SHOREWISE
ENGINEERING CONSULTANTS

PRELIMINARY DESIGN REPORT

FOR PROPOSED WAIPIRO BAY MARINA

Azuma
Property

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Contents

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Revision 0	Rob Brown	30-01-2025
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Revision 2	Rob Brown	11-03-2025

1) INTRODUCTION

Azuma Property are seeking to develop a new marina of approximately 200 to 250 berths in Waipiro Bay, in the Bay of Islands.

The marina will service the demand for vessels in the 13m to 50m size range and will be well positioned in the outer Bay of Islands.

The proposed site is located in a bay used for swing moorings and sheltered anchorage, the proposed location is in the shallower part of the bay that is only useable by smaller vessels.

The proposed site is adjacent to existing coastal wharf and pontoon infrastructure.

Site Locality

2) ABBREVIATIONS

The following abbreviations have been used in the report, or in reports in the appendices:

Abbreviation	Meaning	Description
CMA	Coastal marine area	Coastal waters beyond mean high water springs
SLR	Sea level rise	Amount sea level is expected to rise above current levels.
VLM	Vertical land moment.	Amount land is expected to move below current levels.
HAT	Highest astronomical tide	Highest recorded water level
MHWS	Mean high water springs	Average high tide level during spring tides
MSL	Mean sea level	
MLWS	Mean low water springs	Average low tide level during spring tides
LAT	Lowest astronomical tide	Lowest recorded water level
CD	Chart datum	Chart datum height as advised by LINZ
NZVD	New Zealand vertical datum	Vertical Datum
Hs	Significant wave height	Average of top 1/3 waves in a wave group
Hmo	Spectral wave height	= Hs
Hmax	Maximum wave height	= 1.86 x Hs
Tp	Peak wave period	
Ct	Coefficient of transmission	Transmission coefficient under a wave attenuator
Ht	Height of transmitted wave	Wave transmitted under a wave attenuator
L	Wave length	
D	Water depth	
d	Attenuator draft	
WBM	Waipiro Bay Marina	
T & T	Tonkin and Taylor	
SWAN	Simulating waves near shore	Numerical model for simulation of waves
ULS	Ultimate Limit State	Peak loads the part is to be designed for
SLS	Serviceability Limit State	More frequent loads the part is to be designed for

3) SITE DESCRIPTION

Waipiro Bay is a sheltered bay within Parekura Bay. The southeastern side of Waipiro Bay is a designated small craft mooring area with approximately fifty five swing moorings for vessels from 5m length up to 22.5m length, the swing moorings closest to the marina are generally for 10 – 15m vessels.

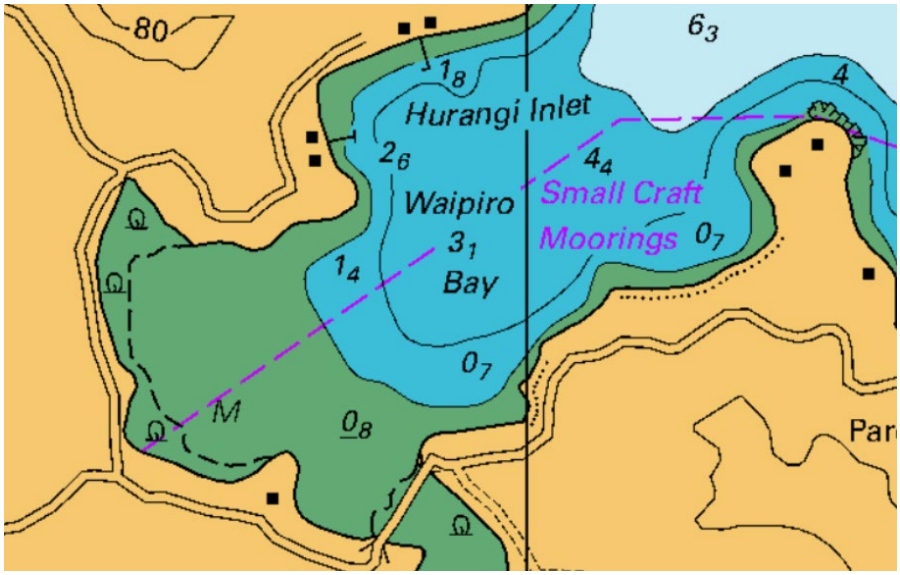
The adjacent Huirangi Inlet has boat ramps, timber jetties and concrete pontoons for the berthage of vessels up to 25 metres in length.

The surroundings are native bush with a mix of residential dwellings, mixed use boat shed structures and some farmland.

4) SEABED DEPTHS

The existing water depths within Waipiro Bay are approx. CD-4m at the outer edge to CD + 1m at the landside, the seabed profile is to be confirmed by a seabed survey.

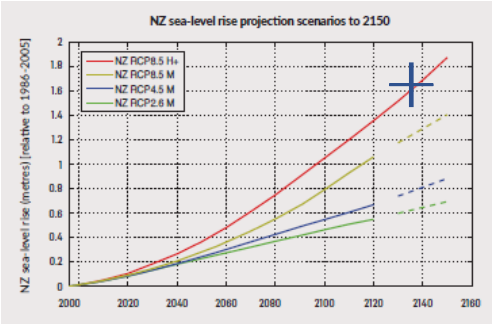
Dredging works will be required to achieve suitable water depths within the marina, refer to section 22 for further dredging information.



5) COASTAL HAZARDS

Coastal hazard responses are controlled by guidance under the New Zealand Coastal Policy statement, as well as the coastal hazards and climate change Guidance by the Ministry for the Environment.

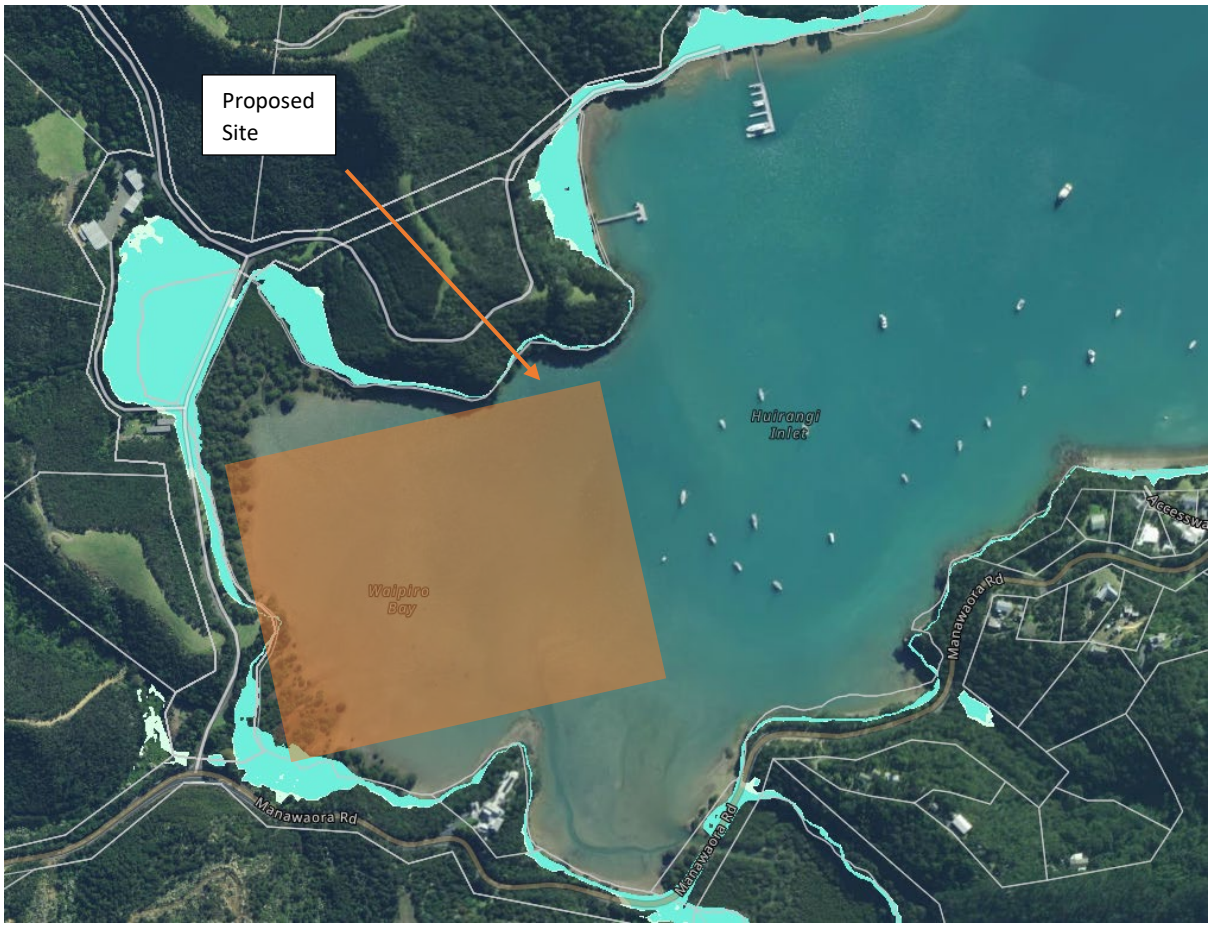
The proposed reclamation is classified as Category A Coastal Developments to the Ministry for the Environment Guidelines. The minimum value for sea level rise to be considered is 1.6 metres for land use planning controls (100 Year period). A lower level of sea level rise can be considered in relation to the durable life of the proposed marina, being a maximum 50 Years.



