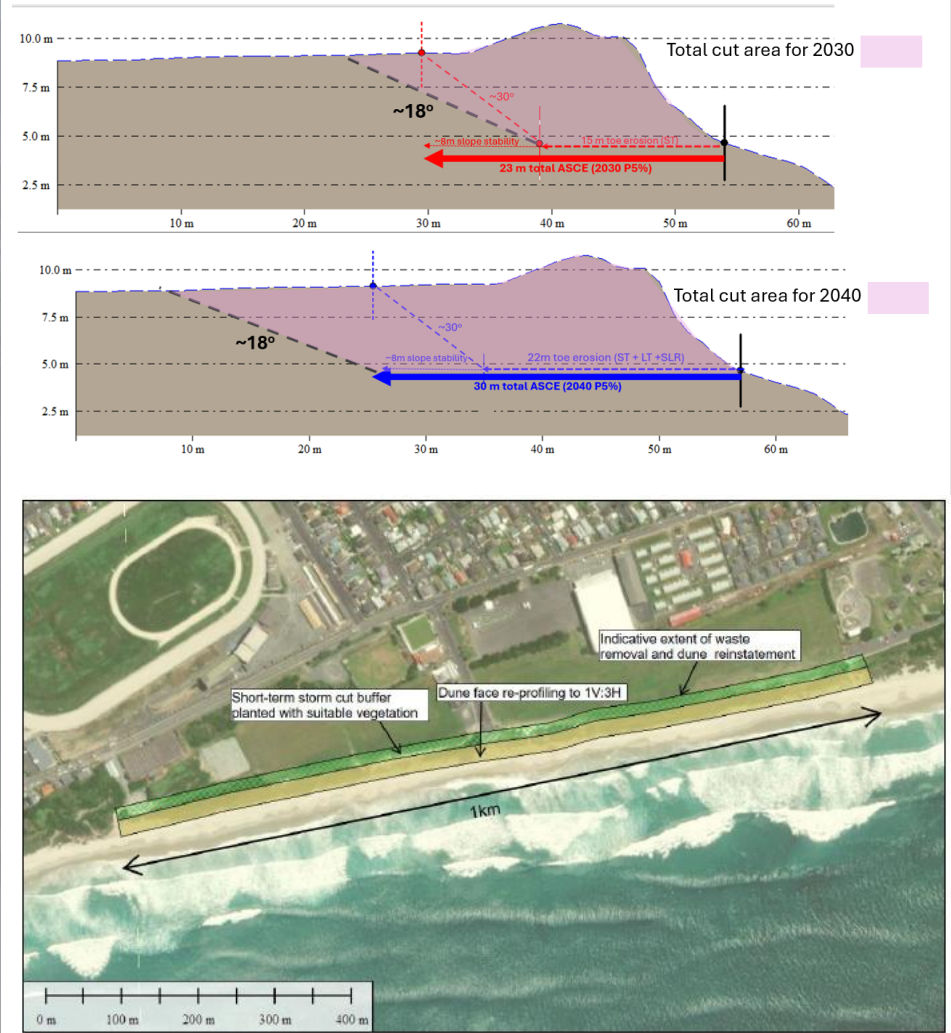


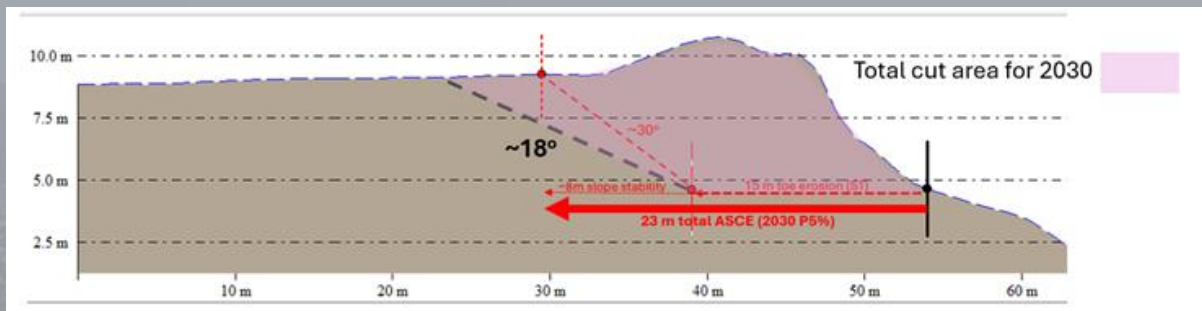
Figure 4-6: Concept plan view of the dune reprofiling.

