

# Coastal Erosion & Management Options Ocean Foreshore: Port Waikato:

Presentation to Port Waikato Community: 25 August 2024

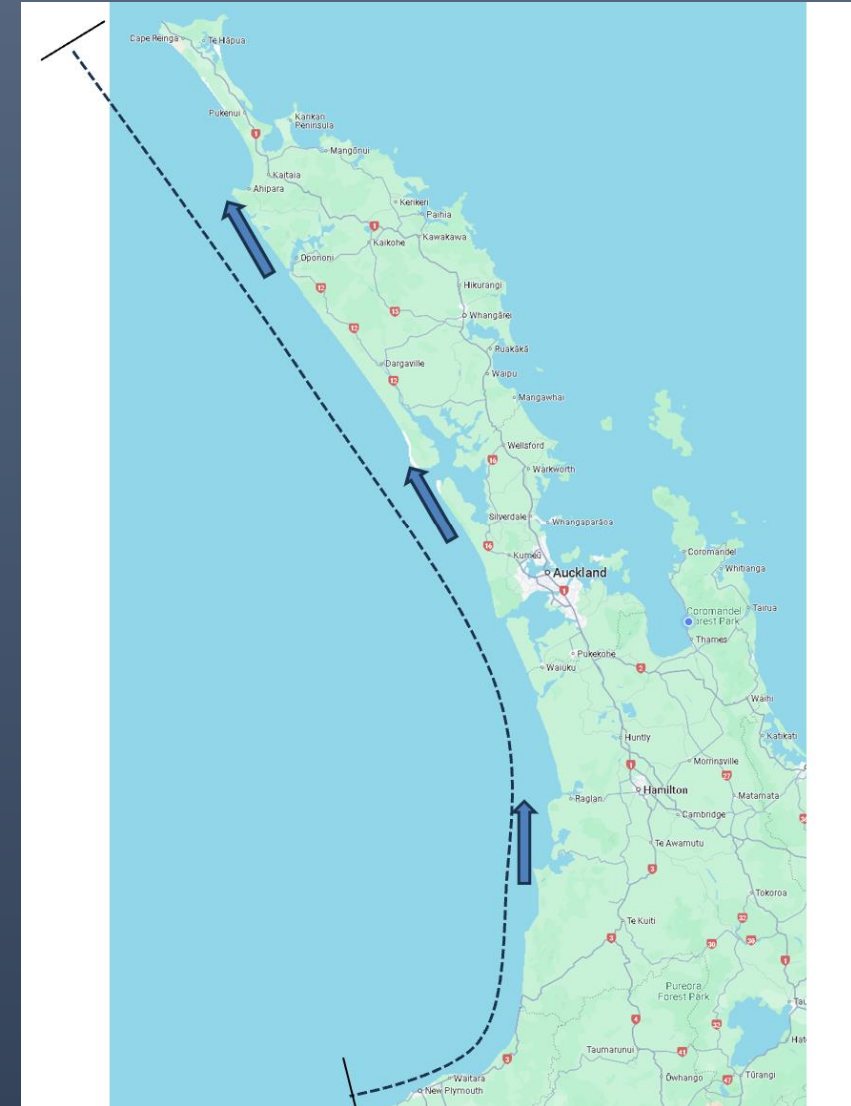
Jim Dahm, Eco Nomos Ltd

# Outline of Presentation

- Erosion
  - Geomorphic setting and coastal processes
  - What has happened in the past (particularly the past 80 years)
  - Close look at the current erosion and rates
  - Best current indications of potential future erosion
- Management
  - Planning a way forward – adaptive management
  - Relevant options at this site (high level overview only)
    - Holding the coast (stopping erosion)
    - Adapting to the erosion - managed retreat
- Questions
- Break-out to Tables

# Setting - Open West Coast Beaches

- High wave energy
- Wide, low gradient sandy beaches
- Part of a HUGE Inter-connected sand system - extending from Taranaki to Cape Reinga
- Waves result in net northerly longshore sand transport over time
- Sand appears to often travel in “slugs” or pulses of sediment (small to very large)
- Shorelines can experience significant changes over time scales up to centuries - complex
- Much uncertainty. Much of the science of the coast not yet done



# Port Waikato Sand Spit – Ocean Coast Shoreline Change 1940s to Present



# Port Waikato 1970s

(with 1940's shoreline  
superimposed – yellow  
line)

