



Ohuiarangi - Pigeon Mountain Tree Removal Methodology

68R Pigeon Mountain Road, Half Moon Bay, Auckland

Client: Tūpuna Maunga Authority

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Prepared by: Treescape Arboriculture Consultants

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This assessment and report have been prepared on behalf of Treescape Ltd (Treescape) by Mr Matthew Priestley, Arboriculture Consultant, for the Tūpuna Maunga Authority

This report should be accepted and read in its entirety. No single statement or part of this report should be used individually in a manner that is outside the context of the whole report.

This assessment and report does not address the matter of environmental effects relating to arboriculture works as it was outside the scope of works.

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Acknowledge that information from relevant reports and/or plans supplied by others may have been used in the formulation of this report, to support the information provided and authorised.

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Introduction

The Tūpuna Maunga Authority has engaged Treescape Ltd to prepare a Tree Removal Methodology (Methodology) for the removal of 112 exotic trees on Ohuiarangi - Pigeon Mountain.

This Methodology includes an inventory of all exotic trees over 3m in height to be removed and their GPS locations. The Methodology has been informed by advice from specialists to avoid damage or disturbance of archaeological, cultural and historical features of the maunga.

This Methodology has been prepared by and/or overseen by appropriately qualified Arboriculture Consultants familiar with large scale tree removal. Treescape Limited undertook the recent removal works at Maungarei.

This Methodology does not give consideration to the environmental effects of the proposed tree removals. Reports by other specialists will assess ecological and landscape visual matters relevant to the wider restoration project.

Scope

Treescape Limited has been engaged by Tūpuna Maunga Authority to prepare a methodology for the removal of exotic species from Ohuiarangi - Pigeon Mountain. This has involved:

- Identifying each exotic tree, its location and the characteristics relevant to defining a removal method
- Determining operating methodologies for their removal that are cost effective, safe and best protect the archaeological, cultural and historical features of the maunga from damage or disturbance; and
- Defining the operations management system and practices required to minimise implementation risks

This Methodology will be used to inform a detailed Arboriculture Works Specification from which potential tree removal contractors can provide sufficiently complete and accurate service solution proposals and pricing estimates.

Scope Exclusions

- An assessment of the environmental effects of planned arboriculture works
- Detailed review and refinement of work specifications at an individual tree level

Operating Methods Assessment & Selection

Assessment & Selection Factors

The factors relevant to, and considered in, developing the Methodology are detailed below in Table 1 below. Assessment & evaluation of these factors, and their interconnection, has determined the specific operating methods selected for given areas and trees.

This section in the table on Overlays has been informed by advice from the project archaeologist and planner. The remaining sections are informed by the arboricultural expertise of the Treescape consultants.

Table 1: Assessment Factors

Category	Factor	Relevance
Overlays	Natural Features	Ground disturbance is not permitted in an natural / unmodified area of the maunga unless approved by the Archaeologist.
	Archaeological sensitivity	Archaeologically sensitive areas must be protected from damage or alteration. The default position is that no ground disturbance, regardless of how minor, is permitted. This eliminates all removal methods that involve tree / tree sections being lowered to the ground at its original location. Crane assisted dismantling can be used to remove trees located less than 40m - 70m (crane size dependent) from a suitable operating area. Any increased tolerance for ground disturbance would give rise to the possible use of crash mats to lessen the impact when lowering tree sections on to sensitive ground. Used in conjunction with rigging techniques that offer maximum control may be a solution that meet acceptable risk thresholds.
Physical Factors	Topography	As the land gradient becomes steeper so to does the level of complexity and risk associated with tree removal. Manually assisted felling and dismantling methods can be used but, for larger trees especially, controlling the direction and resting place of the fall and the feasibility of processing in situ and moving tree rings or logs are important considerations. Crane or helicopter assisted dismantling is highly likely a more cost effective, as well as lower risk, method for removing large trees from sloped areas.
	Built features / Land Modifications	Modifications such as roading and pathways provide potential work areas, or access ways to work areas, for large machinery. In modified areas ground disturbance is permitted as the archaeological effect has already occurred and the risk significantly reduced. The size, gradient and stability of the modified area(s) will determine the size and type of machinery that can be used.
Tree Factors	Provenance	Provenance refers to a tree's place of origin. An objective of this project is remove any species not originating in NZ (exotics) from the maunga. Identifying exotics is a key function of the tree survey.
	Species	Tree species can define tree handling and removal requirements. E.g. species susceptible to diseases posing high biosecurity risk e.g. Dutch Elm, Myrtle and Kauri are subject to specific contols. Some, but not all species will require ringbarking or injecting with herbicides in advance of removal if stumps are to be left to rot and decay.
	Size	Size is a key determinant of the tree removal method. Felling methods require a clear area to land the tree and is only feasible in non-sensitive areas. Cutting large trees into sufficiently small sections to be loaded into trucks is generally not cost effective when compared to dismantling into large sections that can be loaded by crane or helicopter.
	Quantity	When all but a few trees require crane or helicopter assisted removal it is highly likely utilising these tools for the few will be more cost effective.
Regulatory Factors	Noise Disturbance	Noise restrictions will impact when and where helicopters and loud machinery can be operated.
	Traffic Management	Operating on or around roads will require either traffic management plans to be implemented or potentially temporary road closures.
	Health & Safety	An assessment of H&S risk relating to all aspects of planned operations for each site is mandatory and should be viewed as informing the evaluation and selection of tree removal methods.
Cost Factors	Method Cost	[REDACTED]
	Overall Cost	[REDACTED]

Survey Area

The survey area is shown on Figure 1. A survey of the subject-site and all trees >3m in height was undertaken by Treescape Limited.