6) NRC GIS MAP INFORMATION

The NRC GIS maps show that it is mostly the low lying edges of the proposed development area that are affected by coastal hazards. The existing entry road is unaffected.

The site is not at risk of any coastal erosion, due to its sheltered location.



Coastal Flood Hazard Zone 2 (100 years)

Coastal Flood Hazard Zone 2 (100 years)

Coastal Flood Hazard Zone 3 (100 years + Rapid Sea Level Rise Scenario)

Coastal Flood Hazard Zone 3 (100 years + Rapid SLR Scenario)

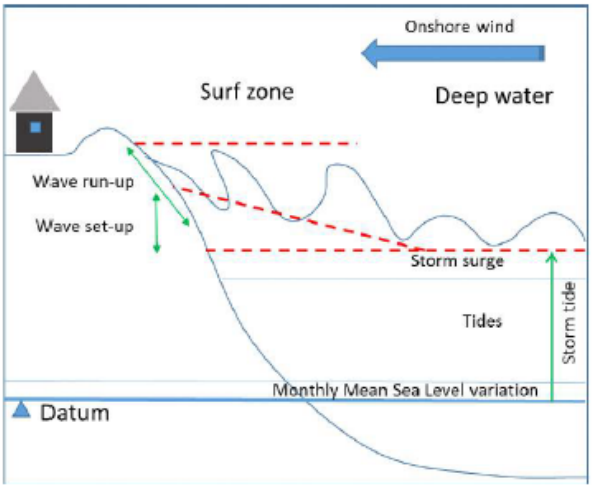
The river hazards are mapped as just affecting the start of the entry road into the site in the River Flood Hazard Zone 100 yr CC event, this road is unlikely to be affected as it has been fully developed as part of the previous subdivision process for the site.

All other areas shown as subject to flooding are directly adjacent and directly draining to the CMA, therefore they may be inundated occasionally but are not flood prone.

7) COASTAL INUNDATION

Coastal inundation is caused by several contributing features, namely extreme high tides coupled with wind setup and storm waves caused by the wind blowing over a given fetch for an extended duration, if the foreshore in front of the property has a sloping seabed that will cause the waves to run up. Wind setup is caused by the wind forcing the water to the land and further elevating the water levels.

As the coastal areas become exposed to sea level rise the annual probability of extreme events occurring increases, and so extreme events occur more frequently which will increase the frequency of inundation.



Schematic illustrating the processes that contribute to coastal inundation.

These coastal inundation areas have been reported on by Tonkin and Taylor for the Northland Regional Council in a report entitled Coastal Flood Hazard Zones for Northland Region (2021).

The Tonkin and Taylor coastal inundation values for Parekura Bay are:

Water level (NZVD 2016)	50 Yr ARI	100 Yr ARI	200 Yr ARI
Storm Tide	1.4m	1.4m	1.5m
Static inundation level	1.6m	1.6m	1.6m
Dynamic inundation level			

The Tonkin and Taylor Coastal Flood Hazard Zone values for Parekura Bay are:

Water level (NZVD 2016)	CFHZ 0	CFHZ 1 (incl 0.6m SLR)	CFHZ 2 (incl 1.2m SLR)	CFHZ 3 (incl 1.5m SLR)
Parekura Bay	1.6m	2.2m	2.8m	3.1

Refer to section 14 for site specific inundation levels.

8) SEA LEVEL RISE

Climate change is predicted to accelerate the rate of sea level rise into the future. The level of predicted sea level rise depends on a number of socio-economic assumptions and predictions vary widely depending on which path is taken.

The NRC refers to Coastal Flood Hazard Zones (CFHZs) which correspond approximately to the respective Representative Concentration Pathways (RCPs) and Shared Socio-economic Pathways (SSPs), as defined by the Ministry for Environment. These values are set from an average MSL baseline in 2000.

The NZSeaRise research program released updated values for the SSP scenarios in 2022 in conjunction with interim MfE guidance (*Ministry for the Environment: Interim Guidance on the use of new sea level rise projections (August 2022)).* These values also include vertical land movement (VML) in their projections.

NZSeaRise projections in searire.takiwa.co also show 'likely ranges' of uncertainty about the median or p50 (50th percentile), spanning the 17th and 83rd percentiles).

The recommended SSP scenarios to use for planning use median (p50) projections.

The highest CFHZ3 projection corresponding to the SSP5-8.5 H+ scenario uses the 83rd percentile (p83) of SSP5-8.5. It should be noted that this is the 'worst case' scenario and has a low probability of occurrence.

Referencing the NZ SeaRise online projections for site 453, and assuming the same CFHZ categorizations apply:

CFHZ	**Scenario** (Excluding. VLM)	**Projection to year** (medium confidence)	**Sea Level Rise**	**Vertical Land Movement**
CFHZ1	SSP5-8.5M (50rd Percentile)	2080	0.58m	0.09m
CFHZ2	SSP5-8.5M (50th Percentile)	2130	1.25m	0.15m
CFHZ3	SSP5-8.5H+ (83rd Percentile)	2130	1.72m	0.3m

Refer to section 14 for site specific inundation levels.

9) IMPORTANCE LEVELS AND WIND SPEEDS SELECTED

Marina structures generally have a 40 year durable life and are designed to a 50 year life for loads.

Marina facilities are classed as importance level 2 structures to AS/NZS 1170.2.

This also agrees with the recommendations in AS4997 Table 5.4.

ANNUAL PROBABILITY OF EXCEEDANCE OF DESIGN WAVE EVENTS

Function category	Category description	Design working life (years)			
		5 or less (temporary works)	25 (small craft facilities)	50 (normal maritime structures)	100 or more (special structures/ residential developments)
1	Structures presenting a low degree of hazard to life or property	1/20	1/50	1/200	1/500
2	Normal structures	1/50	1/200	1/500	1/1000
3	High property value or high risk to people	1/100	1/500	1/1000	1/2000

The reclamation is to be designed using ULS wind speeds of 46 m/s V_{1000} for the reclamation wave exposure, 45 m/s V_{500} for the marina wave exposure with a 50-year return period and SLS wind speeds 37 m/s V_{10} for a 50-year return period, sourced from AS/NZS 1170.2 for the purposes of compliance with the building code, each wind speed has a 10% probability of exceedance.

Terrain category multipliers have been selected as per table 4.1 AS/NZS 1170.2 for a height of 3 metres or less for evaluating wind loads. Terrain Category 1.5 has been used for all fetches.

Regional wind direction multipliers have been selected as per table 3.2 AS/NZS 1170.2.

Refer to section 13 for site specific wave exposure.

10) SURVEY AND WATER LEVELS

SURVEY LEVELS

Levels are relative to survey mark C8ED at RussellL with the following levels provided by the LINZ database have been used to establish the CD to NZVD offset:

Height Chart Datum	Height NZVD 2016	Height OTP Datum
4.118m	2.56m	2.632m
Offset	1.558m	1.486m

WATER LEVELS

Water level data from the Nautical Almanac and LINZ for the nearest site at Roberton Island:

Tide Level	Height Chart Datum	Height NZVD 2016
Highest Astronomical tide (HAT)	2.69m	1.102m
Mean High Water Springs (MHWS)	2.5m	0.942m
Mean Low Water Springs (MLWS)	0.40m	-1.158m
Lowest Astronomical tide (LAT)	0.28m	-1.278m

11) FETCH EXPOSURE

The proposed site for Waipiro Bay Marina is within Parekura Bay and is relatively sheltered, the entrance into the Bay does allow for some wave energy from ocean swells and waves generated in the outer Bay of Islands by the larger wind fetches to enter the site.

The following scenarios have been checked:

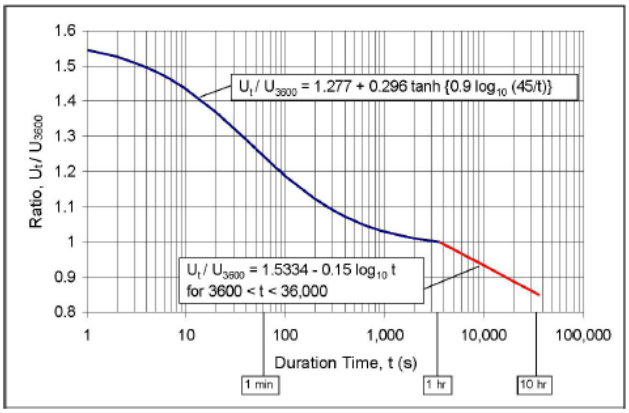
1) Northerly ocean swells entering the Bay of Islands then transforming with some minor wave energy entering Parekura Bay through the entrance, this wave energy will result in a low level wave acting as more of a surge within Waipiro bay.
2) Northwest to Northeast waves generated in the outer Bay of Islands from Moturua Island to Urupukapuka Island and then transforming as part of the wave energy enters Parekura Bay.
3) Fetch generated waves within Parekura Bay, generally from the northeast to east direction.