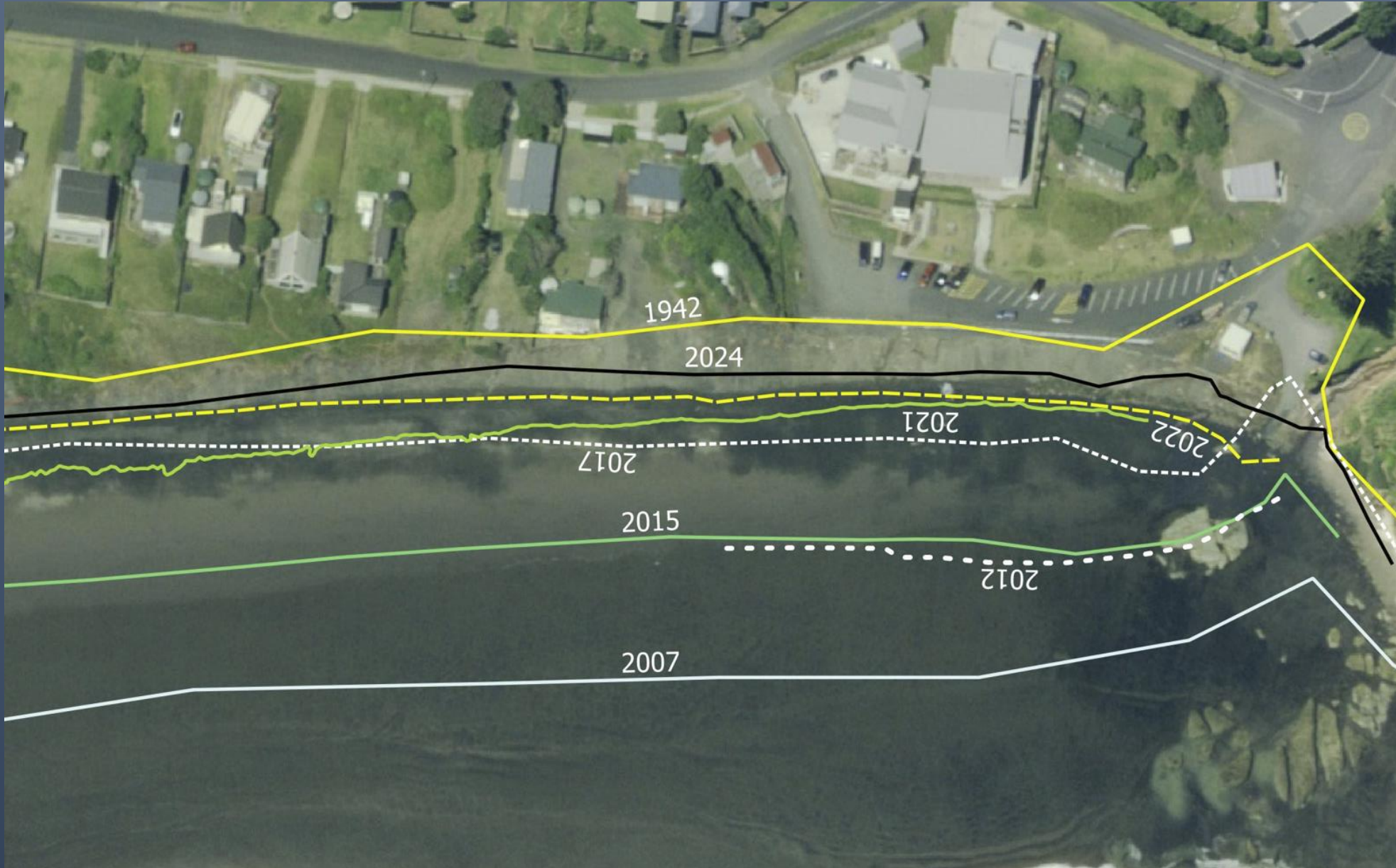


# Shoreline change 1942-2007 on early 2024 Aerial





# Shoreline change: Township: 1942-early 2024





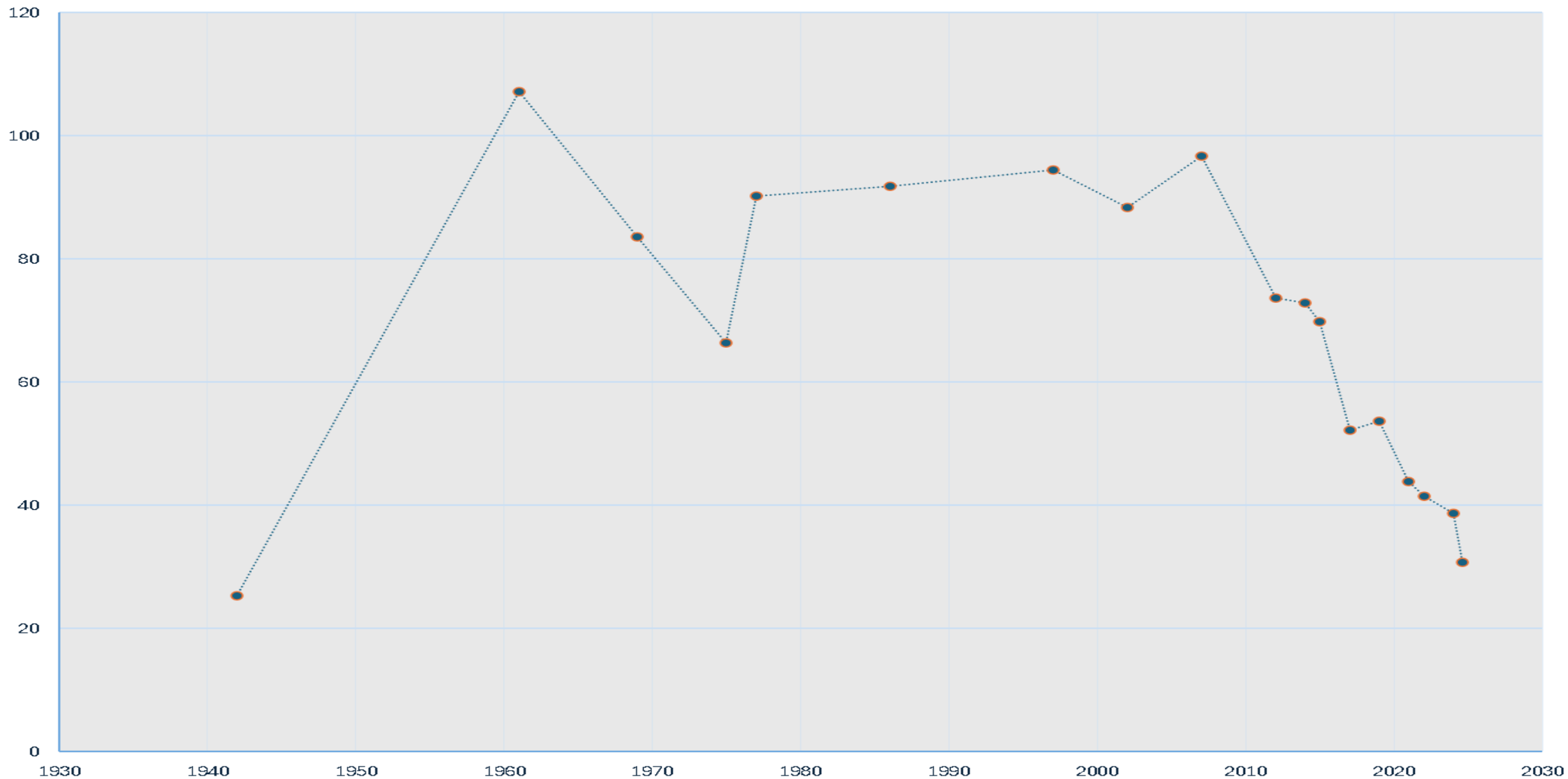
# Recent Situation – End of July 2024





# Port Waikato Carpark – Shoreline Change 1942-2024

**Port Waikato Carpark - Average Shoreline Change 1942-2024 (Draft)**



# Shoreline Changes 1940s to Present

## 1942 to 1960s

- advanced by 70-80 m (typically about 70m)
- *May have started advancing before 1942 (no data earlier)*