Figure 1: Aerial image of the subject site and surrounding area



Tree Population – Survey Area

Native Tree Species

Native species predominantly consist of puriri (*Vitex lucens*), pohutukawa (*Metrosideros excelsa*) and, to a lesser degree, totara (*Podocarpus totara*), kohekohe (*Dysoxylum spectabile*) and karaka (*Corynocarpus laevigatus*). This accounts for approximately 30% - 40% of species within the survey area.

Exotic Tree Species

In total 165 exotic trees (woody vegetation >3m in height) representing 15 species were identified within the survey area. A breakdown by species is given in Table 2 on the following page.

The greatest concentrations of natives are along the western and southern road boundaries with a line bounding the western side of the lower portion of the tihi access slope. Exotics dominate the northern and central areas of the maunga.

Three (3) species account for 79% of exotics: Pines (*Pinus sp.*) - 89 trees; Gums (*Eucalyptus sp.*) – 18 trees and Acmena (*Syzygium smithii*) – 24 trees.

A total of thirty one (31) trees were classed as 'Surveillance – Whole region' pest plants under the regional pest management strategy (RPMS). These comprised twenty four (24) Acmena (*Syzygium smithii*) and seven (7) Hawthorn (*Crataegus laevigata*).

Tree Population - To be Removed

Not all the exotic trees within the wider survey area are included in this application. The majority of the exotic trees to be retained at this stage are located on the north-eastern side of the Tihi. Hereafter reference to survey area means that area that is part of this application.

Native Tree Species

Native species predominantly consist of puriri (*Vitex lucens*), pohutukawa (*Metrosideros excelsa*) and, to a lesser degree, totara (*Podocarpus totara*), kohekohe (*Dysoxylum spectabile*) and karaka (*Corynocarpus laevigatus*). This accounts for approximately 30% - 40% of species within the survey area.

Exotic Tree Species

In total 112 exotic trees (woody vegetation >3m in height) representing 15 species were identified within the survey area. A breakdown by species is given in Table 2 on the following page.

The greatest concentrations of natives are along the western and southern road boundaries with a line bounding the western side of the lower portion of the tihī access slope. Exotics dominate the northern and central areas of the maunga.

Three (3) species account for 70.5% of exotics: Pines (*Pinus sp.*) - 56 trees; Gums (*Eucalyptus sp.*) – 10 trees and Acmena (*Syzygium smithii*) – 13 trees.

A total of thirty one (20) trees were classed as ‘Surveillance – Whole region’ pest plants under the regional pest management strategy (RPMS). These comprised twenty four (13) Acmena (*Syzygium smithii*) and seven (7) Hawthorn (*Crataegus laevigata*).

Table 2: Tree Population Breakdown by Species

Tree Species	No. Trees
Agonis flexuosa - willow myrtle, peppermint tree	1
Araucaria cunninghamii - hoop pine	1
Callistemon sp. - bottle brush	2
Cedrus atlantica - Atlas cedar, blue	1
Crataegus laevigata - English hawthorn	7
Cryptomeria japonica - Japanese cedar	1
Cupressus macrocarpa - Monterey cypress	4
Eucalyptus sp.	10
Grevillea robusta - silky oak	4
Liquidambar styraciflua - sweetgum	1
Lophostemon conferta - Queensland Box	3
Pinus sp.	56
Quercus ilex - holm oak	4
Acmena smithii, Syzygium - lilly pilly, monkey apple	13
Populus sp.	4

Operating Methods

The operating methods are the various tree removal and processing techniques.

Tree Removal

A suite of tree removal method options appropriate for the range of works required has been developed. These have been selected for inclusion on the basis of feasible, effectiveness and cost. Selected methods are listed below and described in Appendix A.

- Ring barking, spraying, drill and fill methods
- Manual felling
- Machine assisted manual felling

- Manual dismantling
- Manual dismantling using rigging techniques
- MEWP assisted dismantling
- Crane assisted dismantling
- Helicopter assisted dismantling

Debris Processing

A suite of processing method options appropriate for the range of works required has been developed. These have been selected for inclusion on the basis of feasibility, effectiveness and cost. Selected methods are listed below and described in Appendix B.

- Cut and leave
- Mulch on-site
- Mulch off-site
- Cut logs on-site
- Cut logs off-site

Operations Plan

Operating Zones

Groupings of trees with same methodology have been bundled into Tree Removal Operating Zones.

Modified areas of sufficient size and proximity to removal works have been identified as Processing Sites.