Wind speeds that are supplied in AS/NZS 1170.2 are stated for 3 second gusts at heights of 10 metres, corrections are required for the wind duration and the height near water level.

Wind speeds are corrected for the duration of wind required by calculating the time required for the waves to become fetch limited using the relationship.

$$t_{x,u} = 77.23 \frac{X^{0.67}}{u^{0.34} g^{0.33}}$$

The wind speed is corrected down from the 3 second gust to the sustained wind speed required for the waves to become fetch limited by the factor R_D. The factor R_D is calculated using the wind speed ratio relationship shown below:



Wind speeds reduce with height from the water surface due to the shear stresses that act between the wind and the water surface, the wind speeds are corrected for height using a factor $M_{Z, CAT}$ for 3 metres above the surface from AS/NZS 1170.2.

The winds that are of concern are those acting for a long enough duration for the waves to become fetch limited, if the wind acts over the fetch for a shorter duration, then a duration limited condition exists, and the wave heights will be less than the maximum predicted.

Terrain category 1.5 as per AS/NZS 1170.2 is used for the roughness values for prediction the waves within a fetch limited environment, as per the guidance in AS3962 and NZS1170.2

Refer to section 13 for site wave exposure.

12) WAVE PREDICTION METHODS

These steady sustained wind speeds, and fetch distance are used to calculate the expected wave period, wave height and wavelength using the relationships.

$$\frac{gH_{m_0}}{u_*^2} = 4.13\times10^{-2}\left(\frac{gX}{u_*^2}\right)^{\frac{1}{2}}$$

$$\frac{gT_p}{u_*} = 0.651\left(\frac{gX}{u_*^2}\right)^{\frac{1}{3}}$$

Wave heights have been predicted using the JONSWAP theory which predicts the spectral density of the wave field and predicts the Hmo wave height based on the maximum energy density.

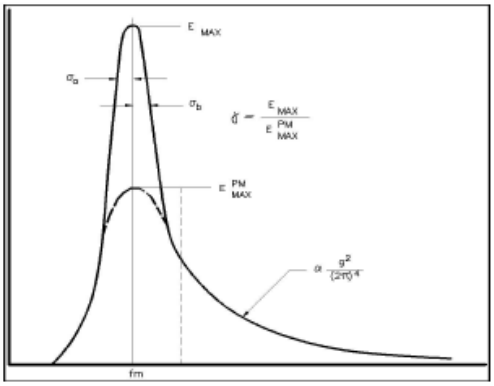


Figure II-2-22. Definition of JONSWAP parameters for spectral shape.

Hmo waves predictions are the equivalent of Hs wave predictions and are the mean of the top 1/3 of wave heights within a wave group.

Maximum wave heights Hmax are calculated by the relationship Hmax = 1.86 Hs.

13) WAVE ENVIRONMENT

The site generally has a moderate exposure to fetches that can generate infra gravity waves. The waves that are expected at the outer edge of the site at the 50m and 35m berths for Annual, 50 year and 100 year storm events are:

Fetch Direction	Fetch (m)	Annual Storm V_{10} Significant wave height Hs (m)	50 Year Storm V_{500} Significant wave height Hs (m)	100 Year Storm V_{1000} Significant wave height Hs (m)	Maximum Wave length (m)	Direction
Northwest Ocean Swell			0.4	0.6	100	Head Seas
Northeast Outer BOI Fetch	3000	0.15	0.25	0.35	7.0	Head Seas
Northeast Local Fetch	1900	0.5	0.7	0.8	6.0	Head Seas

Table 4.2 of AS 3962 describes the criteria for a good wave climate in small craft harbours as below:

CRITERIA FOR A 'GOOD' WAVE CLIMATE IN SMALL CRAFT HARBOURS

Direction and peak period of design harbour wave	Significant wave height (H_s)	
	Wave event exceeded once in 50 years	Wave event exceeded once a year
Head seas less than 2 s	Conditions not likely to occur during this event	Less than 0.3 m wave height
Head seas greater than 2 s	Less than 0.6 m wave height	Less than 0.3 m wave height
Oblique seas greater than 2s	Less than 0.4 m	Less than 0.3 m wave height
Beam seas less than 2 s	Conditions not likely to occur during this event	Less than 0.3 m wave height
Beams seas greater than 2 s	Less than 0.25 m wave height	Less than 0.15 m wave height

NOTE: For criteria for an 'excellent' wave climate multiply wave height by 0.75, and for a 'moderate' wave climate multiply wave height by 1.25. For vessels of less than 20 m in length, the most severe wave climate should satisfy moderate conditions. For vessels larger than 20 m in length, the wave climate may be more severe.

The outer berths at 35m and 50m will likely be subject to an occasional northeast local fetch storm wave environment that exceeds the recommended wave environment for vessels less than 20m, a more severe wave environment is allowable for vessels exceeding 20m in length, therefore the wave environment is likely to be suitable for the outer berths.

The outer pontoons and reclamation will attenuate the waves such that a wave environment can be provided that complies with the requirements of AS3962-2020 for vessels of 20m or less, therefore the wave environment is likely to be suitable for the inner berths.

The wave climate at the site is to be confirmed by a full wave hindcast model prior to detailed design. The waves at the inner marina are to be confirmed by modelling and wave attenuation analysis.

14) MINIMUM SITE LEVELS

The inundation levels calculated from first principles are:

Component	50 Yr ARI (2% AEP)	100 Yr ARI (1% AEP)
Highest Astronomical tide (HAT)	2.69m	
Mean High Water Springs (MHWS)		2.5m
Sea Level Rise	0.6m	1.6m
Vertical Land Movement (VLM)	0.1m	0.2m
Half Wave Height	0.35m	0.4m
Wind Setup	0.05m	0.1m
Inundation Level Chart Datum	3.79m	4.8m
Inundation Level NZVD 2016	2.23m	3.24m

The minimum pile levels calculated from first principles are:

Component	50 Yr ARI (2% AEP)
Inundation Level Chart Datum	3.79m
Pontoon Freeboard	0.6m
Minimum Pile Freeboard	1.0m
Minimum Pile Top Level CD	5.4m
Minimum Pile Top Level NZVD	3.84m

The minimum levels required for the site are:

Level	Chart Datum
Marina Piles (top of pile)	5.4m
Reclamation Carpark (0.1m freeboard)	4.9m
Reclamation Buildings (0.5m freeboard)	5.3m

15) TSUNAMI RISK

The proposed site is mapped as a Tsunami evacuation zone, the site is within close walking distance of elevated platforms on the adjacent hills should the need occur to evacuate the property due to Tsunami risk.

Tsunami Hazard Zones (Northland CDEM)

Shore Evacuation Zone

RED ZONE is the coastline, this zone must be evacuated in response to a 0.2-1 metre wave height. Flooding of land near the shore is not expected

Tsunami Evacuation Zones

ORANGE ZONE matches the 1.5 metre wave height. A threat of coastal flooding near the shoreline exists. For this threat, BOTH red and orange zones must be evacuated

YELLOW ZONE is the worst case scenario. For this threat, ALL zones (red, orange and yellow) must be evacuated

SAFE AREA If driving, keep going once out of the evacuation zones to allow room for others

The effects of Tsunami on the marina are to be assessed at detailed design including pile heights and pile strengths for the expected waves.

16) DESIGN STANDARDS

The following design standards are to be used to evaluate the environmental and wave loads for the marina and reclamation.

Required	Standard
Importance Levels	AS/NZS 1170.0
Wind Speeds	AS/NZS 1170.2
Wind speed Reductions	AS/NZS 1170.2, CEM, AS3962
Wave loads	Coastal Engineering manual (CEM) PIANC floating Breakwater report
Load Combinations	AS3962, AS/NZS 1170.1
Pile Capacity	NZS 3404
Pile Corrosion rates	SNZTS 3404 / AS 2159
Pile Design	NZBC B1/VM4

17) DESIGN CRITERIA

The following design criteria shall be used for the marina detailed design:

Design for	Criteria
Design Life	50 Years
Durable Life	40 Years
Importance Level	2
Pile Loads	Weekly (V_1), Annual (V_{10}), 50 Year (V_{500}) Note: Check for extreme storm waves up to 100 Year event (survival mode)