## 1960s to 2008 (46-47 years)

- Some fluctuations but typically remained 60-70+ m seaward of 1942 position

## 2008 to Present (Aug 2024)

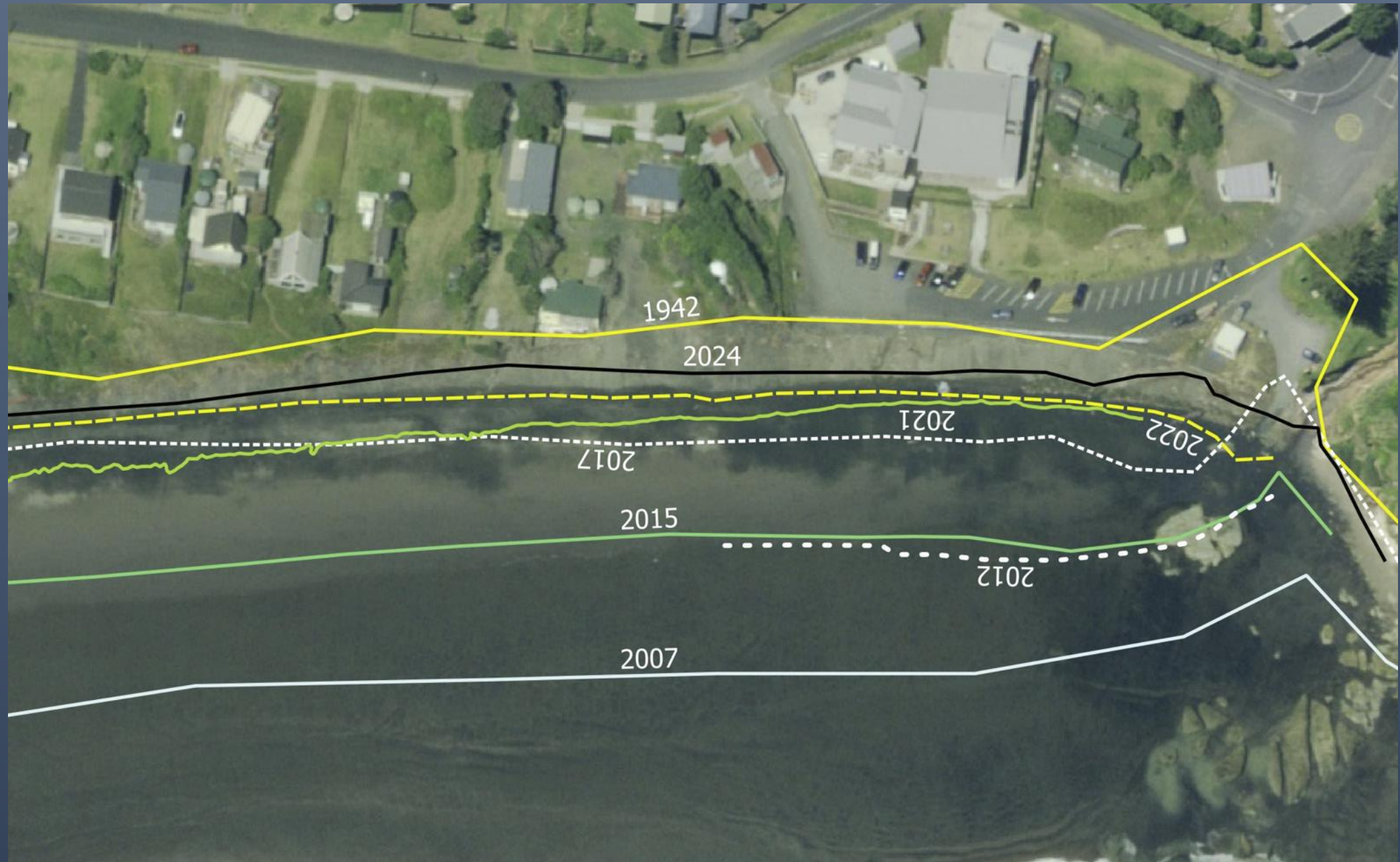
- Rapid erosion
- Now just seaward of 1942 position
- Scale of the erosion is fairly consistent along the entire ocean foreshore

Cause of these changes is uncertain. However, overall, it has the appearance of a large slug/pulse of sediment moving northwards



