



Creating Green Space
Sustainability

Arboricultural Report

Beca

**Whenuapai Redhills: Package 1
Project**



Arboricultural Report

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Date: August 2022

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Executive Summary

The Whenuapai Redhills: Package 1 Project is being commissioned to accommodate growth in the Whenuapai catchment. This report assesses the potential effects of the construction of a pump station at 23 - 27 Brigham Creek Road, a rising main between the pump station and 32 Mamari Road, a culvert at Sinton Stream, a break-pressure chamber at 32 Mamari Road and a small-scale local network diversion from Tamiro Road to the pump station.

The purpose of this report is to identify and assess the potential adverse effects on trees in the vicinity of the works and provide protocols and procedures that guide design and works near the trees.

The proposal requires excavations within the root zone of trees growing within private property, within the riparian areas of streams, and Council owned trees growing within the open space zone and the road reserve.

To reduce risk associated with the final line of works and the slight inaccuracies in the tree plotting, where the works are in close proximity of the Protected Root Zone, they have been included for Tree Owner Approval and resource consent requirements.

The Project results in works within or adjacent to the root zone of 712 trees, of these:

- 546 trees are proposed to be removed, which consists of 50 trees growing within open space, 203 trees growing within the road reserve, 79 trees within a riparian margin and 214 trees growing inside privately owned property. 97 of these trees require resource consent.
- 166 trees are proposed to be retained, of which 47 require resource consent for works within their root zone.
- In total 144 trees require resource consent for removal or works within their root zone.

For the continuity of works, where adverse effects are expected to be more than minor, resource consent for tree removal has been proposed. However, the full effects will not be known until during the works and removal may not be necessary. Where trees can be retained, they will be protected in a manner that ensures adverse effects are kept to be less than minor.

1. Introduction

- 1.1 Beca has engaged Arborlab Consultancy Services Limited to carry out an arboricultural assessment of effects relating to the Whenuapai Redhills: Package 1 Project (the Project)
- 1.2 The Project requires excavations within the root zone of trees growing within private property, within the riparian areas of streams, and Council owned trees growing within the open space zone and the road reserve.
- 1.3 The purpose of this report is to identify and assess the potential effects on trees in the vicinity of the works, and provide protocols and procedures that guide design and works near the trees.

Tree Assessment Methodology

- 1.4 A Visual Tree Assessment (VTA) consistent with modern arboricultural practices (Mattheck and Breloer, 1994) was conducted. This assessment was carried out at ground level.
- 1.5 Tree health assessments are generally based on experience and adaptation from generally accepted industry parameters. The indicators used to determine health are leaf shape, colour, size and form, foliage or bud formation, distribution within the canopy and canopy density. These indicators consider the tree's age and species type. The health is categorised as Good, Fair, Poor, Very Poor or Dead.
- 1.6 No tissue sampling and/or expert geological investigations were carried out. All data was collected without the use of any invasive and/or diagnostic tools.
- 1.7 The tools used onsite to gather the necessary tree data were a measuring tape and hand-held devices. Measurements should be considered an approximation only.
- 1.8 The tree root zone measurements within the report are undertaken using the principles of AS 4970-2007, therefore, the structural rootzones are considered to be from the trunk centre.

Limitations

- 1.9 It should be noted that trees are dynamic organisms affected by environmental, biotic and mechanical stressors, which can impact on health, vitality and structural integrity. Response symptoms of stress can often not be apparent within trees for a number of years. Given the changeable nature of trees, assessments are generally relevant for up to 12-months.
- 1.10 Structural Root Zone (SRZ)¹ and Tree Protection Zone (TPZ)² measurements have been recorded in accordance with Auckland Council's Tree Owner Approval Guide.
- 1.11 If the line of works has been assessed to be marginally outside the SRZ of a tree, we have included it to be within the SRZ. This will account for any minor miscalculations and ensures that the assessment effects is fully understood and the appropriate tree protection measures are applied.
- 1.12 The assessments have considered the size of the pipes and open trenching as the installation

¹ SRZ calculation: $SRZ_{(m)} = 0.27 \times DBH_{(cm)}^{0.56}$

² TPZ calculation: $TPZ_{(m)} = DBH_{(m)} \times 12$

methodology. This provides a base line for the potential adverse effects to the trees, using a 'worst case scenario'.