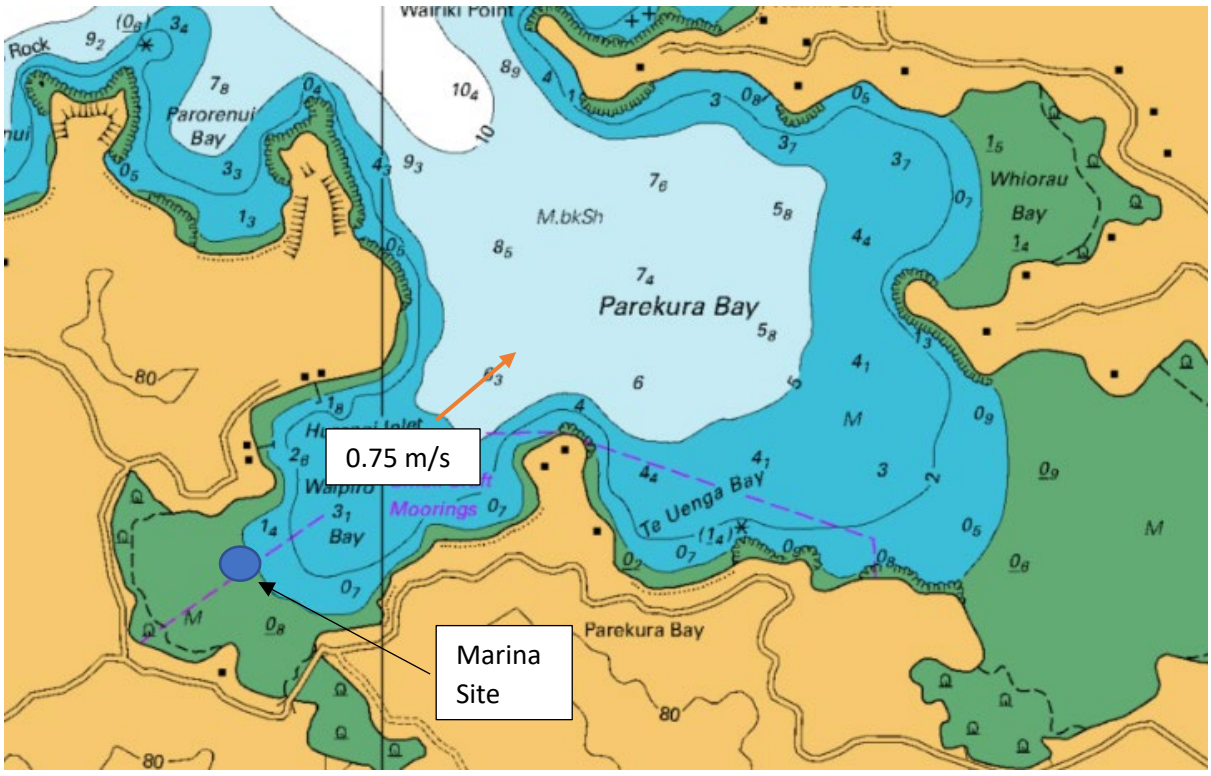
18) TIDAL CURRENTS

Peak spring tidal velocities within the Bay of Islands are in the order of 0.5 to 1.5 m/s with neap tide velocities around half of these values. As Parekura Bay, and more specifically Waipiro Bay is fairly detached from the main channel tidal currents, the main currents in and out of the marina will be limited to the water moving in and out of Waipiro Bay, the bay is quite shallow and of limited volume.

The effect of the tidal currents on the vessels and marina will be limited due to the flows being bow on to the vessels and marina fingers.

Peak tidal currents within Waipiro Bay should be measured prior to detailed design, noting that the peak currents will decrease with the increase in water depth within the Bay.

In the absence of direct peak tidal velocity measurement, a nominal current velocity of 0.75 m/s is to be allowed for in the marina design.



General incoming tide movement patterns

19) GEOLOGY

The Geotechnical map of the Russell area by GNS Science published on the GNS website identifies the site as Greywacke of the Waipapa group, and described as *Massive to thin bedded, lithic volcaniclastic metasandstone and argillite, with tectonically enclosed basalt, chert and siliceous.*

The description is consistent with the underlying soils identified at the site and our visual inspections of the site and its surrounds.

20) GEOTECHNICAL DESIGN PARAMATERS

A geotechnical investigation is to be undertaken at the site to determine the reclamation and marina design parameters.

This office has undertaken site investigation works for marina piling at the adjacent structures in Huirangi Inlet, the ground conditions have generally been a layer of soft marine sediments of limited thickness at the shore end and becoming deeper with further distance into the Bay.

The following ground conditions are expected at the site and are to be confirmed by a full site investigation:

Unit 1: Silty Gravels

Unit 2: Stiff Clays, weathered Greywacke

Unit No	Soil Description	Top of unit	Layer Thickness range (m)	Su (kPa)
1	Soft silty gravels	0m	0.5m to 5.0m	5 - 15
2a	Firm to stiff silty clay	0.5m to 5.5m	1.0m to 3.0m	50 - 75
2b	Stiff clay	1.5m to 8.5m		100 +

Refer to the geotechnical engineers report for further information.

21) MARINA PILES

The marina piles will be constructed with steel pipe or H6 treated Pine and will be designed for 50 yr wind event loads, or any other worst case loading.

All piles will be protected by polyethylene sleeves to prevent corrosion of the steel piles and marine pest invasion into the timber piles.

The polyethylene sleeves will be embedded a minimum 1.5 metres into a soft seabed and sealed at the top with a welded polyethylene cap. The gap between the steel piles and the polyethylene sleeve will be the minimum required for installation to prevent corrosion in the gap. The gap between the polyethylene sleeves and timber piles will be be filled with a fine gravel mix and densified.

The steel piles will be designed for a 50 year life with an allowance for mild corrosion below the seabed of 0.015mm/ year to the inside and outside faces of the piles, below the mudline.

The piles are expected to be driven into the seabed, some may require to be drilled and driven if hard Greywacke rock is encountered. The effects on the seabed are expected to be minor and limited to the construction period only. Any sediment associated with pile drilling will be very localised and will disburse quickly.

The piles will allow the free passage of fish through the water and the free movement of marine creatures across the seabed

22) DREDGING

Dredging will be required at the site to provide a suitable depth for vessel mooring and a suitable base for the reclamation. The site will need to be dredged up to 3 metres in depth. The preliminary expected dredge volume is 250,000 m^3 to 350,000 m^3 and is subject to confirmation after a seabed survey of the site is completed and the geotechnical investigation is completed to confirm the depth to a suitable reclamation base.

The site will be dredged by a barge mounted excavator. Silt curtains and sediment monitoring will be used to ensure the water quality meets the consent level requirements.

The dredgings are likely to be either partially or wholly reused by adding cement to form 'mudcrete' for use in forming the buttress batters around the perimeter of the reclamation, or the reclamation itself.

Any excess dredging material is expected to be completely uncontaminated and suitable for use in filling low areas in the adjacent land sites.

The dredgings will be transferred to land by means of a mud bin mounted at the edge of the site and used to partially dewater the dredgings. The dredgings will be transferred by a tip truck with a sealed tail gate.

23) RECLAMATION

The proposed reclamation will have a top level of CD +5m, approx. 2.5m above the MHWS level. Based on a dredged depth of CD -2m the reclamation fill depth is likely to be approx. 7 metres. The proposed reclamation area is approximately 3.5 to 4.0 hectares with an estimated fill volume of 250,000 m^3 to 350,000m^3. The reclamation fill is likely to be made up of the site dredgings stabilized with cement to form 'mudcrete' as well as some quarry run type hardfill materials. The reclamation arrangement is subject to detailed design.

24) HYDROLOGICAL EFFECTS

The marina piles will allow the free passage of fish and marine creatures and will not modify the movement of water within the bay. The effects of the piles on water movement are expected to be less than minor.

The installation of the reclamation will modify the movement of water within the existing shallow areas of the bay, this effect will however be offset by the dredging works that will increase the cross sectional area at the marina entrance. The effects of the reclamation on the waterflow are expected to be minor, the actual effects are to be determined at the detailed design stage

25) SEABED OCCUPATION AREA

The seabed occupation area of the marina will be approximately 12 – 13 hectares, including the access fairway, dependent on the final design.

26) VESSEL SERVICING

Vessel servicing will be limited to in water maintenance activities at the site, vessels will need to travel to another site to access haul out facilities and vessel workshop facilities.

27) POWER SUPPLY TO THE SITE

Power is available from the overhead power lines on the main network at Manawaora Road, upgrades to the power supply into the site and an additional transformer may be required.

Alternative power supply options such as solar power are likely to be incorporated into the development.

28) STORM WATER MANAGEMENT

Storm water will be collected for reuse where possible.

The rainwater from the building roof areas are expected to be collected for use on site.

Stormwater from the carpark collection surfaces will be filtered and managed through rain gardens or stormwater filters.

29) WATER SUPPLY

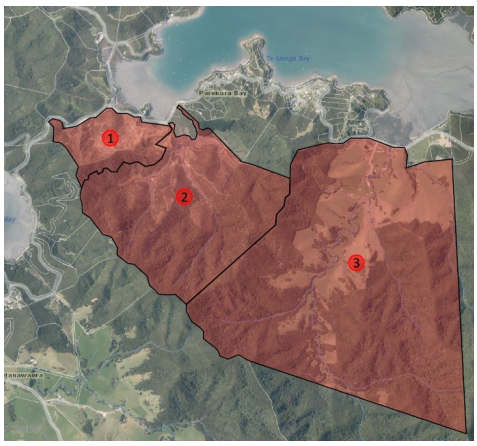
Drinkable potable water is to be supplied to the proposed reclamation buildings and marina.

The water supply will need to comply with the Water Services (Drinking Water Standards for New Zealand) Regulations 2022.