# Port Waikato Township Coastal Erosion 2008-to Present

# Shoreline change: Township: 1942-early 2024





September 2002





February 2006





January 2008





December 2008





July 2011





May 2013





Sept 2014





May 2019



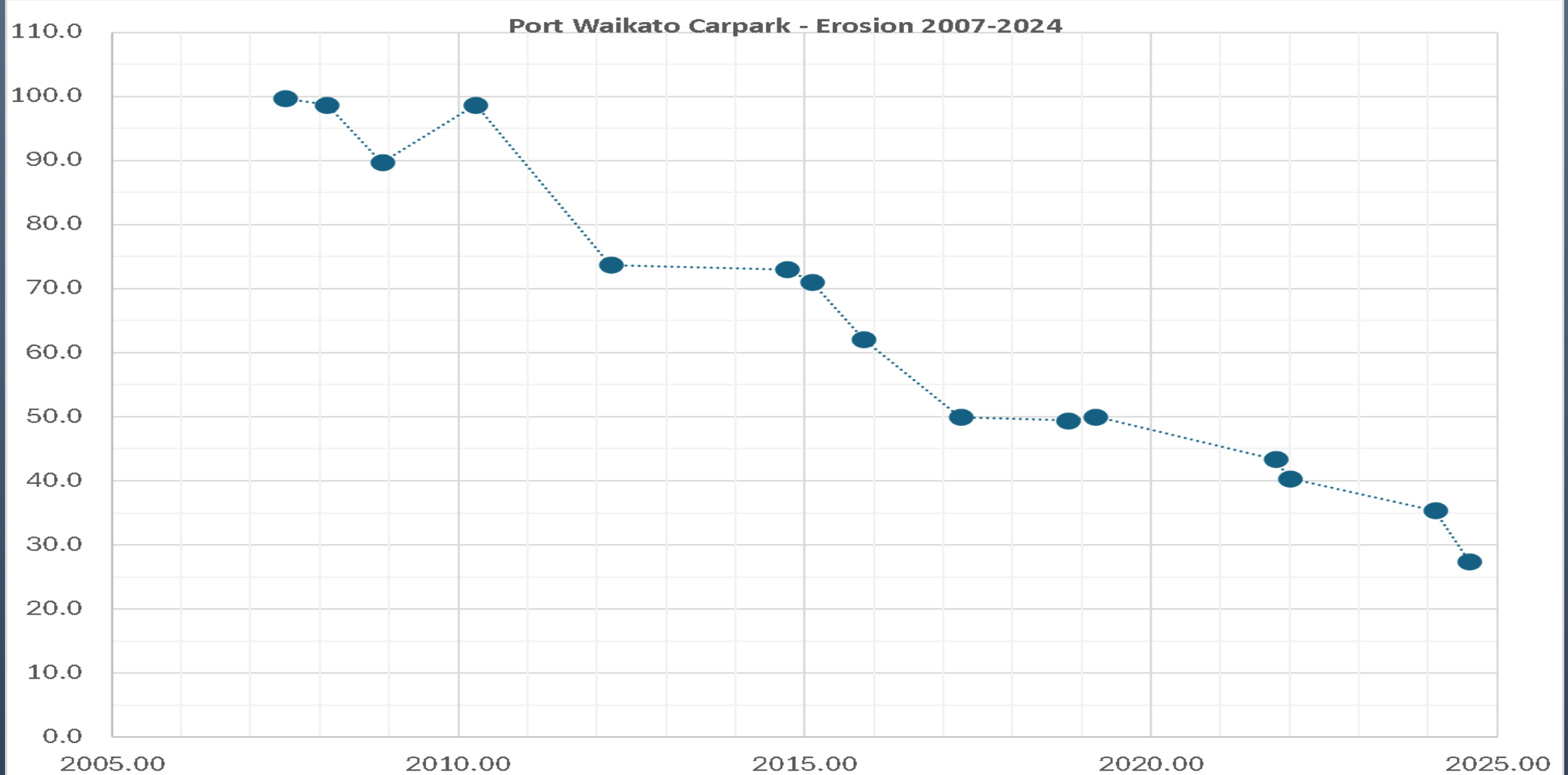


July 2024

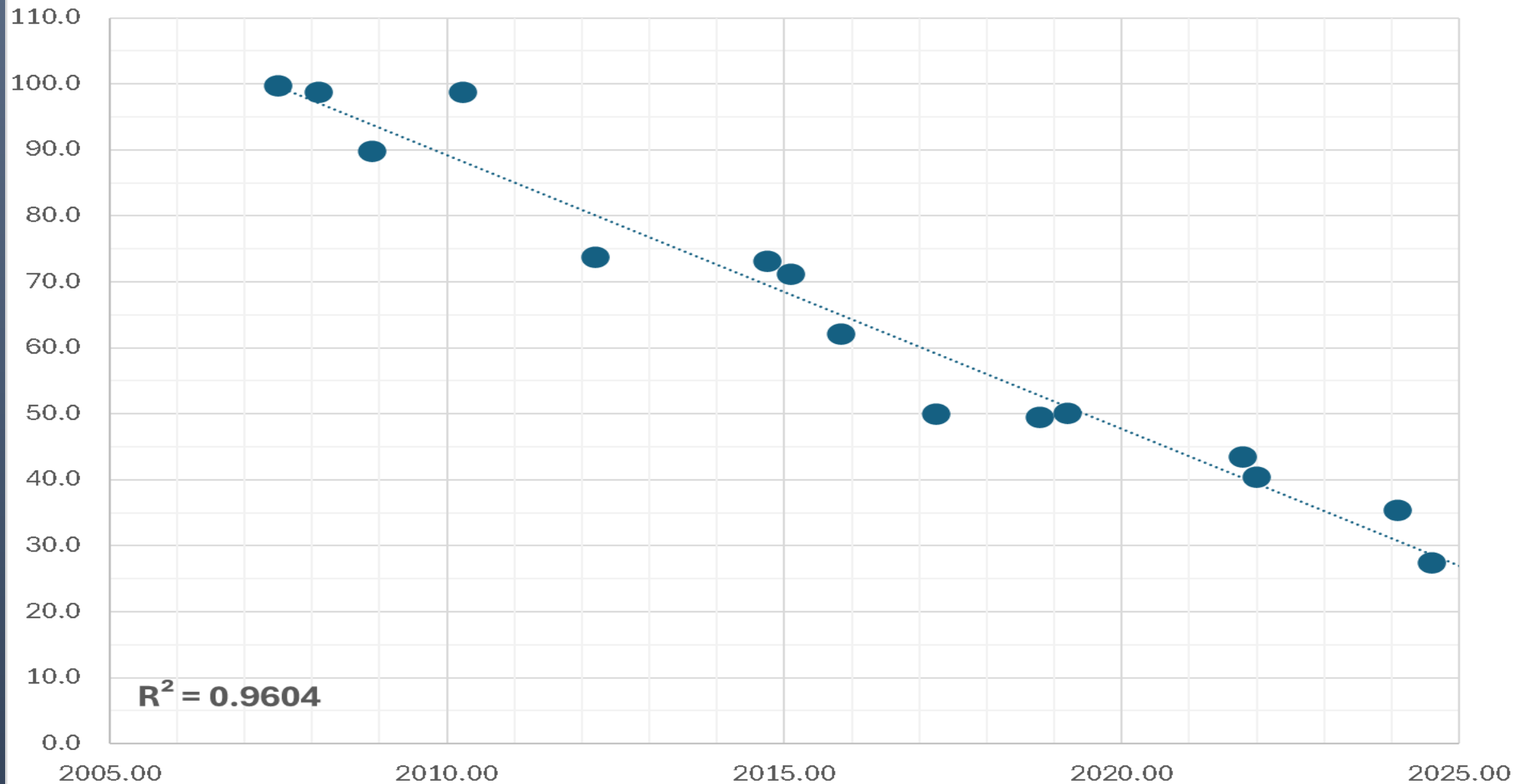