- 1.13 This report provides a spreadsheet outlining the trees identified on the routes. Each tree within the spreadsheet is attributed an identification number that relates to the plans provided.
- 1.14 Tree locations have been plotted using a combination of GIS and overhead mapping. This method, although generally accurate, can be inexact, especially when recording trees in groups, and should not be therefore considered precise.
- 1.15 To reduce risk associated with the final line of works and the slight inaccuracies in the tree plotting, where the works are in close proximity of the Protected Root Zone (PRZ) they have been included for TOA and resource consent requirements.

Project Description

- 1.16 The Project aims to provide wastewater servicing capacity for approximately 10,240 dwellings, or 30,720 people, in the Whenuapai catchment. This growth is projected to occur by 2041. The Project includes the following five key components (see Figure 1 below)
- 1.17 A Pump Station at a point where the Whenuapai and Redhills Catchments meet at 23-27 Brigham Creek Road, with an emergency overflow outfall to Sinton Stream
- 1.18 A Gravity Main Pipeline (approximately 700m long and 375 – 475 mm in diameter) between Whenuapai Village Pump Station on Tamiro Road and the new pump station
- 1.19 A Rising Main (approximately 1.4km long and 500 mm in diameter) between the Pump Station and a proposed new Break Pressure Chamber on Mamari Road (the boundary of Package 2).
- 1.20 A Culvert (approximately 63m long including wing wall and rip rap) to provide access for the rising main across Sinton Stream.
- 1.21 A Break Pressure Chamber which connects to the Massey Connector rising main (proposed under Package 2).

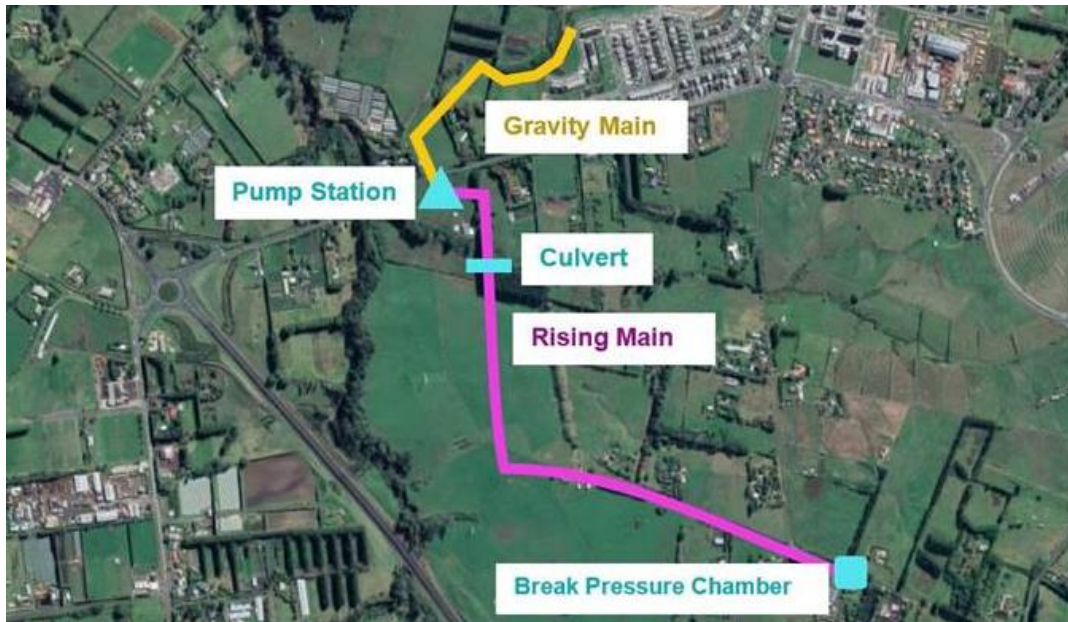


Figure 1 Error! No text of specified style in document.: Aerial image outlining the location of the proposed works.