The water supply is likely to be sourced from one of the following, or a combination:

1) Roof water from the reclamation buildings
2) Water bore installed on the site or adjacent land sites owned by Bentzen Farms Ltd
3) Dam and water catchment formed on the adjacent land sites owned by Bentzen Farms Ltd

There is up to 560 hectares available to be able to establish the water supply, if required. Please refer to the appendices for details of the adjacent land.



30) FIRE FIGHTING WATER SUPPLY

Firefighting water supply is expected to be supplied by portable saltwater firefighting pumps. A full fire management plan is to be developed with and approved by Fire and Emergency New Zealand (FENZ).

31) WASTE WATER DISPOSAL

Wastewater will be generated at the proposed site from the following:

1) Bathroom facilities in the proposed reclamation buildings
2) Marina facilities such as bathrooms, showers, and laundry in the proposed marina building
3) Wastewater tank pump out facilities for the marina vessels.

The wastewater is most likely to be collected into a common wastewater tank and then pumped via a private rising main to a communal wastewater disposal field on land, this is likely to be established on the land adjacent to the site, or the neighboring land as per the water supply.

Grey water will be separated from the black water where possible for reuse on the site for the watering of gardens and other suitable activities.

32) CONCLUSIONS AND RECOMMENDATIONS

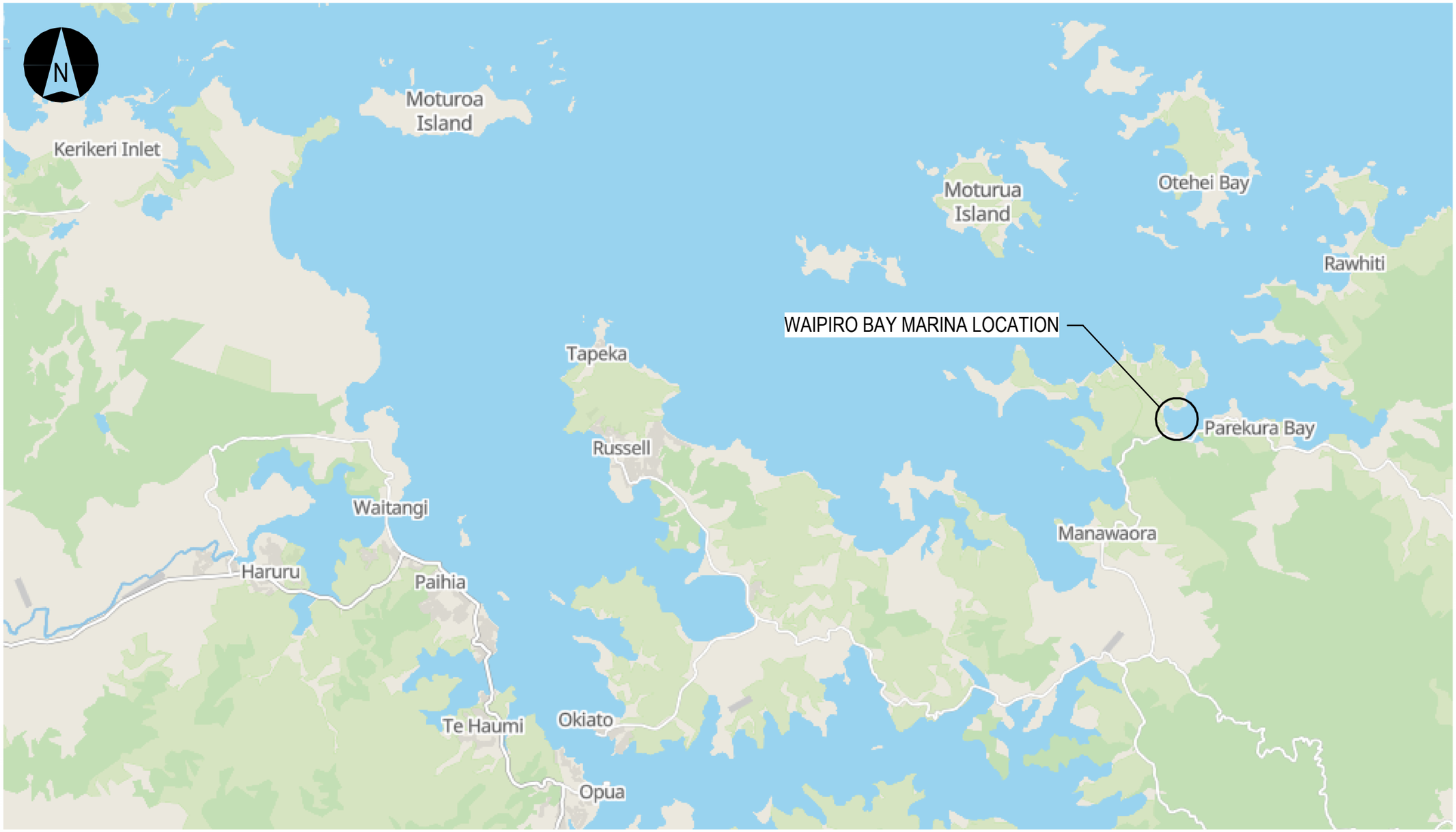
1. The proposed site is relatively sheltered and well suited to providing marina facilities, in an established vessel mooring area.
2. The proposed layout will be able to provide a wave climate that complies with the requirements of AS3962-2020 moderate wave climate for the inner marina.
3. The larger 50m and 35m vessels on the outer part of the marina will be suited to a slightly more severe wave climate in specific storm conditions.
4. The effects on the existing swing moorings within the Bay are expected to be minor.
5. Significant dredging will be required to form the marina basin, the effects of the activity can be managed though standard silt control procedures. The effects on the surrounding bay are expected to be minimal due to the very soft upper seabed that exists at the site.
6. Significant filling will be required to form the proposed reclamation, the construction effects can be managed through standard construction management techniques.
7. The hydrological effects within the bay are expected to be minor, or less than minor. The hydrological effects are to be confirmed at detailed design.
8. The required services and facilities are able to be provided at the proposed site.
9. The proposal is subject to a full detailed site investigation and detailed design.

Prepared By:
Rob Brown

Chartered Professional Engineer (Civil/Structural)
CPEng, CMEngNZ, IntPE(NZ)

APPENDIX A – PRELIMINARY SITE PLAN

WAIPIRO BAY MARINA



Filename:

Plot Date: 29/01/2025 9:36:14 PM

Azuma

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www.shorewise.co.nz

PROJECT NO.	SHEET NO.	SHT	STATUS
25-005	00	A3	PRELIMINARY

Filename:

Plot Date: 26/02/2025 7:38:33 PM

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CLIENT

Azuma

REV	DETAILS	DATE
A	PRELIMINARY FOR REVIEW	30.01.2025
B	RE-ISSUED FOR REVIEW	26.02.2025
C	RE-ISSUED FOR REVIEW	27.02.2025

PROJECT

WAIPIRO BAY MARINA

SHEET DESCRIPTION

GENERAL ARRANGEMENT

STATUS

PRELIMINARY

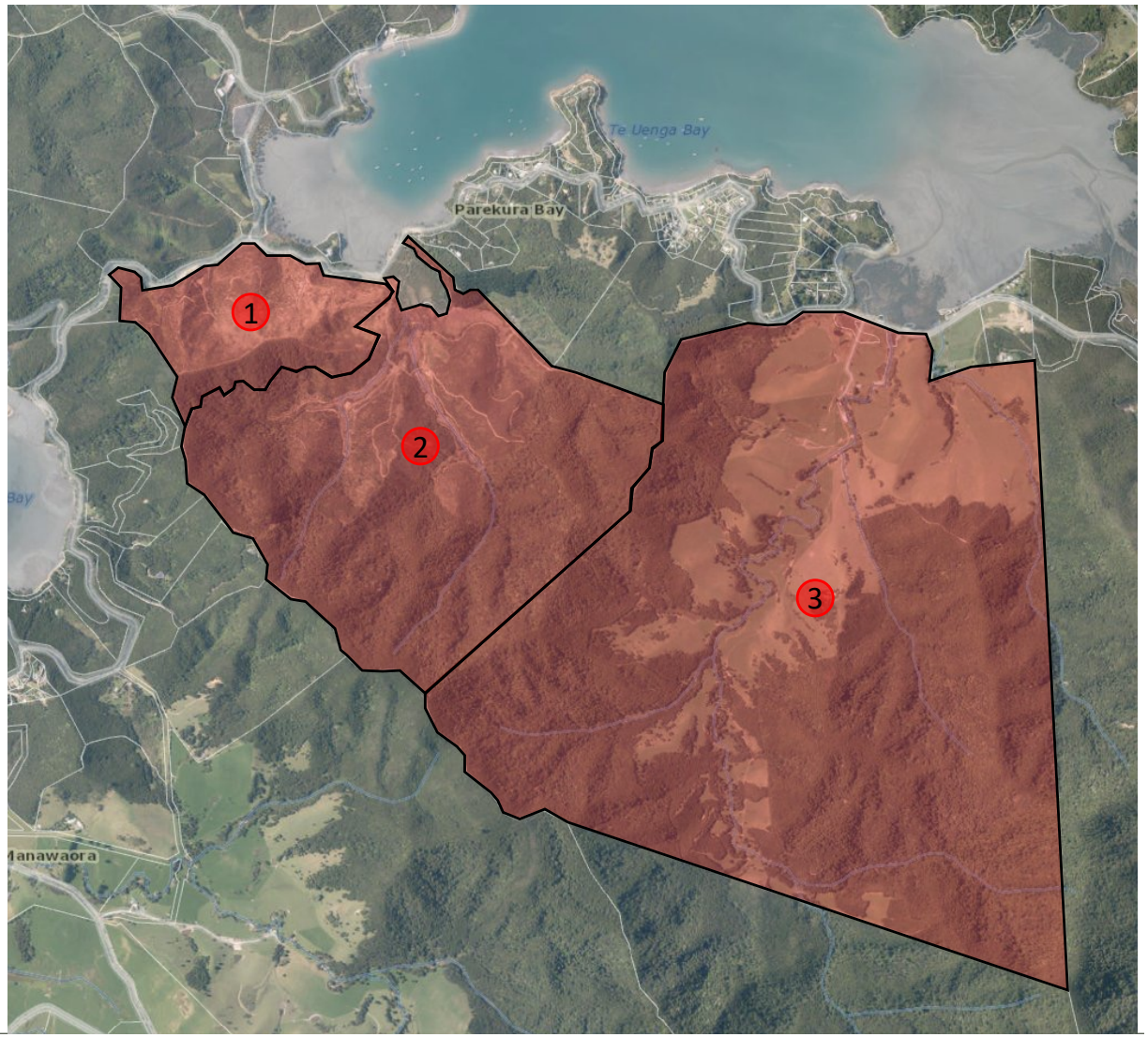
DRAWN BY	APPROVED BY	SHT
GD	RB	A3
PROJECT NO.	**SHEET NO.**	**REV**
25-005	01	C

APPENDIX B – ADJACENT LAND SITE DETAILS

Adjacent Property

Titles

No	Name	Size (ha)	Notes
1	Harbourside	36.18	Northern most title. Heavy contour all with good views of the Bay of Islands. Regenerating bush.
2	Bush	152.00	Predominantly native bush with fingers of regenerating bush. Good northern aspect and multiple waterways.
3	Valley	373.51	The working farm. Approx 50/50 pasture and native bush. Good aspect, however lacking in views.
3 titles		**561.69**	



Azuma Property

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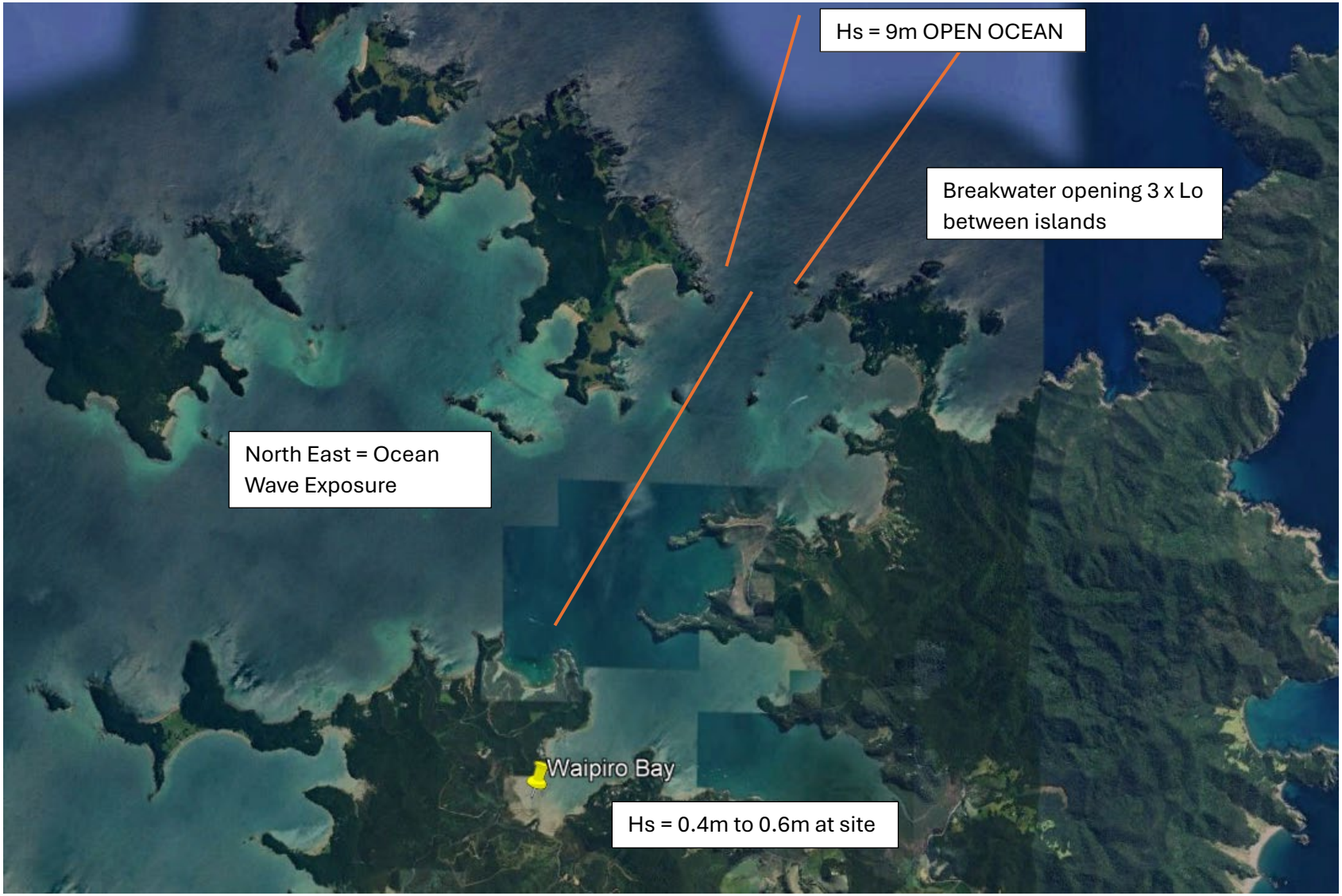
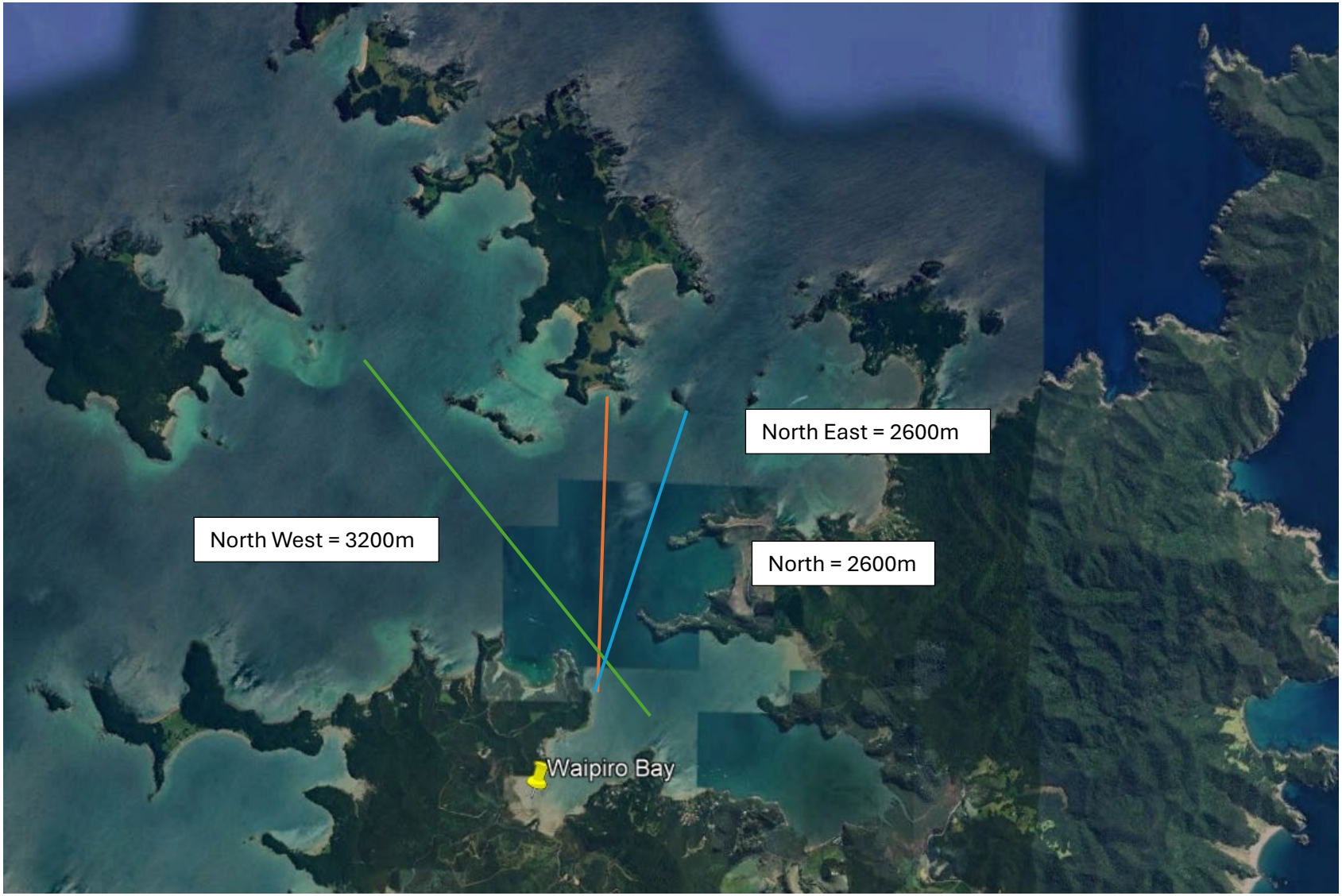
APPENDIX C – PRELIMINARY WAVE CALCULATIONS