# Port Waikato Carpark – Erosion 2008/10-2024 (DRAFT)

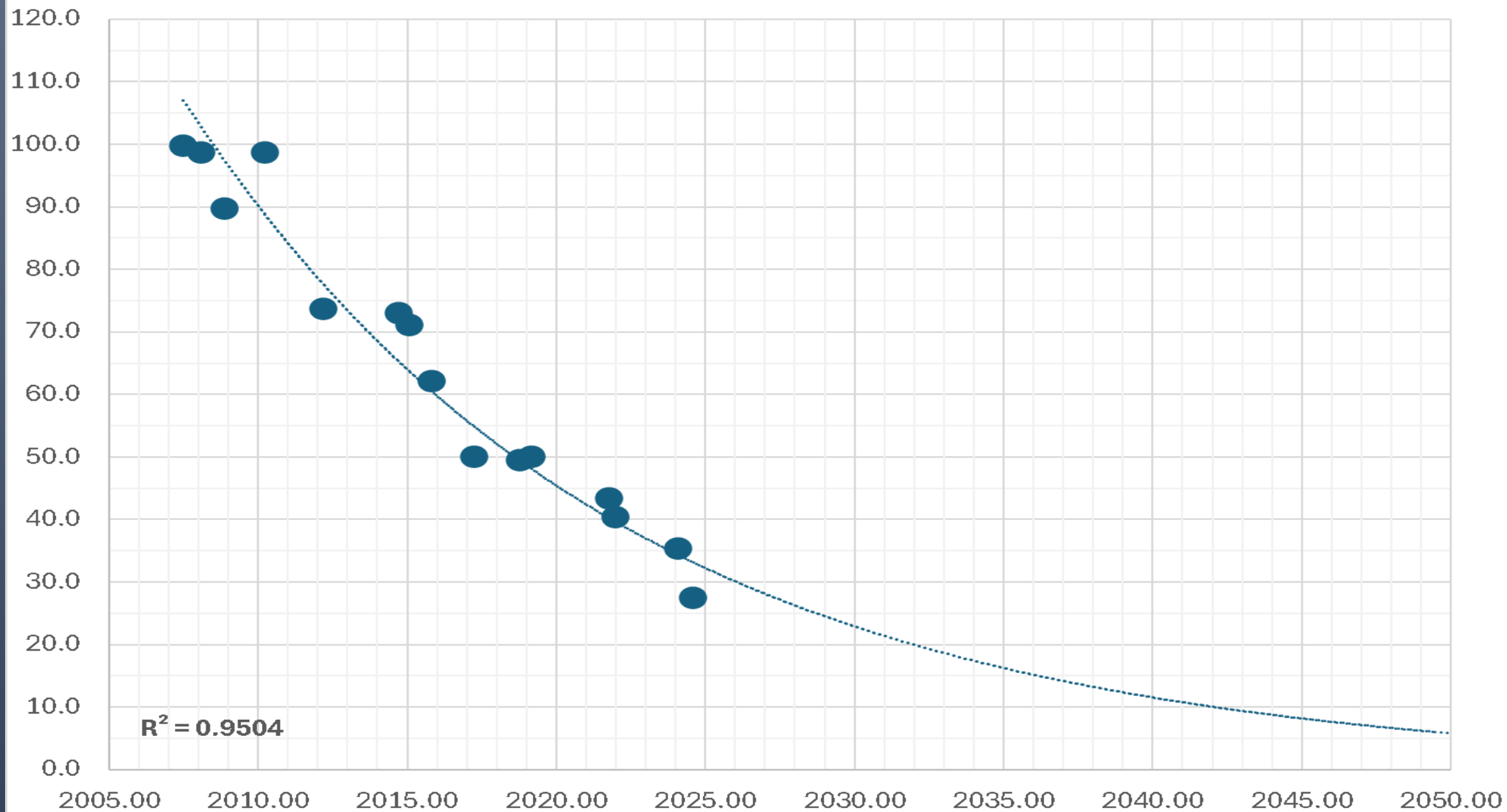


Port Waikato Carpark - Erosion 2007-2024: Best Fit Linear (Draft)

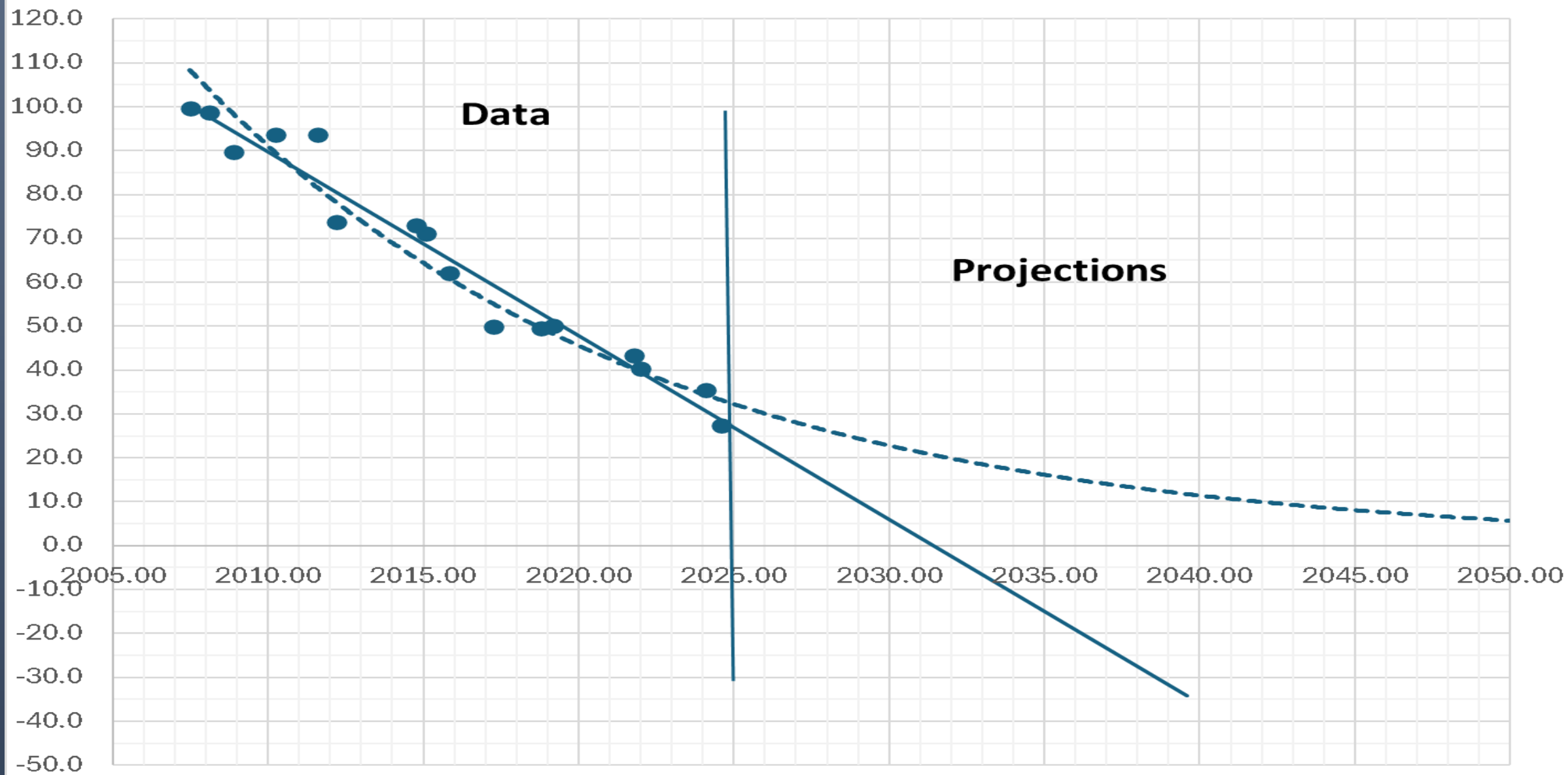




Port Waikato Carpark - Erosion 2007-2024: Best Fit Exponential (Draft)



Port Waikato Carpark - Erosion Projections: Present "Worst Likely" and "Best Likely" (DRAFT)