Figure 2 below identifies the recommended location and boundaries of both Tree Removal Operating Zones (green bordered areas) and Processing Sites (yellow bordered areas). The coloured dots represent the locations of exotic trees, with the colour representing the primary removal method.

The operating zones are detailed more fully in Table 4 on the page 11.

Figure 2: Map of Operating Zones, Tree Locations & Removal Methods



Trees for Removal

Tree Inventory

The species and quantities of exotic trees identified in each operating zone on Ohuiarangi are summarised in Table 3 on the following page and itemised in full in Appendix C.

Table 3: Summary of Exotic Trees

Tree Species	No. Trees
Agonis flexuosa - willow myrtle, peppermint tree	1
Araucaria cunninghamii - hoop pine	1
Callistemon sp. - bottle brush	2
Cedrus atlantica - Atlas cedar, blue	1
Crataegus laevigata - English hawthorn	7
Cryptomeria japonica - Japanese cedar	1
Cupressus macrocarpa - Monterey cypress	4
Eucalyptus sp.	10
Grevillea robusta - silky oak	4
Liquidambar styraciflua - sweetgum	1
Lophostemon conferta - Queensland Box	3
Pinus sp.	56
Quercus ilex - holm oak	4
Acmena smithii, Syzygium - lilly pilly, monkey apple	13
Populus sp.	4
Grand Total	112

Operating Methods

Tree Removal Methods

The tree removal method standard includes:

- Felling a tree (as one section) or dismantling a standing tree by cutting and removing it in sections
- Leaving the remnant stump in place (approx. <1m in height) – N.B. mandatory in archaeologically sensitive areas.
- Any pre-treatment of the tree.

The recommended operating methods are outlined in the Table 5 on the page 12.

The following variations to the method standard are identified for consideration by the relevant other experts.

Leaving stumps > 1m in height Due to the considerable time and expense involved in reducing very large trees to just above ground height, it may be pragmatic to leave taller stumps, of up to 5m in height, as this can result in as much as a 50% reduction in the removal cost for an individual tree.

Use of Crash Mats Crash mats could be used to minimise ground disturbance impact when lowering tree sections on to sensitive ground.

Used in conjunction with rigging techniques that offer maximum control may be a solution that meet acceptable risk thresholds.

Debris Processing Methods

Cuts from trees removed by helicopter assisted dismantling can be loaded directly into the method of transport. Cuts from all other trees will require further processing (at a designated Processing Site) into section sizes suitable for loading.

Processing Sites

Two processing areas are proposed for the helicopter and crane assisted dismantling methods:

Process. Site #	Area Description
1	Area of flat grass area behind kindergarten (only to be used when kindergarten not in use)
2	Sports Field

During helicopter operations one processing site will be utilised to process removed trees and one as a refuelling site for the helicopter.

Processing Methods

As it relates to this Maunga, the Tūpuna Maunga Authority preference is that with the exception of specific logs that may be suitable for carving, processing is mulch on site. Where surplus to requirements, the mulch will be removed off site.

Table 4: Description of Operating Zones

Name	Description	Site Characteristics	Viable Access Points	No. Trees	Tree Population Description	Processing Site Suitability
Quarry	The area is enclosed to the north, west and south by the former BMX track, Car park and toilets and sportsfield	Ridge line has undulating ground and low-moderate gradient Slopes are steep gradient, particularly the rock-garden area to the north side The entire area is classified as archaeologically sensitive. The track itself is classified as a modified area with no significance.	Crane access, limited to high summer/dry conditions from either the BMX track or sportsfield sectors.	57	Specimens of note include a large <i>Macrocarpa</i> on the western shoulder.	No
Eastern Slope	This area includes terracing but consists of widely-spaced specimen trees rather than groupings.	Moderately steep gradient Entire area is deemed archaeologically sensitive, with no access for crane work.	None in proximity	11	A large holm oak and gum dominate the central portion.	No
Road Boundary	This area flanks the lower portion of Pigeon Mountain Road and then turns along Gills Road. The trees form a peripheral belt around more open areas.	Low gradient Modified Area The domain road area is adjacent to a tar road, and parts of this area are considered to be of archaeological significance.	Gills Road/Pigeon Mountain Road	26	Gums and pine predominate the western portion; an <i>Acmena</i> group near the corner and a large liquidamber along Gills Road.	No
North Corner	This area is located at the north end of the Pigeon Mountain wetland.	Flat gradient Archaeological sensitive area. The use of crash mats is required to eliminate ground disturbance.	No operating restrictions	6	A group containing <i>Callistemon</i> , Gum and a <i>Macrocarpa</i>	No - extraction questionable - leave residues on site. Helicopter precluded by dwelling proximity.
Tihi	This area contains the tihi area with skyline pines.	The tihi area is deemed archaeologically sensitive but of low archaeological value on the steep slope (North of the work zone), which was quarried prior to housing construction.	None in proximity	12	4 x <i>acmena</i> /monkey apples (<i>Syzygium smithii</i>) have established in amongst the natives that line the boundary. Single stand-alone specimens of an English hawthorn (<i>Crataegus monogyna</i>) and an olive (<i>Olea</i> sp.).	No