1.22 The Project extends from the existing Whenuapai Village pump station site in Tamiro Road in the north, across Brigham Creek Road, to Spedding Road in the south.

Site Details

1.23 Figure 2 below outlines the proposed designation boundary shown in yellow (the area of proposed works).

1.24 The works are proposed to be undertaken with the following land zones as outlined the Auckland Unitary Plan (AUP) *Future Urban Zone, Road Reserve, Open Space – Informal Recreation*. Additionally, a riparian margin is located within the site of works.

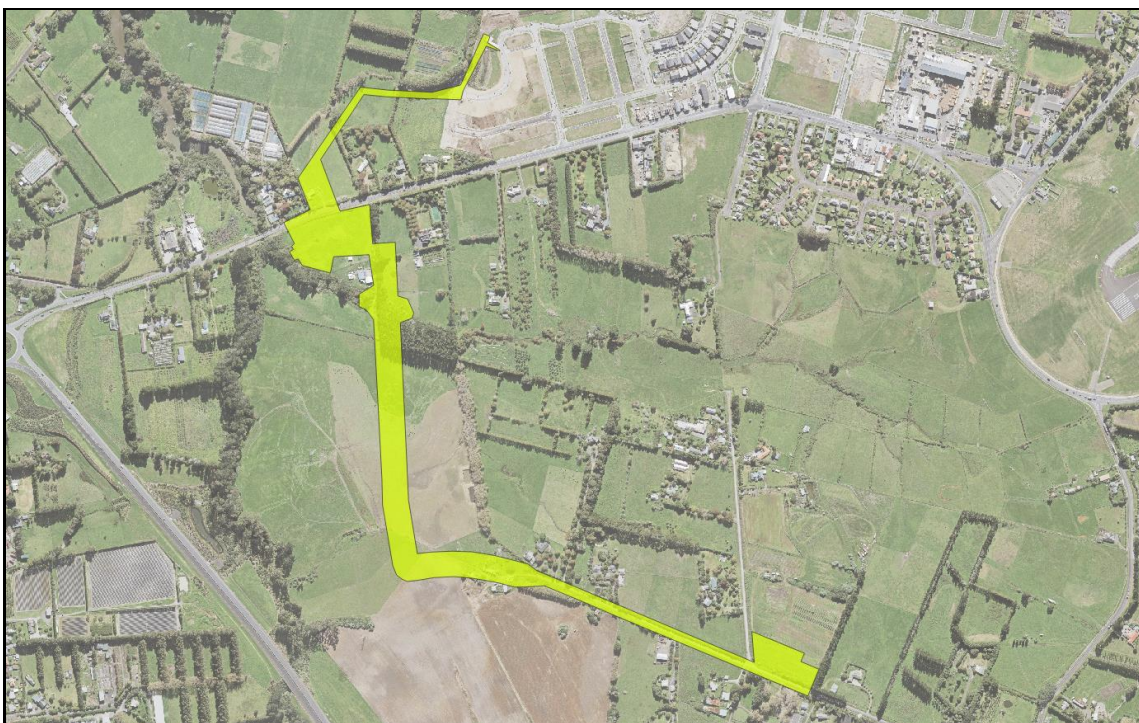


Figure 1: Aerial image outlining the area of the proposed works.

2. Proposed Works

- 2.1 The construction methodology of the works requires a combination of cut and fill excavations, open trenching and trenchless construction via directional drilling or pipe hammering. Two sections north of Brigham Creek Road, including the Brigham Creek Road crossing, are proposed to be installed using trenchless construction methods. It is to be noted however, that the use of trenchless methods will ultimately be determined by the ground conditions and/or the presence of underground obstructions. Where ground conditions of impediments are not favourable for trenchless methods, open trenching will be employed.
- 2.2 Trenchless pipe installation is proposed to be at a depth of at least 800mm below ground. Open excavations for the entry and exit pits will be kept outside the protected rootzones of the trees. Typically, a tree's critical root growth is within the top 600mm soil profile, therefore trenchless construction at 800mm below ground level has been proposed to avoid conflict.
- 2.3 Open excavations will be undertaken by a machine excavator. Where open trenches are required, the works footprint will generally measure ten metres in width, which includes temporary tracking for vehicles and a safe working area. The depth of pipe trench will be approximately 1.2 metres, vegetation growing within the works footprint will need to be removed. Open excavations will also be required within the riparian margin, which will affect trees growing adjacent to the proposed pump station and at Sinton Creek culvert.
- 2.4 Where trees are within proximity of the excavations, it is proposed that arboricultural monitoring and tree protection methodologies will be implemented to manage and mitigate the potential adverse effects. To minimise adverse effects encroachments into the tree's SRZ may require an alternate method of excavation, such as air-vac or hydro-vac. Where works are deemed a major encroachment without mitigation or alternative methods, the tree will require removal.
- 2.5 In general, minor tree trimming may be required to avoid contact with machinery which could result in damage to the trees near the line of works. Any trimming and removal should be undertaken by qualified arboricultural contractor.

