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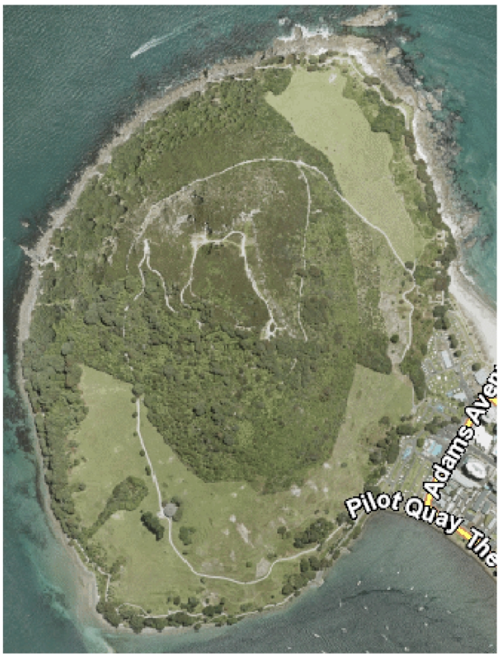
Walk Through Tree Risk Assessment around the Mauao Base Track



For
The Tauranga City Council
Attention: [redacted]

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B.Sc. (Tech)
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Date: May 2021

Bibliographic reference for citation: Walk Through Tree Risk Assessment on The Mauao Base Track Report prepared by Arbor Care Limited for Tauranga City Council 2021		
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Status: Final		Issue Date: May 2021
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May 2021

Tauranga City Council

1 Introduction

1.1 Brief

I have been asked to carry out a walk through risk assessment of the mature trees over the Mauao Base Track

A walk through risk assessment is, as the name suggests, a walk through the site scanning the trees for signs of defects. Where significant defects are noted a specific risk assessment is carried out on that tree or trees to quantify the risk from that defect and where appropriate; maintenance recommendations will be made to reduce the risk.

This is not a detailed inspection of every tree on the site.

It is acknowledged that from time to time trees with no significant defects or obvious defects can fail; this is part of the background risk level of being around trees and cannot be assessed or mitigated.

Only risks from identifiable defects are assessed in this inspection and report, Quantified Tree Risk Assessment (QTRA) is the method to be used for this risk assessment.

I was not provided with any previous inspection reports or inspection data for the trees on this site.

1.2 Qualifications and Experience

I have based this report on the information provided to me along with my observations from the site.

My inspection follows recognised Visual Tree Assessment (VTA) guidelines endorsed by the International Society of Arboriculture (ISA), and follows Quantified Tree Risk Assessment (QTRA) Published by Quantified Tree Risk Assessment Ltd. 2016.

My conclusions were made based on analysis and my interpretation of this information. My qualifications and experience are listed in Appendix 3

2 Site Visit and Observations

2.1 Site Visit

I visited the site with [redacted] on Friday the 21st of May 2021 to carry out the walk through inspection.

2.2 Site Descriptions and Location of the Trees and Background information

The site is the base track of Mauao. For the purpose of this inspection where a defect was identified on an individual tree the tree was listed as an individual and where similar defects are identified in several trees in the same area the trees were identified as a group.

The trees or groups of trees are located as shown on the site map in Appendix 1

2.3 Tree Identification and Observations

Tree Reference	Species	Common Name	Defect (diameter)
Tree 1	Corynocarpus laevigatus	Karaka	Deadwood/seam (300mm) Photo 1 in Appendix 1
Tree 2	Pinus radiata	Pine	Deadwood (200mm)
Group 3	Metrosideros excelsa x 2	Pohutukawa	Deadwood (100mm)
Group 4	Metrosideros excelsa	Pohutukawa	Deadwood (150mm)
Tree 5	Metrosideros excelsa	Pohutukawa	Dead leader/ Deadwood (300mm)
Tree 6	Metrosideros excelsa	Pohutukawa	Dead Tree (300mm)
Group 7	Metrosideros excelsa	Pohutukawa	Deadwood (300mm)
Group 8	Pinus radiata x 2	Pine	Deadwood (300mm)
Tree 9	Metrosideros excelsa	Pohutukawa	Deadwood (100mm)
Tree 10	Metrosideros excelsa	Pohutukawa	Deadwood (100mm)

In addition to the defects above several trees were seen around the track (especially on the western to north western side) with unexplained decline symptoms (Pohutukawa UDS). This Pohutukawa UDS is where a large limb or leader of a Pohutukawa appears dead with the leaves still attached suggesting a quick decline of the tree or portion of the tree. This can affect either a portion of a tree or in some cases a whole tree (see Photo 2 in Appendix 1).