# Port Waikato Township Erosion: Summary 1

- Rapid erosion (about 70m) since 2008/11 – similar scale along the entire ocean shoreline of the spit (about 3.4 km length)
- Erosion occurred in phases during which periods significant erosion can occur (e.g. about 20-25m in 2-3 years)
- Interspersed with quiet periods (often 2-3 years) with little to no erosion
- Average rate of erosion is still high, though may be decreasing

# Port Waikato Township Erosion: Summary 2

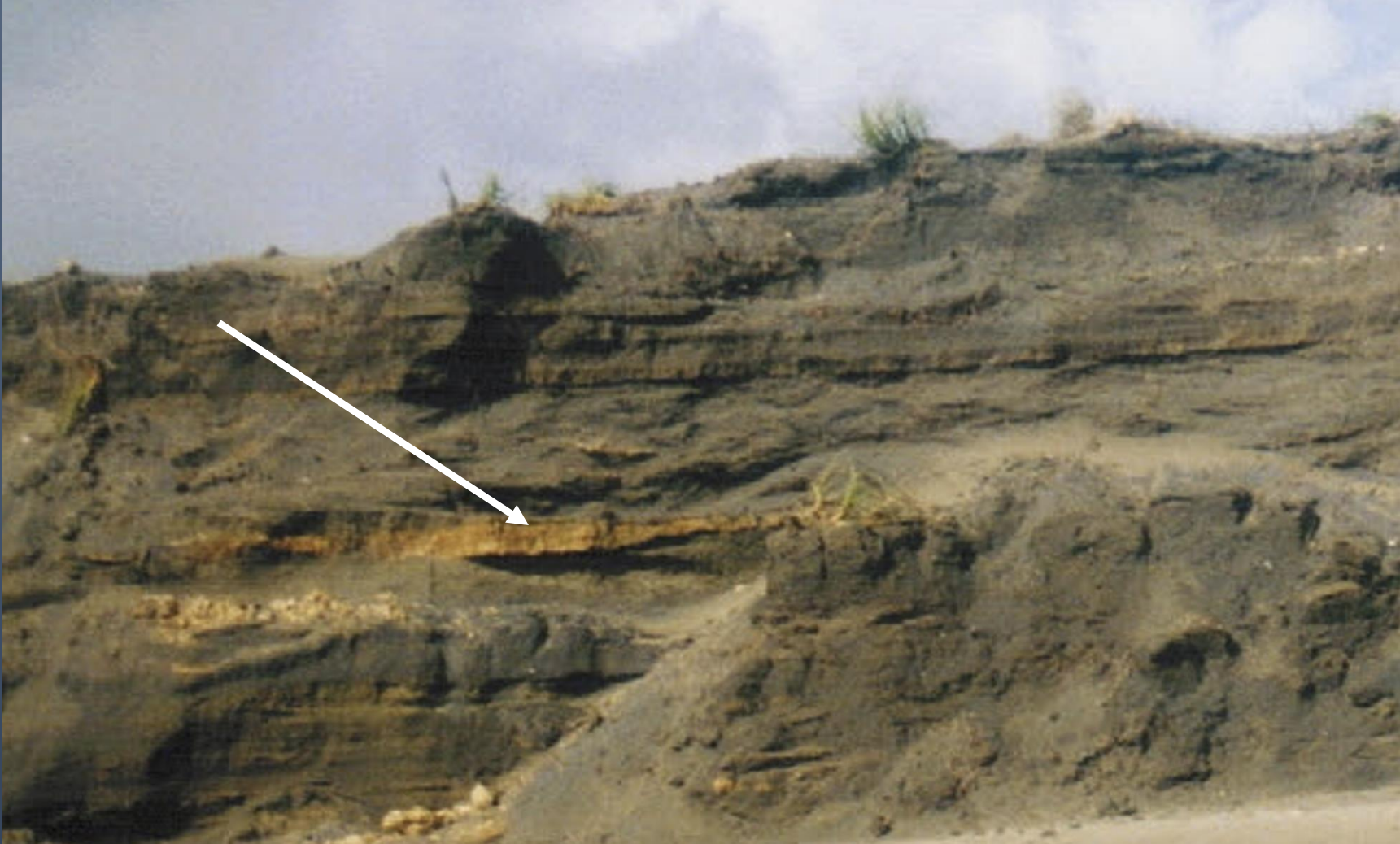
- Future projections based on existing data
  - **Projections, not predictions** (i.e. based on extrapolating past trends)
  - **“Worst likely”** – erosion at same average rate as the last 15-17 years
    - Projects average erosion of 4m/yr for periods of 5 years or more
    - For periods <5 years, need to allow for erosion phases
  - **“Best likely”** – erosion is decreasing over time
    - But still projects at least 15-20m further erosion before 2050
      - Can't rule out a better outcome – but no evidence for this at present
    - Still finalising these projections – above figures are DRAFTS
  - **Monitoring is important – refine/improve projections over time**



# Question Re Erosion

- If erosion continues, will it eliminate the high dune and flood the town?
- Categorically – NO!
- Experience of severe erosion at other sites indicates a high dune is likely to migrate landward with the erosion (unless humans prevent)
- In addition, it is very easy to form a dune if ever required using push-ups
- BUT when planning for the medium-long-term future you need to allow space for a dune behind the eroded shoreline
  - Particularly for “worst case” projection where the shoreline might eventually erode back to what are presently low-lying areas

# Former Northern Car Park Surface in Eroding Dune: Muriwai 2001





# Northern Car Park Muriwai (Southern end): 2006





# Management Considerations & Options



# Management Considerations

- Leading on from erosion analysis, planning for appropriate action is urgent
  - Some private assets (houses and property) already impacted
  - Action will be required on others including some houses (probably at least 3) in the very near future
  - Car park severely impacted, now barely viable
  - Surf club, hub and coffee could all potentially be threatened within the next 4-6 years with worst case scenario

Given the serious issues & uncertainties, an adaptive management approach is required

Also requires partnership approach, with all parties sitting around the table

# Adaptive Management vs Managed Retreat

**Adaptive Management** is about **how** we make decisions. It's a process.

- A flexible, ongoing decision-making process – ideal for uncertainties
- Form a plan for different scenarios (best case, worst case, etc)
- Based on best present knowledge & community aspirations
- Flexible – monitor & change that plan as we learn or as circumstances change (trigger points)

**Managed Retreat**, on the other hand, is a specific option or strategy.

Refers to the decision to move buildings, infrastructure, or people away from areas that are at high risk,



# Management Options

If the erosion continues management options at this site essentially reduce to:

- Holding the line
  - Temporary measures (e.g. to buy time)
  - More permanent measures (i.e. for defined design life/conditions)
- Retreat
  - Managed Retreat
  - Unmanaged retreat (e.g. do nothing)