Table 5: Summary Operating Methods

Operating Area	# Trees	Tree Species																Felling / Dismantling Methods								Processing Method								Tree Removal Method Selection Notes	Processing Method Selection Notes																																																						
		Acmena smithii - Lilly pilly, monkey apple	Agonis flexuosa - willow myrtle, peppermint tree	Araucaria cunninghamii - hoop pine	Callistemon sp. - bottle brush	Casuarina sp. - tree fern	Ceratophyllum demersum - water hyacinth	Corymbia laevis - blue gum	Cupressus macrocarpa - Monterey cypress	Eucalyptus sp.	Grevillea robusta - silky oak	Liquidambar styraciflua - sweetgum	Lophodermium - Japanese cedar	Pinus sp.	Populus sp.	Quercus ilex - holm oak	1. Ring-barking / spraying / drill and fill	2. Manual Felling	3. Machine Assisted Felling	4. Manual Dismantling	5. MEWP Assisted Dismantling	6. MEWP Assisted Dismantling	7. Crane Assisted Dismantling	8. Helicopter Assisted Dismantling	Processing Site 1	Processing Site 2	Cut & Leave	Mulch On Site	Mulch Off Site	Cut Logs On Site	Cut Logs Off Site																																																										
Quarry	57	0	1	1	0	0	1	0	2	0	4	0	0	47	0	1	x																				x	x														No proximity to access point, large quantity of trees to be removed, area of archaeological sensitivity.	Area of archaeological sensitivity - no ground disturbance Cut material to be moved to Processing Site 1 or 2 according to proximity/reach.																																				
Eastern Slope	11	0	0	0	0	0	3	0	1	4	0	0	3	0	0	0																																										x																					No proximity to access point, 7 trees to be removed, area of archaeological sensitivity.	Area of archaeological sensitivity - no ground disturbance Cut material to be moved to Processing Site 2.									
Road Boundary	26	13	0	0	0	0	1	1	0	4	0	1	0	0	3	3																																													x																							Proximity to the access road, large quantity of trees and specimen to be removed.	Area of archaeological sensitivity - no ground disturbance Cut material can be lifted on to the road, carpark or direct to Processing Site 1 or 2				
North Corner	6	0	0	0	2	1	0	0	1	1	0	0	0	0	1	0	x																																														x																							Archaeological sensitive area. The use of crash mats is required to eliminate ground disturbance.	Area of archaeological sensitivity - no ground disturbance Cut material to be processed either within work area or at Processing Site 1		
Tihi	12	0	0	0	0	0	2	0	0	1	0	0	0	9	0	0																																																x	x	x	x																					No proximity to access point, small number of trees to be removed, area of archaeological sensitivity on tihi but negligible on steep northern slope.	Area of archaeological sensitivity - no ground disturbance on tihi. Cut material from tihi to be moved to Processing Site 1 or 2

Operational Management Requirements

Appendix E sets out operational management requirements for carrying out the works.

The requirements focus on compliance with health and safety, regulation compliance and client relationship.

This would form part of a delivery plan and its purpose to achieve the desired outcomes within the various requirements and constraints of the project, as well as providing reassurance to the Authority, it is recommended that the contractor be required to adequately demonstrate appropriate operations management system controls.

Appendix A: Description of Tree Removal Methods

Method	Description
Ringbarking, spraying, drill and fill methods	Where trees can be left to die and decay in situ, various techniques can be employed to kill a standing tree. Removing a complete ring of bark near the base of the tree can effectively kill the upward portion of many types of tree that exhibit secondary growth. Other alternative methods involve the application of herbicide via holes drilled in the base of the stem or direct spraying of the foliage or basal bark. The trees will die after a period and will slowly decay and fall apart in sections or fail at the root plate or base.
Manual felling	The tree is cut at the base using approved felling techniques. A pre-installed pull rope can be hand pulled by ground staff or attached to a hand winch to assist with directional felling. The cutting arborist (herein after referred to as the cutter) may use other tools such as hammer and wedges, felling lever, or jack to push open the back cut to assist with directional felling. Once the final cut (the back cut) has been completed, and the tree begins to fall, the cutter retreats from the base of the tree via pre-planned escape route. If pull assisted felling is being employed, the cutter may have the opportunity to retreat via the escape route before the tree is pulled over. A felled tree is typically dismantled using approved snedding or delimiting techniques to remove side branches. Logs can be cut to required lengths.
Machine assisted manual felling	The excavator operator positions the excavator in an appropriate position to push the tree in the intended direction of fell or is attached to a pull line and positioned to pull the tree in the intended felling direction. The cutter makes felling cuts at the base of the tree. Once the final cut (the back cut) has been completed, the cutting arborist retreats from the base of the tree via pre planned escape route. The excavator then pushes or pulls the tree over. A felled tree is typically dismantled using approved snedding or delimiting techniques to remove side branches. Logs can be cut to required lengths.
Manual dismantling	The tree may be accessed using a mobile elevated work platform (MEWP or by a climber with a rope and harness. Approved cutting techniques can be used to cut the tree in sections. Sections can be cut and allowed to free fall to the ground or can be cut and snapped off by hand and then thrown to the ground. Cut sections can be pushed by the climber or pulled by ground staff using a pull line to assist cut sections to fall in a particular direction.
Manual dismantling using rigging techniques	The tree can be accessed using a MEWP or by a climber with a rope and harness. The tree can be dismantled in sections using approved cutting techniques. Where there are targets below and/or debris needs to be lowered or relocated in a controlled manner, rigging techniques can be employed. Rigging typically involves the use of a system of ropes, pulleys/rings, and a ground based friction device, and other hardware. Rigging techniques can be used to lift or lower cut sections, or more advanced techniques such as sky/speed line or compound rigging can be used to transport cut material to another location. Using appropriate rigging techniques can reduce or avoid the impact of falling debris. Additional impact prevention measures can be implemented for sensitive sites such as the use of padding or impact resistant materials for crash pads.
MEWP assisted dismantling	The MEWP operator will position the truck and set it up in an appropriate place. The work platform is used to access the tree. From the platform, the tree can be dismantled using proper cutting and rigging procedures. If the work is near overhead power lines, an insulated boom, insulated tools and other specialist equipment can be utilised by competent and suitably qualified staff to clear vegetation from the power lines. Specific procedures need to be followed for work around overhead power lines. The voltage, weather and proximity of vegetation, vehicles, tools, and staff all need to be considered. When working near overhead power lines, a dedicated safety observer is positioned to watch the MEWP operator to ensure no part accidentally comes in contact with the overhead lines. When working on network lines the network