3. Auckland Unitary Plan Regulatory Requirements

3.1 The proposal will require excavations within the protected root zone (PRZ) of trees, any work activities being undertaken within the PRZ are subject to rules and standards outlined in the Auckland Unitary Plan (AUP). The PRZ is defined as the; “*circular area of ground around the trunk of a protected tree, the radius of which is the greatest distance between the trunk and the outer edge of the canopy. For columnar crown species the protected root zone is half the height of the tree*”.

3.2 The following tables outline the AUP (OP) rules subject to the works.

Table 1: E26.4.3.1 Activity table – Trees in Roads and Open Space Zones

Activity		Auckland wide-rules Trees	
		Trees in Roads	Open Space Zones
Operation, maintenance, renewal, repair, construction and removal of network utilities and electricity generation facilities and, minor infrastructure upgrading			
(A82)	Pest Plant Removal *of any tree less than 4m in height and less than 400mm in girth	Permitted	Permitted
(A87)	Works within the protected root zone that comply with Standard E26.4.5.2	Permitted	Permitted
(A88)	Works within the protected root zone not otherwise provided for	Restricted Discretionary	Restricted Discretionary
(A90)	Tree trimming, alteration or removal on roads adjoining rural zones and on roads adjoining the Future Urban Zone	Permitted	Not Applicable
(A91)	Tree alteration or removal of any tree less than 4m in height and/or less than 400mm in girth	Permitted	Permitted
(A92)	Tree alteration or removal of any tree greater than 4m in height and/or greater than 400mm in girth	Restricted Discretionary	Restricted Discretionary

Table 2: E26.3.3.1 Activity table – Trees in Riparian areas

Activity		Auckland wide-rules Trees
		Riparian areas
Operation, maintenance, renewal, repair, construction and removal of network utilities and electricity generation facilities and, minor infrastructure upgrading		
(A76)	Vegetation alteration or removal	Permitted
(A77)	Vegetation alteration or removal that does not comply with Standards E26.3.5.1 to E26.3.5.4	Restricted Discretionary

- 3.3 The proposal requires the removal and works within the root zone of trees growing within zones future urban, road reserve, open space and within the riparian margin.
- 3.4 Tree trimming, alteration or removal of 203 trees growing within the road reserve on roads adjoining the Future Urban Zone, as outlined in E.26.4.3.1 (A90), is a permitted activity.
- 3.5 The removal of 50 trees growing within land zoned as open space as outlined in E.26.4.3.1 (A92) is considered a restricted discretionary activity.
- 3.6 Forty-seven trees growing within the riparian margin require works within their root zone. These works are a restricted discretionary activity, as outlined in E.26.3.3.1 (A77).
- 3.7 Seventy-nine trees growing within the riparian margin are proposed to be removed. The removal of 47 trees is considered a restricted discretionary activity as they are over 6 metres in height and/or 600mm girth. The removal of the remaining 32 trees is a permitted activity as they do not meet the dimension threshold that affords them protection.
- 3.8 Overall, the works will require restricted discretionary activity resource consent. Additionally, tree owner approval (TOA) from the Community Facilities arborist is required for works within the root zone and removal of trees growing within the road reserve and open space.
- 3.9 As the trees are growing within the road corridor and open space zone, tree owner approval (TOA) is required from Council's Community Facilities arborist. In accordance with the TOA Guidance Document, this report references the SRZ and the TPZ. Any assessment of Council trees using these root zones is for TOA process only and are not relevant to the rules and standards outlined in the Auckland Unitary Plan.
- 3.10 The Australian Standards AS 4970-2009, describe the TPZ as the optimal combination of crown and root area that requires protection during the construction process so that the tree can remain viable. The TPZ is an area that is isolated to ensure that tree sensitive construction measures are implemented so that any disturbance or encroachment is mitigated. The Standards describes the SRZ as the area of the root system used for stability, mechanical support and anchorage of the tree. Construction and work activities in this area are avoided or heavily limited.