# Holding the Line – Temporary Options (1)

E.g. Options such as temporary structures or “sand push-ups”

- Not intended to permanently stop erosion but to “buy time”

Given the forces at work & the rapid erosion, even temporary options will be difficult & expensive

On this coast, while the erosion continues, such measures are also likely to have a very short design life

- During pulses of erosion, that design life might be as little as weeks or months (or even less) – probably until the first big storm
- During quieter periods between erosion pulses, might last 1-3 years (i.e. until the when quiet period ends, and the next erosion pulse starts)



# Holding the Line – Temporary Options (2)

Given the difficulties with these options:

- Use them judiciously if they form part of your adaptive plan
  - Only for short-term purposes
  - Ensure they will serve a clear purpose & need, otherwise avoid
    - E.g. May be required to allow relocation of a threatened structure in some cases
- Pick your conditions if you can
  - Will be easier and cheaper and likely last longer in quiet conditions than during an erosion pulse
  - If you must do such work during an erosion pulse, try to pick a period when suitable wave and tide conditions are forecast
- Work quickly to achieve your short-term purpose

# Holding the Line – More Permanent Measure (1)

- i.e. Well-designed and well-constructed measures designed to hold the line for set design conditions or a set design period
- At this site, would likely require a very rigorously engineered sea wall
- Option has significant complications at this site:
  - Very difficult to design with uncertainties around future erosion
    - Would need to be designed for specific design conditions
  - Design life could be very short
    - (e.g. <10-15 years) for worst case scenario at this site
  - Would be very expensive (likely \$15-30k per metre length)

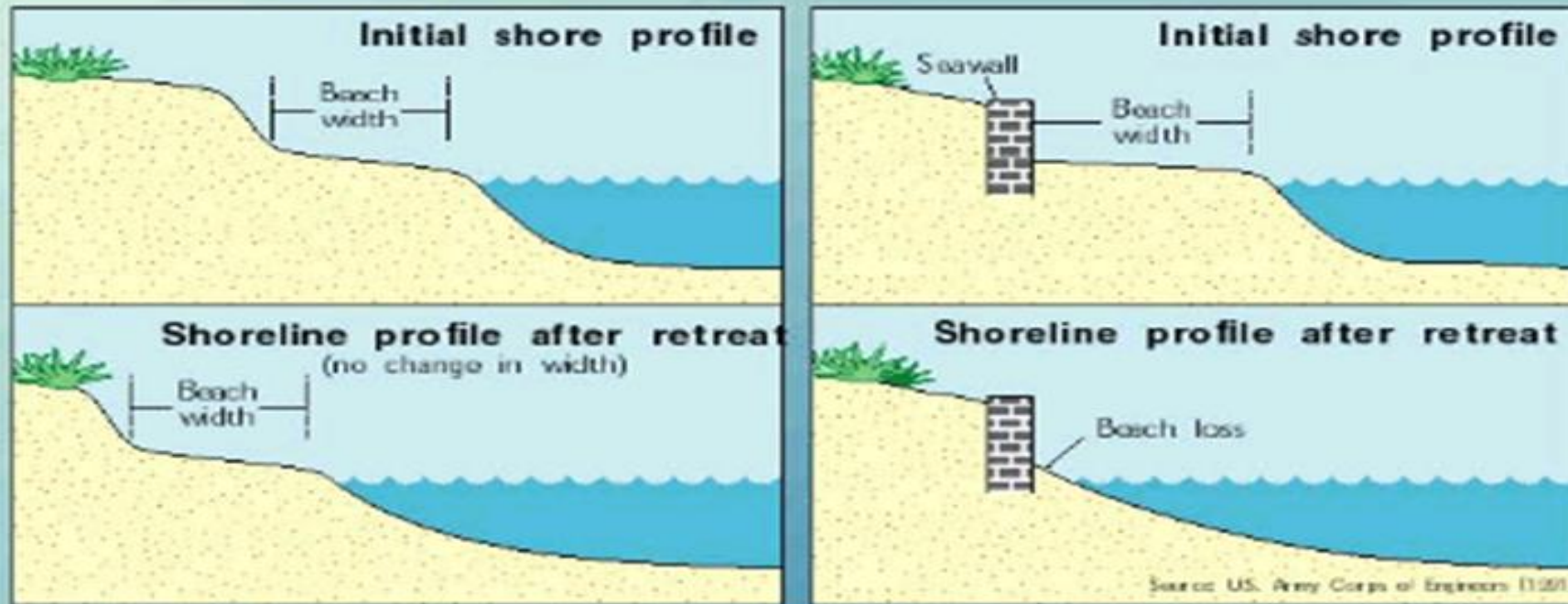


# Holding the Line – More Permanent Measure (2)

- If erosion continued, an engineered seawall would have major adverse environmental effects on the beach
  - Loss of beach width, increasing over time with erosion
  - Significant adverse effects on beach amenity and access, increasing over time
  - Difficult and time-consuming consenting process with no certainty
- Council has ruled this option out for public assets
  - For good reason - the measure would make no sense for the public assets
    - Beach seaward of car park would be increasingly diminished over time
      - Tide against the seawall at higher stages of the tide
      - Beach not exposed until well after high tide, getting worse over time
    - Access from the car park to the beach would become increasingly difficult
      - Maintaining beach accessways over the rocks would eventually be impractical
      - Safety issues for beach users, esp. with waves