	<p>operator's control centre needs to be notified about timing and location of work. A MEWP may also be utilised to dismantle trees that are unsafe to climb or difficult for a climber to access. The MEWP operator can cut small sections that can be snapped off by hand. The MEWP can be used to fly the held piece over to an appropriate position where they can be safely dropped.</p>
Crane assisted dismantling	<p>The crane will be setup in an appropriate location. A climber will access the tree using a rope and harness or via the crane. The lifting dogman will direct the crane operator to manoeuvre the hook to the climber. The climber will attach the crane hook using chains or sling to the section to be cut. The dogman will direct the crane operator to apply appropriate tension and position the hook over the section's centre of gravity. The climber will descend to a position agreed with the dogman to perform the cut sequence. Once directed by the dogman, the climber will proceed to cut the section to release it in a controlled manner. As the piece is released, the dogman will direct the crane operator to lift the section smoothly up and away from the climber. The crane operator will fly the load to the processing site where he will be directed by the landing dogman to lower and settle the section. Once the section has been stabilised, the sling/chains can be released by ground staff. The crane operator then directs the hook back to the climber for the next lift and the sequence is repeated.</p>
Helicopter assisted dismantling	<p>A suitably qualified climbing arborist (herein after referred to as the climber) will access the tree using a rope and harness. The tree may be pre-stropped (long choker slings/strops attached prior, to minimise flying time). The climber will check and adjust if necessary sling. The lifting dogman will direct the helicopter pilot to manoeuvre the helicopter hook to the climber. The hook is attached to the helicopter via a long line. The climber will attach the sling to the hook and signal the dogman. The lifting dogman will direct the pilot to take up the slack and position the helicopter over the load's centre of gravity. The lifting dogman will communicate with the climber to place the cuts at an appropriate point to ensure the load is within the helicopter's lifting capabilities and so the loaded can be lifted smoothly away from the climber.</p> <p>Once the climber has completed the cut procedure, the lifting dogman will direct the pilot to lift the load away from the climber and transport it to the processing site, via planned extraction zones. The landing dogman will direct the pilot to lower and release the load at the processing site. All machinery, vehicles and staff are kept clear of the flight path and suspended load. Once the load has been released, the pilot will return for the next lift, and the procedure will be repeated.</p> <p>During flying operations, only work that is strictly necessary is to be carried out within the landing zone, e.g. releasing slings and safe placement of loads. Loads are only to be approached once they have been safely landed and stabilised.</p>

Appendix B: Description of Tree Processing Methods

Method	Description
Cut and Leave	Material can be left as it lies or stacked into eco piles that will provide habitat and decay over time returning nutrients to the soil.
Mulch On Site	Where mulch can be utilised on site, the chipped material can be chipped directly into a pile or chipped into a truck and tipped at an accessible location. If the cut material is to be chipped directly onto the site, a track mounted chipper can be used for less accessible sites.
Mulch Off Site	Chip-able material can be fed manually or by an excavator into a wood chipper that sprays the chip into the back of a tipper truck. Two 10t trucks will operate in rotation to remove mulch from site when processing higher volumes with an excavator. Truck movements can be up to 8-10 movements to and from site per day.
Log On Site	Logs can be left in length or cut into manageable sizes for the public to remove for firewood.
Log Off Site	Larger logs can be cut up and loaded into a truck manually, or loaded in larger lengths with a loader, crane, hiab or excavator. Logs can be transported from site in up to 5m lengths using a 10t tip truck or hiab truck with of 5m deck which can tow a trailer with additional 5m deck. Truck movements are estimated to be up to 4-5 movements to and from site per day.