4. Findings

4.1 Table 3 below contains details of the Council owned trees, all tree groups within Table 3 require TOA and one requires RC.

4.2 Table 4 below contains details of the privately owned trees, no tree groups within Table 4 require TOA and eleven require RC.

Table 3 – Vegetation inventory – Council owned trees

Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
1 (x50)	Mixed Native Vegetation	4	300	1.5	2	3	Good	Open Space	Yes	Yes	Remove (trenched method)	Reserve trees. Affected by trenched method and require removal Unaffected by trenchless methods, can be retained The group is primarily made up of the recently planted Manuka, Flax and cabbage tree species growing adjacent to existing Whenuapai Village Pump Station.	Tamiro Road, Whenuapai
14 (X15)	Mixed Vegetation	3	200	1.5	2	3	Fair	Road Reserve	Yes	No	Remove	Road Reserve Mixed species consisting of pest plants Compromised by excavation	20-22 Brigham Creek Road Whenuapai
15 (X1)	<i>Banksia integrifolia</i>	4	500	1.7	2	3	Poor	Road Reserve	Yes	No	Remove	Road Reserve Compromised by excavation	20-22 Brigham Creek Road Whenuapai
16 (X1)	<i>Casuarina cunninghamiana</i>	6	500	1.7	2	4	Poor	Road Reserve	Yes	No	Remove	Road Reserve Compromised by excavation	20-22 Brigham Creek Road Whenuapai
17 (X1)	<i>Prunus cerasifera</i>	4	500	1.7	2	4	Fair	Road Reserve	Yes	No	Remove	Road Reserve Compromised by excavation	23-27 Brigham Creek Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
35 (X35)	<i>Pittosporum crassifolium</i>	3	700	1.8	2.6	3	Fair	Road Reserve	Yes	No	Remove	Road Reserve Compromised by excavation works	14 Spedding Road Whenuapai
40 (X10)	<i>Salix fragilis</i>	6	1200	2.4	4.5	4	Fair	Road Reserve	Yes	No	Remove	Road Reserve Compromised by excavation works	13 Spedding Road Whenuapai
45 (X20)	<i>Fraxinus ornus</i>	6	700	1.8	2.6	3	Fair	Road Reserve	Yes	No	Remove	Road reserve Compromised by excavation works	11 Spedding Road Whenuapai
46 (X90)	<i>Kunzea ericoides</i>	4	700	1.8	2.6	3	Fair	Road Reserve	Yes	No	Remove	Road reserve Compromised by excavation works	10 Spedding Road Whenuapai
51 (X30)	<i>Ligustrum lucidum</i>	4	700	1.8	2.6	3	Fair	Road Reserve	Yes	No	Remove	Road reserve – Spedding Road Pest Plants Compromised by excavation works	32 Mamari Road Whenuapai