These symptoms have been seen in Pohutukawa throughout the Tauranga area and the Tauranga City Council Urban Forestry Team are aware of the potential issue.

3 Risk Assessment

Where a defect was noted for an individual tree a risk assessment was carried out.

Inspections were carried out from the ground using a systematic Visual Tree Assessment (VTA).

This VTA was followed up with a Quantified Tree Risk Assessment (QTRA)

See Appendix 2 for more detailed methods.

3.1 Quantified Tree Risk Assessment (QTRA)

A risk of harm probability has been calculated where defects were noticed using the QTRA Method (see appendix 2).

In brief QTRA gives a probability of harm after taking into account the most likely target for any failure, the size of the tree part or branch most likely to fail and the probability of the tree or branch failing.

The target range is the time per day spent directly under the tree or the likely amount of damage should the tree or a part of the tree fail onto property causing damage.

The size is the diameter range the branch or trunk fits into.

The probability of failure is the likelihood of failure as assessed against a perfectly normal tree/branch and an extensively defective tree/branch.

The calculated risk levels can be considered in 4 bands:

1. Green - Broadly acceptable level of risk <1/1,000,000
2. Yellow - Tolerable Level of risk (when imposed on others) 1/10,001 to 1/1,000,000 if the risk is as low as reasonably practical (ALARP)
3. Amber - Tolerable by agreement only 1/1001 to 1/10,000
4. Red - Unacceptable level of risk 1/1,000 or greater

This inspection and report will give the tree a risk rating and options for mitigation. It is up to the trees owners to decide what if any action is to be taken depending on their tolerance to risk.

3.1.1 Results

As this is a walking track I have considered the risk for pedestrians.

Area Occupation

The mount base track has approximately 500,000 visits per year giving it a class 2 occupation rating in the QTRA system.

Table 1 Risk Of Harm

Reference Number	Tree Type	Defect	Size	Probability of failure range	Risk of harm Target range 2
Tree 1	Corynocarpus laevigatus	Deadwood/seam (300mm)	2	3	1/10,000
Tree 2	Pinus radiata	Deadwood (200mm)	3	3	1/50,000
Group 3	Metrosideros excelsa x 2	Deadwood (100mm)	4	3	1/500,000
Group 4	Metrosideros excelsa	Deadwood (150mm)	3	3	1/50,000
Tree 5	Metrosideros excelsa	Dead leader/ Deadwood (300mm)	2	3	1/10,000
Tree 6	Metrosideros excelsa	Dead Tree (300mm)	2	3	1/10,000
Group 7	Metrosideros excelsa	Deadwood (300mm)	2	3	1/10,000
Group 8	Pinus radiata x 2	Deadwood (300mm)	2	3	1/10,000
Tree 9	Metrosideros excelsa	Deadwood (100mm)	4	3	1/500,000
Tree 10	Metrosideros excelsa	Deadwood (100mm)	4	3	1/500,000

The assessed risk levels for these trees all fall into the following bands:

Green = Broadly Acceptable level of risk (the level of risk with these trees is already as low as reasonably practical

Yellow = Tolerable level of risk (when imposed on others) if the risk level is as low as reasonably practical (ALARP)

Amber = Tolerable only by agreement (otherwise not tolerable)

Red = Unacceptable level of risk

Risks in the Red zone should be mitigated as soon as practical.

Risks in the Amber zone should be considered and either mitigated as soon as practical or measures put in place to ensure users of the track have agreed to the level of risk.

Risks in the Yellow zone can be assessed to decide if they are as low as reasonably practical with no works required, or if not as low as reasonably practical then works can be prioritised to reduce the risks.

4 Discussion:

If accepting that the target range should be “2” for these trees then the risks from all these trees are either in the tolerable by agreement only (Amber Zone where works should be prioritised first and the tolerable range (Yellow Zone) where works only need to take place if the risk is not as low as reasonably practicable.

4.1 Amber Zone

Trees in the Amber Zone are only tolerable by agreement with those at risk so in these circumstances this would mean excluding people from the area unless they are informed and agree to the risks, otherwise works will need to be programmed to reduce the risk to at least a tolerable level (Yellow Zone).