Waipiro Bay - Ocean Wave Exposure



Waipiro Bay - Bay of Islands Fetch Exposure



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Site Wind Check TO AS/NZS 1170

Job Name: Waipiro Marina
Location: Waipiro Bay
Client: Azuma Property
Date: 21/01/2025
Prepared by: Rob Brown
Region: NZ1
Design Life: 50 Years
% Probalility of exceedance: 10%
Regional wind Speed designation: V_{500} Waves at Entrance to Parekura Bay from BOI Fetches
Regional wind speed m/s: 45

Wind Direction	Fetch (m)	Wind direction Multiplier Md	Terrain Height Multiplier Mz,cat	Shielding Multiplier Ms	Site wind speed Vsit,B (3 Sec Gust m/s)	30 Second gust wind speed Vsit,B (m/s)	Time reqd for waves to become fetch limited *tx,u*) seconds	3 sec wind gust factor U3 / U3600	Sustained steady wind state factor Ut / U3600	Conversion factor Rd	Sustained wind speed for fetch limited waves to become fully developed (m/s)
N	2600	0.90	0.97	1.0	39.3	**34.1**	2025	1.51	1.010	0.669	**26.3**
NE	2600	0.95	0.97	1.0	41.5	**36.0**	1989	1.51	1.010	0.669	**27.7**
NW	3200	0.95	0.97	1.0	41.5	**36.0**	2285	1.51	1.007	0.667	**27.7**

SHOREWISE
ENGINEERING CONSULTANTS

Site Wave Check TO US ARMY CORPS OF ENGINEERS COASTAL ENGINEERING MANUAL

Job Name: Waipiro Marina
Location: Waipiro Bay
Client: Azuma Property
Date: 21/01/2025
Prepared by: Rob Brown
Region: NZ1
Design Life: 50 Years
% Probalility of exceedance: 10%
Regional wind Speed designation: V500
Regional wind speed m/s: 45

Waves at Entrance to Parekura Bay from BOI Fetches

				FETCH GENERATED WAVES								LOCAL WAVES			
Wind Direction	**Fetch (m)**	**CD**	**u***	**Fetch water depth (m)**	**Water depth to wave length ratio**	**Wave height to water depth classification**	**Wave Height Hmo (m)**	**Wave Period Tp (seconds)**	**Fetch wave length Lo (m)**	**Fetch wave cerility Co**	**Deep water Water particle velocity (m/s)**	**Wave length L (m)**	**Wave cerelity C (m/s)**	**Maximum horizontal Water particle velocity u (m/s)**	**Wave Type**
N	2600	0.0020	1.1888	*16*	2.4	Deep	**0.8**	**2.1**	6.7	3.2	1.2	**6.7**	3.2	0.4	NON BREAKING
NE	2600	0.0021	1.2715	*16*	2.3	Deep	**0.9**	**2.1**	7.0	3.3	1.3	**7.0**	3.3	0.4	NON BREAKING
NW	3200	0.0021	1.2670	*7.5*	0.9	Deep	**0.9**	**2.3**	8.0	3.5	1.3	**8.0**	3.5	0.4	NON BREAKING

OFFSHORE WAVES FROM NORTH WEST

FROM RAUKIUI REPORT 2004

OCEAN WAVES $H_S = 9m$

$T_S = 10-11$ sec

$L_o = 160-190m$

AT 90m WATER DEPTH OUTSIDE BAY

$\frac{d}{L} \approx \frac{90}{180} = \frac{1}{2}$ MOVING TO TRANSITIONAL WATER DEPTH

AS WAVES MOVE INTO 8-10m OF WATER PERIOD REMAINS CONSTANT AT 10 SEC

$C_o = \frac{9.81 \times 10}{2 \times \pi} = 15.6$ wave celerity

$C_{go} = 15.6/2 = 7.8$ group celerity

SHALLOW WATER WAVE LENGTH $L = 10 \times \sqrt{9.81 \times 10} = 99m$

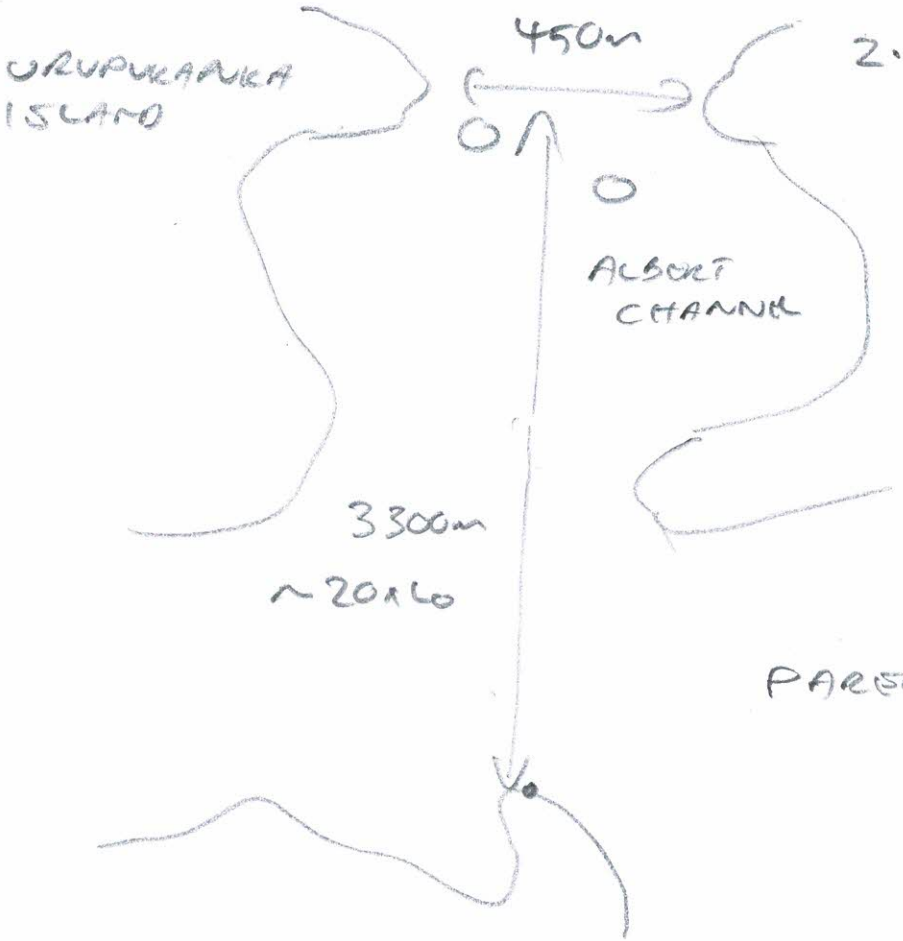
$\frac{d}{L} = \frac{10}{99} > \frac{1}{25}$ ∴ TRANSITIONAL WATER.

$L = \frac{9.81 \times 10^2}{2\pi} \times \tanh\left(\frac{2\pi \times 10}{L}\right)$ $L = 102m$ (close to shallow)

$H/H_o = \sqrt{\frac{C_{go}}{C_g}}$ ∴ $H_S = \sqrt{\frac{7.8}{\sqrt{9.81 \times 10}}} \times 9 = 7.98m$

∴ $H_S = 8m$

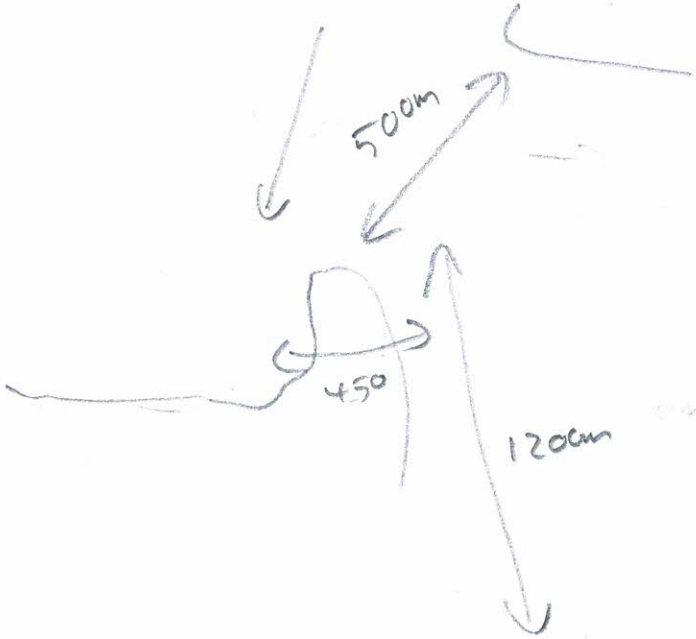
WAVE TRANSFORMATION FROM ALBERT CHANNEL TO PAREKURA BAY ENTRANCE - JOHNSON 1952
FROM SPM 2-50



$K' \sim 0.7$

$H_S \sim 6.3m$

WAVE TRANSFORMATION INTO SITE SPM 2-36



$K' \sim 0.075$

$\therefore H_T \sim 0.47m$

$\therefore H_S \sim 0.4 - 0.6m$

MAX OCEAN STORM.