Advantages	Disadvantages
- Increases the capacity of the dune to reach dynamic equilibrium (Brunn’s rule), enhancing the beach ability to buffer storms. - Reinstates a dune gradient allowing the onshore migration of wind-blown sand (natural sediment storage mechanism). - Constitutes a partial landfill remediation extending behind the dunes - Enhances the natural aspect of the beach as well as beach access. - Provides space for the local flora and fauna to re-establish	- Will require the implementation of a Marram grass control program. - Will require planting to increase surface roughness, decrease ground wind speed and enhance sand storage within the dune system. - Will require some type of sand traps to keep the blown sand within a reasonable distance of the dune crest
Lifespan	Cost
20 years	\$37M - \$61M



Preferred option refinement

Risk
Solution
Impact



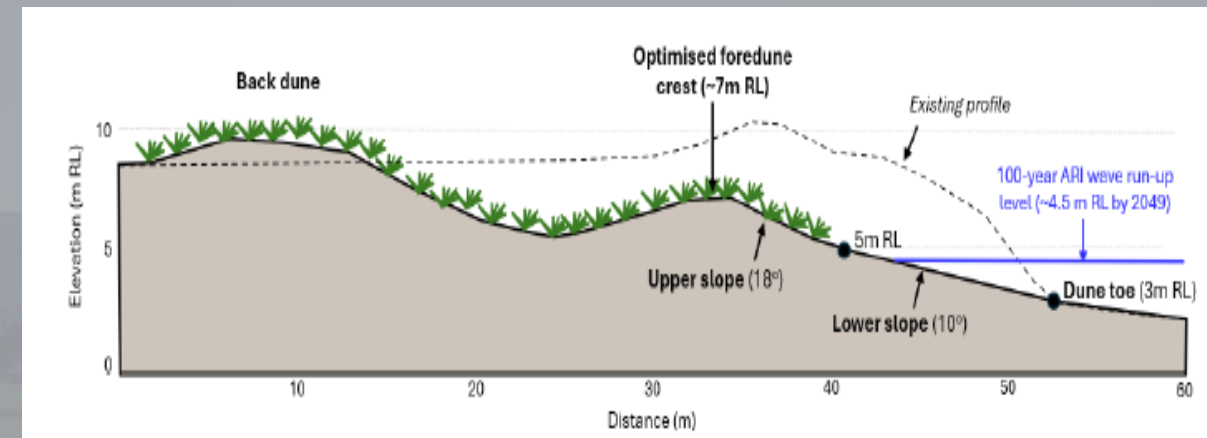
\$37M reprofiling

Advantage:

- Reduces risk of material discharge
- Works with natural processes for this coastal cell

Limitations:

- Lower resilience to extreme storms
- Can have negative effects on adjacent coastal cells
- Can result in maladaptation due to coastal squeeze
- Dune toe will remain unprotected



\$60M reprofiling

Advantage:

- Reduces risk of material discharge
- Works with natural processes for this coastal cell
- Increase extreme storm resilience
- Provides buffer to try implementing other options (e.g. backstop wall)
- Increases opportunity for public access and colonisation by coastal species
- Provides protection to dune toe

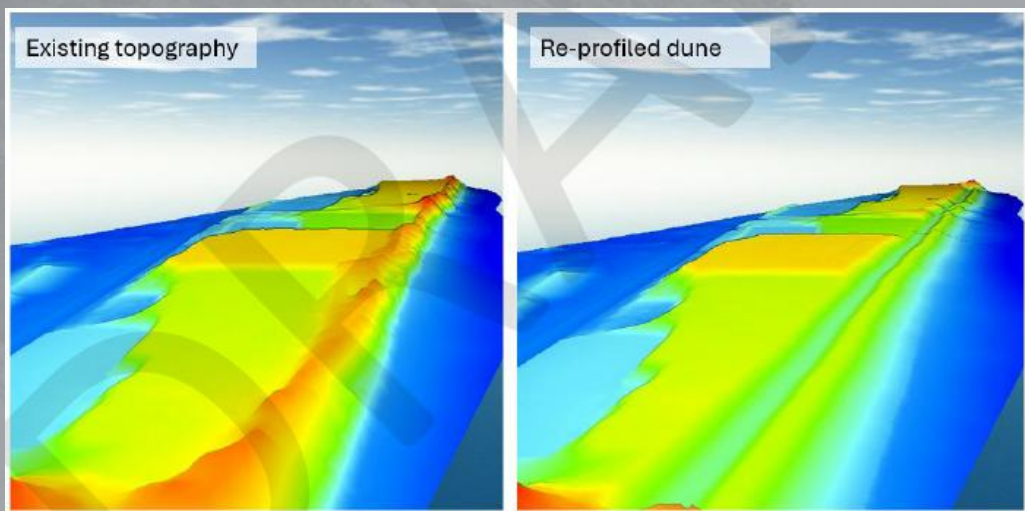
Limitations:

- Higher cost



Preferred option refinement

Risk
Solution
Impact





Community engagement data analysis

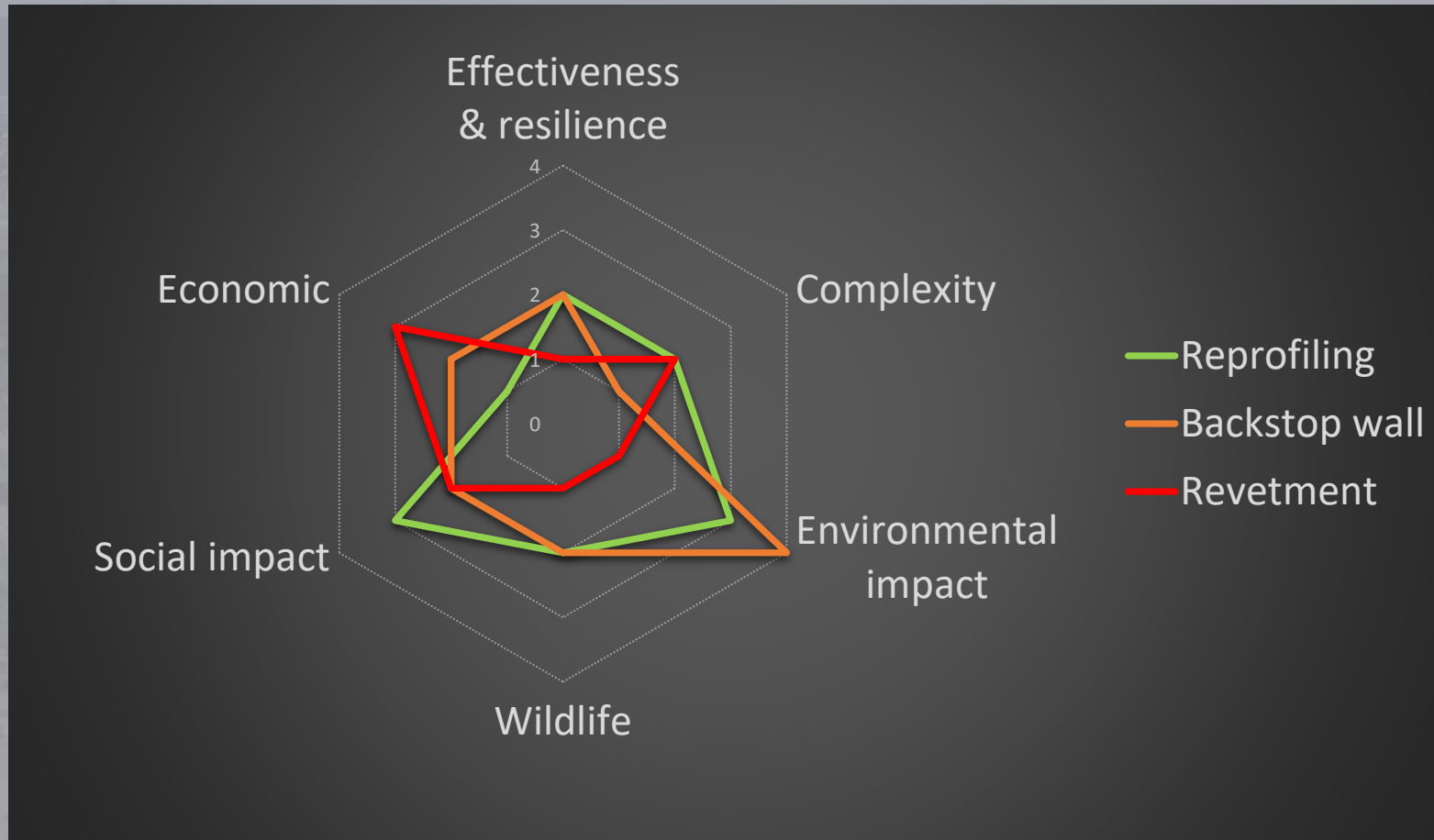
Table 7 Summary of the assessment of community sentiment against the options

REMEDIATION OPTION	COMMUNITY SENTIMENT – OVERALL COMMENTARY	RANKING
Do nothing	Community are against this option as the risk to the environment is too high.	4
Geosynthetic containers as short term, emergency protection	This is accepted in the short term but is not a long-term fix for the landfill.	3
Backstop wall	This option might provide benefits but the community weren't convinced it would resolve erosion issues and it puts a structure in the coast.	2
Remediate the old landfill and reprofile the dunes	This is the most supported by the community because of the key values of natural environment and access.	1



Multi criteria assessment

Risk
Solution
Impact



Ranking
1
2
3