# Beach Loss on Eroding Shoreline

## Shoreline Hardening and Beach Loss



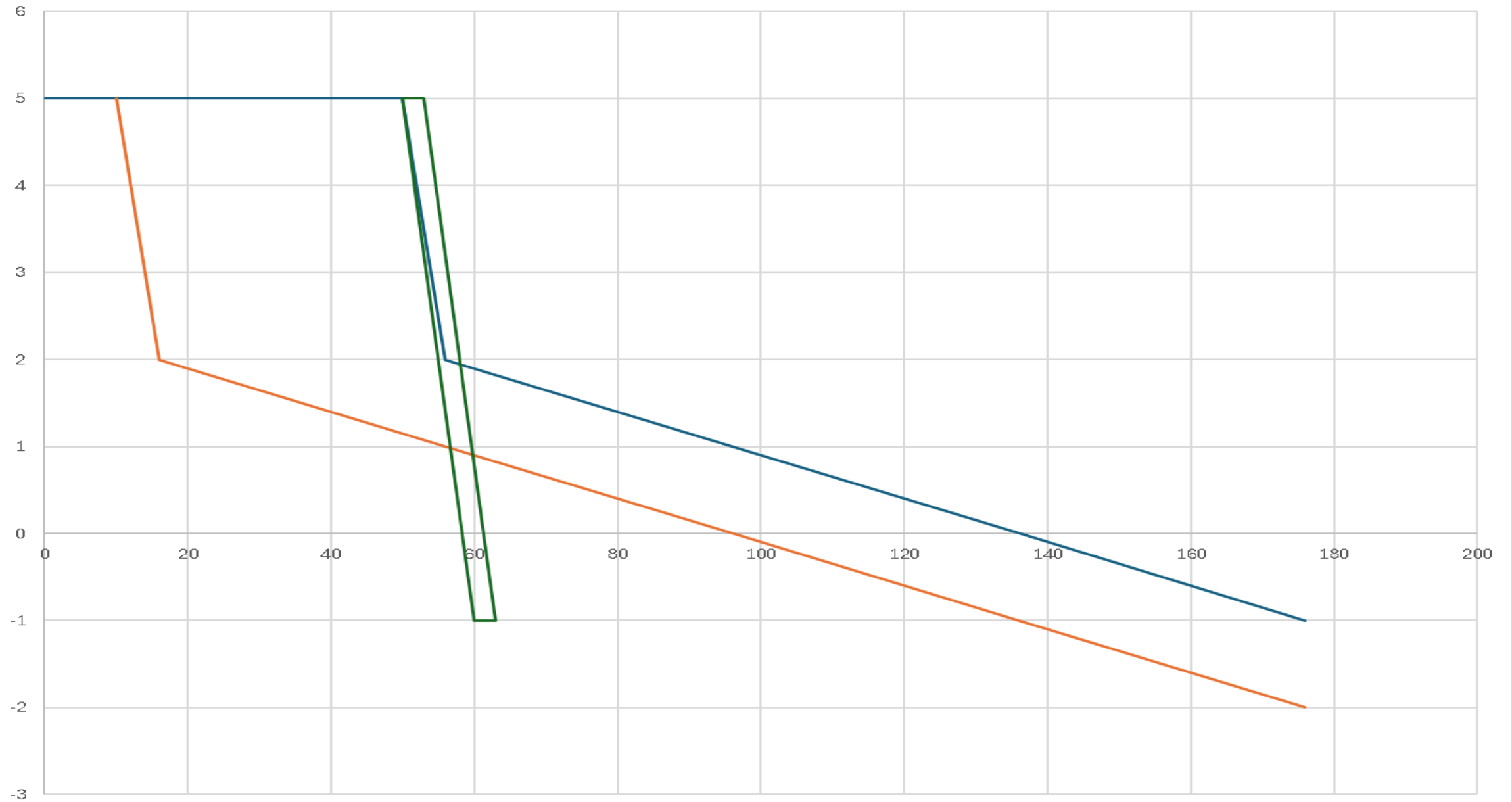
Beaches on chronically eroding shores can maintain their natural width as they slowly retreat landward. Beach loss eventually occurs in front of a seawall where there is chronic erosion.



# Raumati



Example Sketch: Seawall for 5-Year Design: For "Worst Case" Erosion Scenario





# Managed Retreat

Involves relocation of assets away from vulnerable areas

- Not a popular option and usually involves significant challenges
- Usually involves a trigger for implementation, so relocation only occurs if it is necessary
- But can be very effective & increasingly being used (and likely to be very widely used longer term with climate change). BUT guidelines are presently limited

Unfortunately, it is probably the only realistic option at this site when/if erosion continues to the point that public and/or private assets are seriously threatened

Different considerations and complications for public and private assets

# Managed Retreat: Public Assets (1)

Very strong preference for public assets to stay where they are if at all practicable

However, that is becoming increasingly impracticable

- Car park is already marginal
- If erosion continues at the average rate of the last 17 years (i.e. 4m/yr), other assets will likely need to be moved within 5 years
- If erosion markedly slows or stops, it may be practicable to stay – but that looks increasingly unlikely

So, adaptive management plan required fairly urgently

- Need to consider “worst-likely” as well as “best-likely” scenarios



# Managed Retreat: Public Assets (2)

Managed retreat requires a place to go

- At this site, there are viable options for public assets if needed
- Discussed in detail in previous reports and discussions

Main requirement is an agreed adaptive management plan

- Preferred relocation sites identified
  - May vary according to the asset
- Appropriate trigger(s) for relocation identified
  - Needs to allow for practical difficulties, so asset moved in good time
  - Needs to consider potential erosion (monitoring important)
- Any relevant funding and consenting matters (etc) addressed

# Managed Retreat: Private Assets (1)

## Very difficult option for private landowners

- One positive - deep sections that have space for retreat
  - Provides an option while on-site relocation is possible
- But significant complications & costs
  - Relocation costs
  - Some buildings difficult to relocate & may need to be replaced
  - Disruption & rearrangement of services, landscaping, driveways, etc
  - Consenting requirements
  - Often other significant issues for some owners
- So, understandably, owners reluctant to move until it is necessary
- Plus, longer term uncertainties
  - Will relocation solve the problem, or will erosion eventually render incapable of reasonable use?



# Managed Retreat: Private Assets (2)

Council working with landowners to assist as best they can through:

- Updated information on erosion and on setting up monitoring to assist landowner planning (will be able to provide site-specific data)
- Looking at options to simplify/streamline consenting and related requirements to make that process as least time-consuming & costly as possible
- Steering group to work through issues with landowners & assist with adaptive planning
- Discussions with landowners and other parties (e.g. central & regional government) re longer term uncertainties & potential assistance
  - What happens if reasonable use of the properties eventually becomes impractical?
  - What assistance will be practicable? (e.g. compensation?, buy-outs? land exchange? other?)
  - Some national guidance developed for earthquakes, flooding & debris flows but not yet for managed retreat associated with coastal erosion

# Summary

- Very complex & difficult issue – overall, probably the most difficult coastal erosion issue in NZ at present.
- Very high energy coastline experiencing large-scale & rapid shoreline retreat
  - Shoreline has retreated by over 70m since 2008/11 and is still retreating rapidly.
- Uncertainty around future erosion – but present data suggests two possible & different future scenarios:
  - “Worst Case” - Erosion continues as in past at an average rate of 4m/yr, occurring in pulses with up to 20-25 m in 2 years possible
  - “Best Case” - Erosion slows, but still a further 18-20m+ erosion likely before 2050
  - While better outcomes might occur, there is presently no firm evidence that this is likely
- If the erosion continues it poses significant risk to both public and private assets
  - Some public and private have already been significantly impacted
- If severe erosion continues, the only option is likely to be managed retreat.
  - This options presents complex issues for both public and private assets which will need to be addressed and resolved
- The uncertainties around future erosion and the complexities require an adaptive management approach and a partnership approach