4.2 Yellow Zone

Trees in the yellow zone are a tolerable risk level when imposed on others if the risk level is as low as reasonably practical (ALARP).

When making decisions on whether the risk is as low as reasonably practical factors that should be taken into account include:

- The transferred risk to those carrying out the works e.g there is a risk in climbing a tree so it may not be worth the risk involved in removing small defects such as small deadwood or minor hangers in out of the way areas

- The cost of the works in relation to the risk reduction gained. For example it would not be worth spending much money to reduce a risk from 1/500,000 to 1/1,000,000 as the risk is already at a very low level

In the following table I have listed the recommended works in priority order with the amber section being the tree works that should be prioritised first.

For the yellow section I have recommend works in priority order to ensure the risk is as low as reasonably practical (ALARP), these should be carried out in the priority order listed.

Reference	Tree Type	Recommended works
Tree 1	Corynocarpus laevigatus	Remove or reduce tree
Tree 5	Metrosideros excelsa	Remove dead limb/leader
Tree 6	Metrosideros excelsa	Remove tree
Group 7	Metrosideros excelsa	Remove deadwood
Group 8	Pinus radiata x 2	Remove deadwood
Tree 2	Pinus radiata	Remove deadwood
Group 4	Metrosideros excelsa	Remove deadwood
Group 3	Metrosideros excelsa x 2	Remove deadwood
Tree 9	Metrosideros excelsa	Remove deadwood
Tree 10	Metrosideros excelsa	Remove deadwood

<u>5 Conclusion:</u>

In conclusion the risk level from all the trees have been calculated and categorised as either Amber or Yellow. Any risk reduction works should be targeted at the highest priority trees first (Amber); followed by the next highest priorities (Yellow) as budgets and programs allow.

I recommend that ongoing walkthrough inspections should be carried out by an arborist. Given the frequency the track is occupied and the condition of the trees I would recommend a walkthrough inspection be carried out on an annual basis.

I would also recommend that after significant storm events a quick walkthrough inspection be carried out to identify any obvious defects in large limbs or trunks. This inspection could be undertaken by anyone with a basic knowledge of tree defects.

6 References

Dunster, Julian A., E. Thomas Smiley, Nelda Matheny, and Sharon Lilly. 2013 Tree Risk Assessment Manual. Champaign, Illinois: International Society of Arboriculture.

E. Thomas Smiley, Nelda Matheny, and Sharon Lilly. 2011 Tree Risk Assessment – Best Management Practices

ANSI A300 (Part9) – 2011 Tree Risk Assessment a. Tree Structure Assessment

Mattheck C. & Breloer H. (1994) The Body Language of Trees. London: HMSO.

QTRA Quantified Tree Risk Assessment User Manual Version 5.