Appendix C: Itemised Tree Inventory

item_number	tree_species	Operating Area	latitude	longitude	rpms_status	dbh_mm	height_approx	crown_spread	Removal Method
1	Pinus sp.	Tihi	-36.88843405	174.9033459	Not a pest plant	10	12	2	Helicopter Assisted
2	Pinus sp.	Tihi	-36.88846811	174.9037053	Not a pest plant	30	18	5	Helicopter Assisted
3	Eucalyptus sp.	Tihi	-36.88848608	174.903824	Not a pest plant	50	22	9	Helicopter Assisted
4	Liquidambar styraciflua - sweetgum	Road Boundary	-36.89045485	174.9033258	Not a pest plant	90	11	16	Crane Assisted Felling
5	Cryptomeria japonica - Japanese cedar	Road Boundary	-36.89024274	174.9038686	Not a pest plant	110	13	13	Crane Assisted Felling
6	Eucalyptus sp.	Eastern Slope	-36.88949273	174.905549	Not a pest plant	120	13	18	Helicopter Assisted
7	Eucalyptus sp.	Eastern Slope	-36.88949273	174.905549	Not a pest plant	120	13	18	Crane Assisted Felling
8	Crataegus laevigata - English hawthorn	Eastern Slope	-36.88888161	174.9043641	Surveillance - Whole Region	25	5	12	Helicopter Assisted
9	Crataegus laevigata - English hawthorn	Eastern Slope	-36.88888161	174.9043641	Surveillance - Whole Region	25	5	12	Helicopter Assisted
10	Lophostemon conferta - Queensland Box	Eastern Slope	-36.8892345	174.9043316	Not a pest plant	65	16	13	Helicopter Assisted
11	Lophostemon conferta - Queensland Box	Eastern Slope	-36.8892345	174.9043316	Not a pest plant	65	16	13	Helicopter Assisted
12	Lophostemon conferta - Queensland Box	Eastern Slope	-36.8892345	174.9043316	Not a pest plant	65	16	13	Helicopter Assisted
13	Eucalyptus sp.	Eastern Slope	-36.88985285	174.9035011	Not a pest plant	40	10	7	Helicopter Assisted
14	Pinus sp.	Tihi	-36.88966676	174.9031162	Not a pest plant	85	18	13	Helicopter Assisted
15	Pinus sp.	Tihi	-36.88966676	174.9031162	Not a pest plant	85	18	13	Helicopter Assisted
16	Cupressus macrocarpa - Monterey cypress	Eastern Slope	-36.88945492	174.9037268	Not a pest plant	140	13	15	Helicopter Assisted
17	Pinus sp.	Tihi	-36.88911007	174.9040912	Not a pest plant	95	18	8	Helicopter Assisted
18	Crataegus laevigata - English hawthorn	Eastern Slope	-36.88888804	174.9040637	Surveillance - Whole Region	25	6	6	Helicopter Assisted
19	Pinus sp.	Tihi	-36.88865475	174.9034921	Not a pest plant	95	12	15	Helicopter Assisted
20	Pinus sp.	Tihi	-36.88872661	174.9033697	Not a pest plant	85	13	8	Helicopter Assisted
21	Pinus sp.	Tihi	-36.88872929	174.9033412	Not a pest plant	160	13	19	Helicopter Assisted
22	Pinus sp.	Tihi	-36.88870865	174.903257	Not a pest plant	80	12	9	Helicopter Assisted
23	Crataegus laevigata - English hawthorn	Tihi	-36.88861318	174.9030203	Surveillance - Whole Region	25	6	8	Crane Assisted Felling
24	Crataegus laevigata - English hawthorn	Tihi	-36.88872125	174.9029583	Surveillance - Whole Region	25	5	8	Crane Assisted Felling
25	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
26	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
27	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
28	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
29	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
30	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
31	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
32	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
33	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
34	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
35	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
36	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
37	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
38	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling

item_number	tree_species	Operating Area	latitude	longitude	rpms_status	dbh_mm	height_approx_m	crown_spread_m	Removal Method
39	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
40	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
41	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
42	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
43	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
44	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
45	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
46	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
47	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
48	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
49	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
50	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
51	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
52	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
53	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
54	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
55	Pinus sp.	Quarry	-36.88880625	174.9019253	Not a pest plant	85	20	8	Crane Assisted Felling
56	Quercus ilex - holm oak	Quarry	-36.88880384	174.9014616	Not a pest plant	60	8	9	Crane Assisted Felling
57	Cupressus macrocarpa - Monterey cypress	Quarry	-36.88907521	174.901289	Not a pest plant	400	16	22	Crane Assisted Felling
58	Grevillea robusta - silky oak	Quarry	-36.88930797	174.9019937	Not a pest plant	95	11	9	Crane Assisted Felling
59	Grevillea robusta - silky oak	Quarry	-36.88930127	174.9019582	Not a pest plant	95	15	9	Crane Assisted Felling
60	Agonis flexuosa - willow myrtle,peppermint tree	Quarry	-36.88920366	174.9015465	Not a pest plant	45	10	10	Crane Assisted Felling
61	Pinus sp.	Quarry	-36.88913099	174.9015954	Not a pest plant	40	9	7	Crane Assisted Felling
62	Grevillea robusta - silky oak	Quarry	-36.88918703	174.901581	Not a pest plant	30	11	8	Crane Assisted Felling
63	Grevillea robusta - silky oak	Quarry	-36.88918703	174.901581	Not a pest plant	30	11	8	Crane Assisted Felling
64	Pinus sp.	Quarry	-36.88905859	174.9015797	Not a pest plant	120	24	10	Crane Assisted Felling
65	Pinus sp.	Quarry	-36.88919052	174.9017017	Not a pest plant	110	22	12	Crane Assisted Felling
66	Pinus sp.	Quarry	-36.88902453	174.9017664	Not a pest plant	95	22	9	Crane Assisted Felling
67	Pinus sp.	Quarry	-36.88899423	174.901813	Not a pest plant	60	10		Crane Assisted Felling
68	Pinus sp.	Quarry	-36.88898377	174.9018539	Not a pest plant	80	20	5	Crane Assisted Felling
69	Pinus sp.	Quarry	-36.88902534	174.9018864	Not a pest plant	75	22	4	Crane Assisted Felling
70	Pinus sp.	Quarry	-36.88898324	174.9019703	Not a pest plant	110	24	16	Crane Assisted Felling
71	Pinus sp.	Quarry	-36.88898324	174.9019703	Not a pest plant	110	24	16	Crane Assisted Felling
72	Pinus sp.	Quarry	-36.88898324	174.9019703	Not a pest plant	110	24	16	Crane Assisted Felling
73	Pinus sp.	Quarry	-36.88898324	174.9019703	Not a pest plant	110	24	16	Crane Assisted Felling
74	Pinus sp.	Quarry	-36.8891216	174.9020212	Not a pest plant	80	22	7	Crane Assisted Felling
75	Pinus sp.	Quarry	-36.88913233	174.902047	Not a pest plant	80	22	6	Crane Assisted Felling
76	Pinus sp.	Quarry	-36.88915351	174.9021101	Not a pest plant	120	22	12	Crane Assisted Felling
77	Pinus sp.	Quarry	-36.88915351	174.9021101	Not a pest plant	120	22	12	Crane Assisted Felling
78	Pinus sp.	Quarry	-36.88915351	174.9021101	Not a pest plant	120	22	12	Crane Assisted Felling
79	Araucaria cunninghamii -hoop pine	Quarry	-36.88917843	174.9022123	Not a pest plant	50	6	12	Crane Assisted Felling
80	Crataegus laevigata - English hawthorn	Quarry	-36.88942569	174.9024178	Surveillance - Whole Region	40	7	7	Crane Assisted Felling

item_number	tree_species	Operating Area	latitude	longitude	rpms_status	dbh_mm	height_approx_m	crown_spread_m	Removal Method
81	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.8908804	174.9020873	Surveillance - Whole Region	40	10	5	Crane Assisted Felling
82	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
83	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
84	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
85	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
86	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
87	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
88	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
89	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
90	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
91	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
92	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
93	Acmena smithii, Syzyium - lilly pilly, monkey apple	Road Boundary	-36.89093832	174.9017926	Surveillance - Whole Region	50	11	12	Crane Assisted Felling
94	Quercus ilex - holm oak	Road Boundary	-36.89103796	174.9013511	Not a pest plant	100	11		Crane Assisted Felling
95	Quercus ilex - holm oak	Road Boundary	-36.89109465	174.9012742	Not a pest plant	100	11	16	Crane Assisted Felling
96	Quercus ilex - holm oak	Road Boundary	-36.89095146	174.9012611	Not a pest plant	20	4	4	Crane Assisted Felling
97	Eucalyptus sp.	Eastern Slope	-36.89050043	174.901183	Not a pest plant	900	10	10	Crane Assisted Felling
98	Eucalyptus sp.	Road Boundary	-36.89067875	174.9012598	Not a pest plant	90	12	8	Crane Assisted Felling
99	Crataegus laevigata - English hawthorn	Road Boundary	-36.89065972	174.9011824	Surveillance - Whole Region	40	6	9	Crane Assisted Felling
100	Eucalyptus sp.	Road Boundary	-36.89062432	174.901235	Not a pest plant	90	20	18	Crane Assisted Felling
101	Eucalyptus sp.	Road Boundary	-36.89057391	174.9012236	Not a pest plant	50	16	9	Crane Assisted Felling
102	Cedrus atlantica - Atlas cedar,blue	North Corner	-36.88847653	174.8998278	Not a pest plant	1500	15	12	Manual Felling
103	Cupressus macrocarpa - Monterey cypress	North Corner	-36.88827352	174.8998883	Not a pest plant	650	10	12	Manual Felling
104	Callistemon sp. - bottle brush	North Corner	-36.88828098	174.8999819	Not a pest plant	600	5	8	Manual Felling
105	Populus sp.	North Corner	-36.888299	174.8999412	Not a pest plant	850	15	8	Manual Felling
106	Callistemon sp. - bottle brush	North Corner	-36.88837385	174.8999416	Not a pest plant	1000	6	10	Manual Felling
107	Eucalyptus sp.	North Corner	-36.88840927	174.9000952	Not a pest plant	750	11	8	Manual Felling
108	Eucalyptus sp.	Road Boundary	-36.89021749	174.9011916	Not a pest plant	11000	24	18	Crane Assisted Felling
109	Populus sp.	Road Boundary	-36.88991956	174.9011131	Not a pest plant	1000	12	17	Crane Assisted Felling
110	Populus sp.	Road Boundary	-36.88981709	174.9011321	Not a pest plant	1200	12	15	Crane Assisted Felling
111	Populus sp.	Road Boundary	-36.88973648	174.9011076	Not a pest plant	1000	12	12	Crane Assisted Felling
112	Cupressus macrocarpa - Monterey cypress	Quarry	-36.88950238	174.9010663	Not a pest plant	1500	15	20	Crane Assisted Felling