Waipiro Bay Local Fetch

SHOREWISE
ENGINEERING CONSULTANTS

Site Wind Check TO AS/NZS 1170

Job Name: Waipiro Marina
Location: Waipiro Bay
Client: Azuma Property
Date: 21/01/2025
Prepared by: Rob Brown
Region: NZ1
Design Life: 50 Years
% Probalility of exceedance: 10% Preliminary Check Only
Regional wind Speed designation: V_{500} Waves within Parekura Bay from local fetches
Regional wind speed m/s: 45

Wind Direction	Fetch (m)	Wind direction Multiplier Md	Terrain Height Multiplier Mz,cat	Shielding Multiplier Ms	Site wind speed Vsit,B (3 Sec Gust m/s)	30 Second gust wind speed Vsit,B (m/s)	Time reqd for waves to become fetch limited *tx,u*) seconds	3 sec wind gust factor U3 / U3600	Sustained steady wind state factor Ut / U3600	Conversion factor Rd	Sustained wind speed for fetch limited waves to become fully developed (m/s)
N	300	0.90	0.97	1.0	39.3	**34.1**	477	1.51	1.062	0.703	**27.6**
NE	1900	0.95	0.97	1.0	41.5	**36.0**	1612	1.51	1.015	0.672	**27.9**
E	2200	0.95	0.97	0.7	29.0	**25.2**	2007	1.51	1.010	0.669	**19.4**
SE	300	0.95	0.97	1.0	41.5	**36.0**	468	1.51	1.063	0.704	**29.2**
S	300	0.90	0.97	1.0	39.3	**34.1**	477	1.51	1.062	0.703	**27.6**
SW	300	1.00	0.97	1.0	43.7	**37.9**	460	1.51	1.064	0.704	**30.8**
W	300	1.00	0.97	1.0	43.7	**37.9**	460	1.51	1.064	0.704	**30.8**
NW	300	0.95	0.97	1.0	41.5	**36.0**	468	1.51	1.063	0.704	**29.2**

SHOREWISE
ENGINEERING CONSULTANTS

Site Wave Check TO US ARMY CORPS OF ENGINEERS COASTAL ENGINEERING MANUAL

Job Name: Waipiro Marina
Location: Waipiro Bay
Client: Azuma Property
Date: 21/01/2025
Prepared by: Rob Brown
Region: NZ1
Design Life: 50 Years
% Probalility of exceedance: 10%
Regional wind Speed designation: V500
Regional wind speed m/s: 45

Preliminary Check Only

Waves within Parekura Bay from local fetches

				FETCH GENERATED WAVES								LOCAL WAVES			
Wind Direction	**Fetch (m)**	**CD**	**u***	**Fetch water depth (m)**	**Water depth to wave length ratio**	**Wave height to water depth classification**	**Wave Height Hmo (m)**	**Wave Period Tp (seconds)**	**Fetch wave length Lo (m)**	**Fetch wave cerility Co**	**Deep water Water particle velocity (m/s)**	**Wave length L (m)**	**Wave cerelity C (m/s)**	**Maximum horizontal Water particle velocity u (m/s)**	**Wave Type**
N	300	0.0021	1.2649	*6*	3.6	Deep	**0.3**	**1.0**	1.7	1.6	0.9	**1.7**	1.6	0.5	NON BREAKING
NE	1900	0.0021	1.2791	*6*	1.1	Deep	**0.7**	**1.9**	5.7	3.0	1.2	**5.7**	3.0	0.4	NON BREAKING
E	2200	0.0018	0.8238	*6*	1.3	Deep	**0.5**	**1.7**	4.7	2.7	0.9	**4.7**	2.7	0.3	NON BREAKING
SE	300	0.0022	1.3543	*6*	3.5	Deep	**0.3**	**1.1**	1.7	1.6	0.9	**1.7**	1.6	0.6	NON BREAKING
S	300	0.0021	1.2649	*6*	3.6	Deep	**0.3**	**1.0**	1.7	1.6	0.9	**1.7**	1.6	0.5	NON BREAKING
SW	300	0.0022	1.4455	*6*	3.3	Deep	**0.3**	**1.1**	1.8	1.7	1.0	**1.8**	1.7	0.6	NON BREAKING
W	300	0.0022	1.4455	*6*	3.3	Deep	**0.3**	**1.1**	1.8	1.7	1.0	**1.8**	1.7	0.6	NON BREAKING
NW	300	0.0022	1.3543	*6*	3.5	Deep	**0.3**	**1.1**	1.7	1.6	0.9	**1.7**	1.6	0.6	NON BREAKING

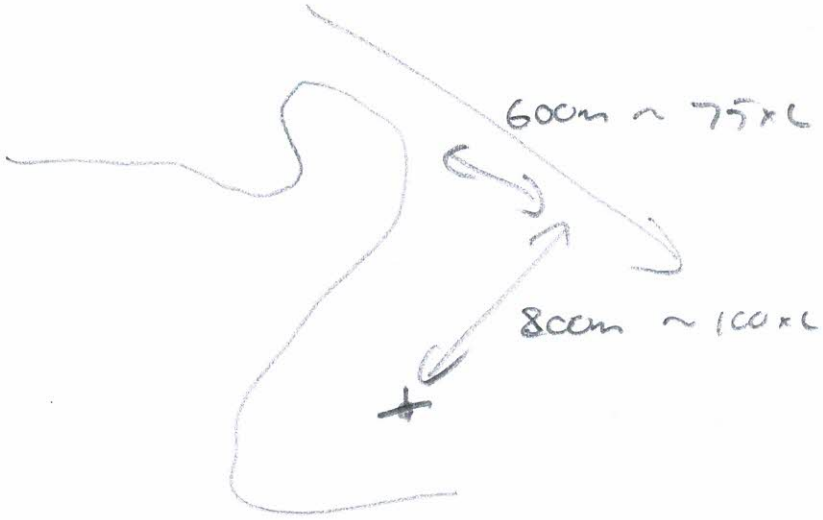
FOR WAVES FROM MOTUKIEKIE / MOTURUA FROM NORTH WEST

- FETCH = 3200m

$H_S \sim 0.9m$

$L \sim 8.0m$

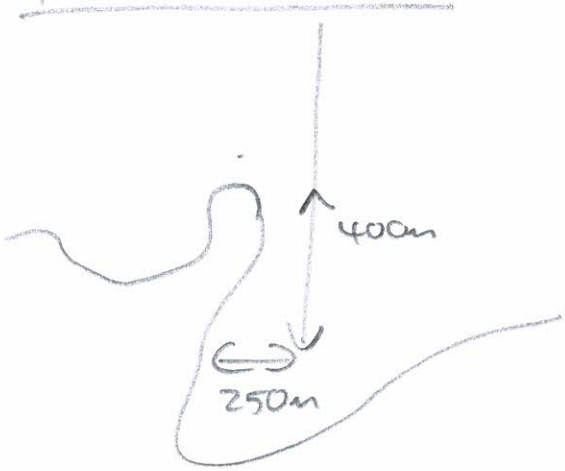
USING SPM 2-33



$K' \sim 0.08$

$H_S \sim 0.07m$

FOR NORTH



$H_S \sim 0.8m$

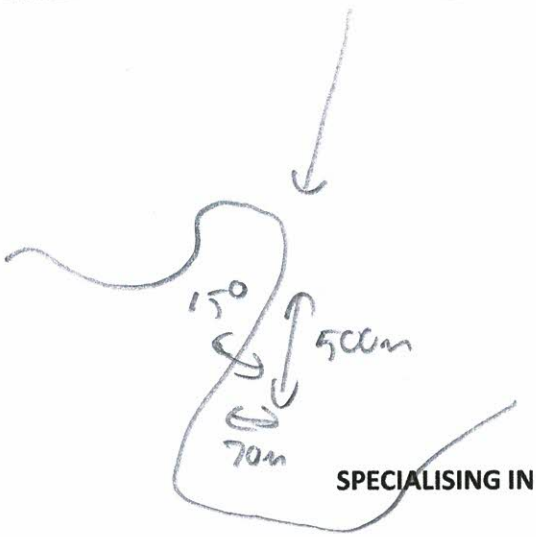
$L \sim 6.7m$

USING SPM 2-33

$K' \sim 0.15$

$H_S \sim 0.12m$

NORTH EAST



$H_S \sim 0.9m$

$L \sim 7m$

USING SPM 2-33

$K' = 0.2 - 0.4$ MAX

$H_S = 0.18m - 0.36m$