Appendix 1 Site Map and Photos

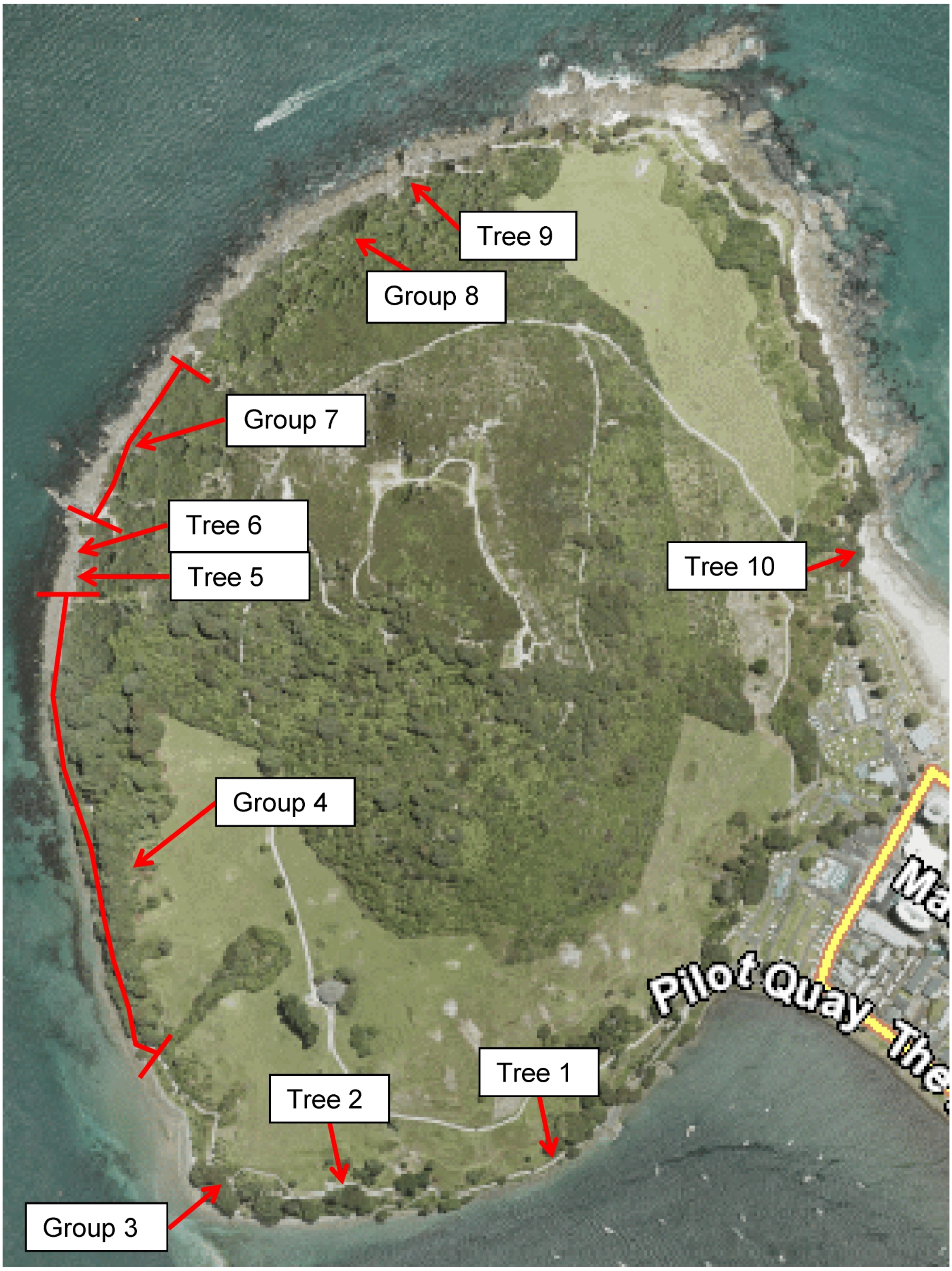
Tree 9
Group 8
Group 7
Tree 6
Tree 5
Tree 10
Group 4
Pilot Quay
Tree 1
Tree 2
Group 3

Photo 1 Tree 1 Karaka

Photo 2 Pohutukawa showing Pohutukawa UDS

Appendix 2 Methods

VTA

VTA is a three-step process.

1. A visual inspection for defects symptoms and vitality is carried out from the ground. If there is no sign of a problem the investigation is concluded.
2. If a defect is suspected on the basis of symptoms, its presence or absence must be confirmed by thorough examination.
3. If the defect is confirmed and appears to be a reason for concern it must be measured and the strength of the remaining part of the tree evaluated. (Matthek and Breloer 1994)

When carrying out VTA the main defect symptoms to be looked for are ridges, bulges and hollows or depressions as well as the obvious cavities, dead wood and disease.

Bulges can be a sign of hollow areas or cracks. The bulges are the result of the tree producing reaction wood around a hollow area as it strives to conform to the axiom of uniform stress (the theory that a tree grows in response to stresses to attempt to alleviate those stresses, e.g. producing more wood in certain locations to strengthen them).

Hollows or depressions in the trunk can be a sign of the tree being unable to produce enough reaction wood to counter a defect. If this is the case the tree could be in a serious condition.

QTRA Quantified Tree Risk Assessment

What is Quantified Tree Risk Assessment?

A Non-technical Summary

Tree safety management is a matter of limiting the risk harm from tree failure while maintaining the benefits conferred by trees. Although it may seem counter intuitive, the condition of trees should not be the first consideration. Instead, tree managers should first take account of the usage of the land on which the trees stand, which in turn will inform the process of assessing the trees.

The Quantified Tree Risk Assessment (QTRA) system applies established and accepted risk management principles to tree safety management. Firstly, the targets (people and property) upon which trees could fail are assessed and quantified, thus enabling tree managers to determine whether to assess trees and to what degree of rigour a survey or inspection of the trees is required. Where necessary, the tree is then considered in terms of both size (potential impact) and probability of tree or branch failure. Values derived from the assessment of these three components (target, size and probability of failure) are combined to calculate the probability of significant harm occurring.