Appendix E: Recommended Operational Management Requirements

Health and Safety

A detailed plan showing the contractor's health and safety policy and site specific hazards plans and how it will be specifically applied to the works;

Environmental Management

A detailed plan showing the processes and procedures the contractor will use to ensure the service meets all of the legislative / regulatory requirements;

Resource Plan

A detailed plan showing the resources (equipment and labour) the contractor will use to ensure the works meet all of the requirements stated in an agreement yet to be drawn up. This agreement would detail the number of staff, qualification levels and competencies with regard to arboricultural operations. This plan will also include management of response work requests, including 24/7 call centre or equivalent processing to take account of incidents which could arise at the site;

Traffic Management Plan

A detailed plan showing the processes and procedures the contractor will use to ensure that appropriate traffic management systems, procedures and plans are used to ensure the work processes meet all of the legislative requirements:

- (i) The contractor is to adopt/develop, implement and manage suitable generic and specific traffic management plans (TMPs) so that the works requiring public highway access can be undertaken in accordance with the relevant legislative requirements;
- (ii) Temporary traffic control shall be in accordance with 'The NZTA Code of Practice for Temporary Traffic Management' and any other Codes of Practice adopted by the Authority, depending upon the specific traffic control requirements for the site; and

Relationship Management Plan

A detailed plan showing the processes and procedures the contractor will use to ensure that all communications relating to the management and operation of the works facilitates understanding and provides a 'No surprises' regime. This is likely to be a high profile undertaking and regular exchanges of information will be required to field potential external queries and inform timely intervention where matters unexpectedly deviate from the plan.

Emergency Work Plan

A detailed plan showing the processes and procedures the contractor will use to manage any Emergency Work that is required to be undertaken as part of the works;

Business Continuity Plan

A detailed plan showing the processes and procedures the contractor will use to manage uninterrupted continuation of the works;

Risk Mitigation Plan

A detailed plan showing the processes and procedures the contractor will use to manage risk assessment and management of risks identified by the contractor. The contractor will need to ensure Public liability cover of at least \$2 million indemnity is current for the duration of the works;

Information and Reporting

A detailed plan showing the processes for gathering, managing, checking and reporting information;

Billing

A detailed plan showing the processes for ensuring invoicing is on time, with enough information for the Authority to be able to easily ask questions, understand what is being billed for, and assess the progress of works to date.

Quality Management Plan (QMP)

A detailed Quality Management Plan should be provided by the contractor.

It may prove expedient for the Authority to agree with any prospective contractor the standard to be adopted for the purposes of the contract as a baseline reference point. The content of the Quality Management Plan should include but not be limited to:

- Quality management processes to ensure all works are delivered to the appropriate standard and comply with all relevant industry practises and legislation;
- A compliments and complaints procedure, including a process for effectively responding to complaints; and
- All other things necessary to ensure the quality of the works as may be required by the Authority.

The Quality Management Plan should be approved in writing by the Authority. If such a quality management plan is rejected by the Authority the contractor should address all issues regarding the Quality Management Plan made known to the contractor by the Authority and re-submit until approval is obtained.

Variation to the QMP may be required from time to time by mutual agreement.

The contractor must regularly update and maintain the Quality Assurance Plan throughout the works period.

Best Practice Standards

All operations shall have regard to arboricultural best practice. In general, the determination of good practices can be gleaned from the following:

- <https://www.nzarb.org.nz/Safety++Compliance/Guides.html> (NZ)
- BS 5837:2012 Trees in relation to design, demolition and construction– Recommendations (UK)
- BS 3998:2010 Tree work. Recommendations (UK)
- ANSI A300 (series) American National Standard for Tree Care Operations (USA)
- AS 4970-2009 Protection of trees on development sites (Aus)
- AS 4373—2007 Pruning of amenity trees (Aus)

Working Hours

The contractor shall need to ensure that all works, particularly helicopter extractions, which generate excessive noise or other hindrances are carried out at times that minimise the impact to the public and local residents and comply with any relevant bylaws and/or specific noise restrictions.