Table 4: Vegetation inventory – Privately owned trees

Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
2 (x1)	<i>Cupressus macrocarpa</i>	10	1400	NA	NA	5	Good	Future Urban	No	No	Retain	Private property.	28 Brigham Creek Road Whenuapai
3 (X1)	<i>Cupressus macrocarpa</i>	15	1800	NA	NA	5	Good	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property.	28 Brigham Creek Road Whenuapai
4 (X1)	<i>Populus nigra</i>	10	1400	NA	NA	5	Good	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property.	28 Brigham Creek Road Whenuapai
5 (X1)	<i>Taxodium distichum</i>	6	1000	NA	NA	3	Good	Future Urban	No	Yes (riparian margin)	Remove (trenched method)	Private property. Affected by trenched	28 Brigham Creek Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
												method and require removal unaffected by trenchless methods, can be retained	
6 (X40)	<i>Casuarina cunninghamiana</i>	18	1000	NA	NA	12	Fair	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property.	28 Brigham Creek Road Whenuapai
7 (X1)	<i>Salix babylonica</i>	7	700	NA	NA	3	Fair	Future Urban	No	No	Retain	Private property. Uneffaced as the works will be outside of root zone	28 Brigham Creek Road Whenuapai
8 (X1)	<i>Radermachera sinica</i>	5	500	NA	NA	3	Fair	Future Urban	No	No (removal within permitted standards)	Remove	Private property. Compromised by open trench works	28 Brigham Creek Road Whenuapai
9 (X1)	<i>Populus nigra</i>	18	1800	NA	NA	8	Fair	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property.	28 Brigham Creek Road Whenuapai
10 (X10)	<i>Cryptomeria japonica</i>	15	1000	NA	NA	3	Very poor	Future Urban	No	No	Remove	Private property and riparian margin x3 within riparian margin x7 outside riparian margin Compromised by open trench works	28 Brigham Creek Road Whenuapai
11 (X1)	<i>Eucalyptus sp.</i>	25	2500	NA	NA	8	Fair	Future Urban	No	No	Retain	Private property. Uneffaced as the works will be outside of root zone	26 Brigham Creek Road Whenuapai
12 (X10)	<i>Cryptomeria japonica</i>	10	1000	NA	NA	3	Fair	Future Urban	No	No	Remove	Private property. Compromised by open trench works	26 Brigham Creek Road Whenuapai
13 (X30)	<i>Cryptomeria japonica</i>	10	700	NA	NA	3	Very poor	Future Urban	No	No	Remove	Private property. Compromised by open trench works	20-22 Brigham Creek Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
18 (X5)	<i>Cryptomeria japonica</i>	5	700	NA	NA	3	Good	Future Urban	No	No	Retain	Private property. Minor works that effects less than 10% of the trees' root zones	31 Brigham Creek Road Whenuapai
19 (X20)	<i>Pinus radiata</i>	18	2800	NA	NA	10	Good	Future Urban	No	No	Retain	Private property. Minor works that effects less than 10% of the trees' root zones	31 Brigham Creek Road Whenuapai
20 (X30)	<i>Cryptomeria japonica</i>	10	700	NA	NA	3	Poor	Future Urban	No	No	Remove	Private property. Compromised by open trench works	31 Brigham Creek Road Whenuapai
21 (X6)	<i>Cryptomeria japonica</i>	6	700	NA	NA	3	Poor	Future Urban	No	No	Remove	Private property. Compromised by open trench works	31 Brigham Creek Road Whenuapai
22 (X3)	<i>Pinus radiata</i>	18	3000	NA	NA	12	Fair	Future Urban	No	No	Remove	Private property. Compromised by open trench works	31 Brigham Creek Road Whenuapai
23 (X15)	<i>Pinus radiata</i>	25	2200	NA	NA	9	Fair	Future Urban	No	No	Remove	Private property. Compromised by open trench works	31 Brigham Creek Road Whenuapai