The system moves the management of tree safety away from labelling trees as either 'safe' or 'unsafe' and requiring definitive statements of tree safety from either tree surveyors or tree managers. Instead, QTRA quantifies the risk of harm from tree failure in a way that enables tree managers to balance safety with tree value and operate to predetermined risk thresholds.

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The QTRA method provides a framework for the assessment of the three primary components of tree failure risk. The input values for these components are set out in broad ranges of Target, Size, and Probability of Failure. The QTRA user estimates values for the three components and inputs them into the QTRA calculator to calculate the risk of harm.

Targets

Targets are assessed as either damage to property, harm to human pedestrians or occupiers of the area under the tree and damage to vehicle traffic.

In the assessment of target there are six ranges of value are available as set out in the following table.

Table 2. Targets

Target Range	Property (repair or replacement cost)	Human (not in vehicles)		Vehicle Traffic (number per day)	Ranges of Value (probability of occupation or fraction of $3 600 000)
1	$3 600 000 – >$360 000 (£2 000 000 – >£200 000)	**Occupation:** **Pedestrians & cyclists:**	Constant – 2.5 hours/day 720/hour – 73/hour	26 000 – 2 700 @ 110kph (68mph) 32 000 – 3 300 @ 80kph (50mph) 47 000 – 4 800 @ 50kph (32mph)	1/1 – >1/10
2	$360 000 – >$36 000	**Occupation:** **Pedestrians & cyclists:**	2.4 hours/day – 15 min/day 72/hour – 8/hour	2 600 – 270 @ 110kph (68mph) 3 200 – 330 @ 80kph (50mph) 4 700 – 480 @ 50kph (32mph)	1/10 – >1/100
3	$36 000 – >$3 600	**Occupation:** **Pedestrians & cyclists:**	14 min/day – 2 min/day 7/hour – 2/hour	260 – 27 @ 110kph (68mph) 320 – 33 @ 80kph (50mph) 470 – 48 @ 50kph (32mph)	1/100 – >1/1 000
4	$3 600 – >$360	**Occupation:** **Pedestrians & cyclists:**	1 min/day – 2 min/week 1/hour – 3/day	26 – 4 @ 110kph (68mph) 32 – 4 @ 80kph (50mph) 47 – 6 @ 50kph (32mph)	1/1 000 – >1/10 000
5	$360 – >$36	**Occupation:** **Pedestrians & cyclists:**	1 min/week – 1 min/month 2/day – 2/week	3 – 1 @ 110kph (68mph) 3 – 1 @ 80kph (50mph) 5 – 1 @ 50kph (32mph)	1/10 000 – >1/100 000
6	$36 – $4	**Occupation:** **Pedestrians & cyclists:**	<1 min/month – 0.5 min/year 1/week – 6/year	None	1/100 000 – 1/1 000 000

Vehicle, pedestrian and property Targets are categorised by their frequency of use or their monetary value. The probability of a vehicle or pedestrian occupying a Target area in Target Range 4 is between the upper and lower limits of 1/1 000 and >1/10 000 (column 5). Using the VOSL $3 600 000, the property repair or replacement value for Target Range 4 is $3 600- >$360.

Tree or Branch Size
In the quantification of risk from falling trees, stem or branch mass is probably the most realistic measure of the likely force upon impact. In making the QTRA assessment there are 4 sizes available as outlined in the following table:

Size Range	Size of Branch or Tree	Impact Potential
1	>450mm Diameter	1/1 - >1/2
2	450-260mm Diameter	1/2 - >1/8.6
3	250-110mm Diameter	1/8.9 - > 1/82
4	100-25mm Diameter	1/82 – 1/2500

Probability of Failure
The probability of failure of the given branch or tree over the next year is estimated in relation to two benchmarks and recorded in the calculator as a range of value (shown in the table below).

Probability of Failure Range	Probability of Failure
1	1/1 – 1/10
2	1/10 – 1/100
3	1/100 – 1/1000
4	1/1000 – 1/10000
5	1/10000 – 1/100000
6	1/100000 – 1/1000000
7	1/1000000 – 1/10000000

Appendix 3 Qualifications and Experience

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