24 (X1)	<i>Eucalyptus sp.</i>	18	1500	NA	NA	6	Fair	Future Urban	No	No	Remove	Private property. Compromised by open trench works	31 Brigham Creek Road Whenuapai
25 (X1)	<i>Pinus radiata</i>	12	2000	NA	NA	13	Fair	Future Urban	No	No	Unaffected by works	Private property & riparian margin.	23-27 Brigham Creek Road Whenuapai
26 (X1)	<i>Cupressus macrocarpa</i>	12	2000	NA	NA	8	Fair	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property & riparian margin. Single tree	23-27 Brigham Creek Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
27 (X1)	<i>Eucalyptus sp.</i>	12	1200	NA	NA	6	Good	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property & riparian margin. Single tree	23-27 Brigham Creek Road Whenuapai
28 (X1)	<i>Coprosma robusta</i>	2	200	NA	NA	2	Good	Future Urban	No	No	Remove	Private property & riparian margin. Compromised by excavation works	23-27 Brigham Creek Road Whenuapai
29 (X30)	<i>Ligustrum lucidum</i>	4	300	NA	NA	2	Good	Future Urban	No	No	Remove	Private property & riparian margin. Pest Plants Compromised by excavation works	23-27 Brigham Creek Road Whenuapai
30 (X1)	<i>Pinus radiata</i>	15	1800	NA	NA	10	Fair	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property & riparian margin.	23-27 Brigham Creek Road Whenuapai
31 (X1)	<i>Eucalyptus sp.</i>	20	1800	NA	NA	8	Fair	Future Urban	No	Yes (riparian margin)	Works within the root zone - Retain	Private property & riparian margin.	23-27 Brigham Creek Road Whenuapai
32 (X3)	<i>Eucalyptus sp.</i>	8	500	NA	NA	3	Good	Future Urban	No	Yes (riparian margin)	Remove	Private property & riparian margin. Compromised by excavation works	23-27 Brigham Creek Road Whenuapai
33 (X130)	<i>Pinus radiata</i>	25	2200	NA	NA	10	Fair	Future Urban	No	Yes, x40 trees (riparian margin) No x90 trees (outside riparian margin)	Remove	Private property & riparian margin. Crop pine trees X40 within riparian margin X90 Outside of riparian margin	31 Brigham Creek Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
34 (X1)	<i>Salix fragilis</i>	12	2200	NA	NA	8	Fair	Future Urban	No	No	Unaffected by works	Private property	14 Spedding Road Whenuapai
36 (X10)	<i>Pittosporum crassifolium</i>	3	700	NA	NA	4	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	14 Spedding Road Whenuapai
37 (X1)	<i>Cedrus deodara</i>	8	1800	NA	NA	5	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	14 Spedding Road Whenuapai
38 (X1)	<i>Cedrus deodara</i>	8	1800	NA	NA	5	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	14 Spedding Road Whenuapai
39 (X40)	<i>Salix fragilis</i>	6	1200	NA	NA	11	Fair	Future Urban	No	No	Remove x5 Retain x35 - Works within the root zone	Private property	15-19 Spedding Road Whenuapai
41 (X10)	<i>Pittosporum eugeniodes</i>	6	700	NA	NA	3	Fair	Future Urban	No	No	Works within the root zone - Retain	Private property	10 Spedding Road Whenuapai
42 (X2)	<i>Pittosporum tenuifolium</i>	2	700	NA	NA	3	Fair	Future Urban	No	No	Works within the root zone - Retain	Private property Grouping of trees	10 Spedding Road Whenuapai
43 (X1)	<i>Araucaria heterophylla</i>	6	700	NA	NA	3	Fair	Future Urban	No	No	Works within the root zone - Retain	Private property Single tree	10 Spedding Road Whenuapai
44 (X1)	<i>Pinus radiata</i>	9	2000	NA	NA	6	Fair	Future Urban	No	No	Works within the root zone - Retain	Private property Single tree	10 Spedding Road Whenuapai



Tree No. (amount)	Name	Height (m)	Girth (mm)	SRZ (m)	TPZ (m)	PRZ (m)	Health	Land Zoning	TOA Required	RC Required	Remove / Retain	Comments	Address
47 (X1)	<i>Eucalyptus sp.</i>	11	1500	NA	NA	5	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	7 Spedding Road Whenuapai
48 (X1)	<i>Acacia melanoxylon</i>	5	2000	NA	NA	6	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	7 Spedding Road Whenuapai
49 (X1)	<i>Eucalyptus sp.</i>	11	1500	NA	NA	6	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	7 Spedding Road Whenuapai
50 (X1)	<i>Araucaria heterophylla</i>	11	1500	NA	NA	6	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	7 Spedding Road Whenuapai
52 (X1)	<i>Banksia integrifolia</i>	3	700	NA	NA	4	Fair	Future Urban	No	No	Remove	Private property Compromised by excavation works	5 Spedding Road Whenuapai
53 (X40)	<i>Pinus radiata</i>	12	1500	NA	NA	9	Fair	Future Urban	No	No	Works within the root zone - Retain	Private property	6 Spedding Road Whenuapai



5. Aerial Plans and Tree Locations

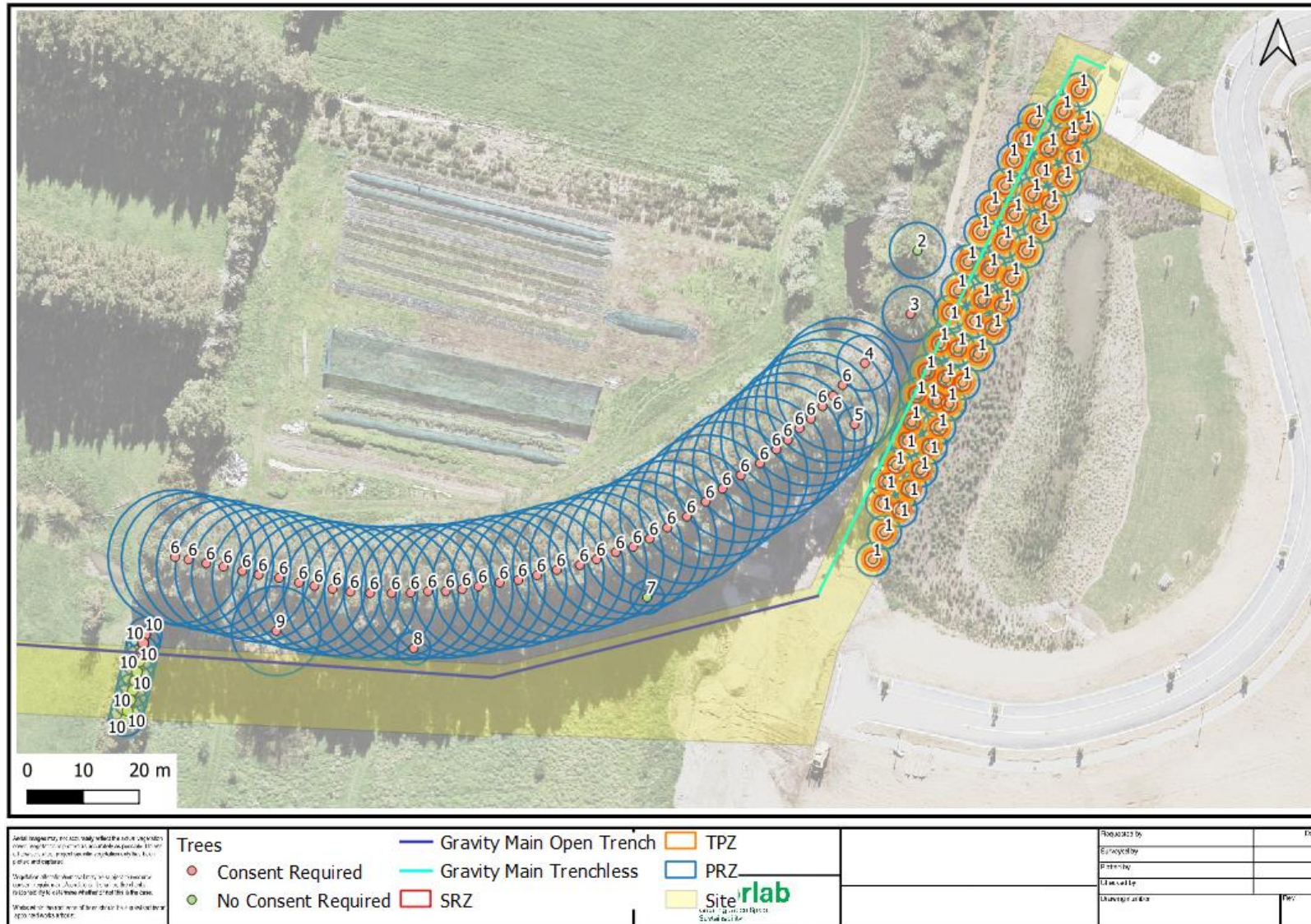


Figure 3: Aerial image outlining the area of the proposed works (yellow) and tree locations

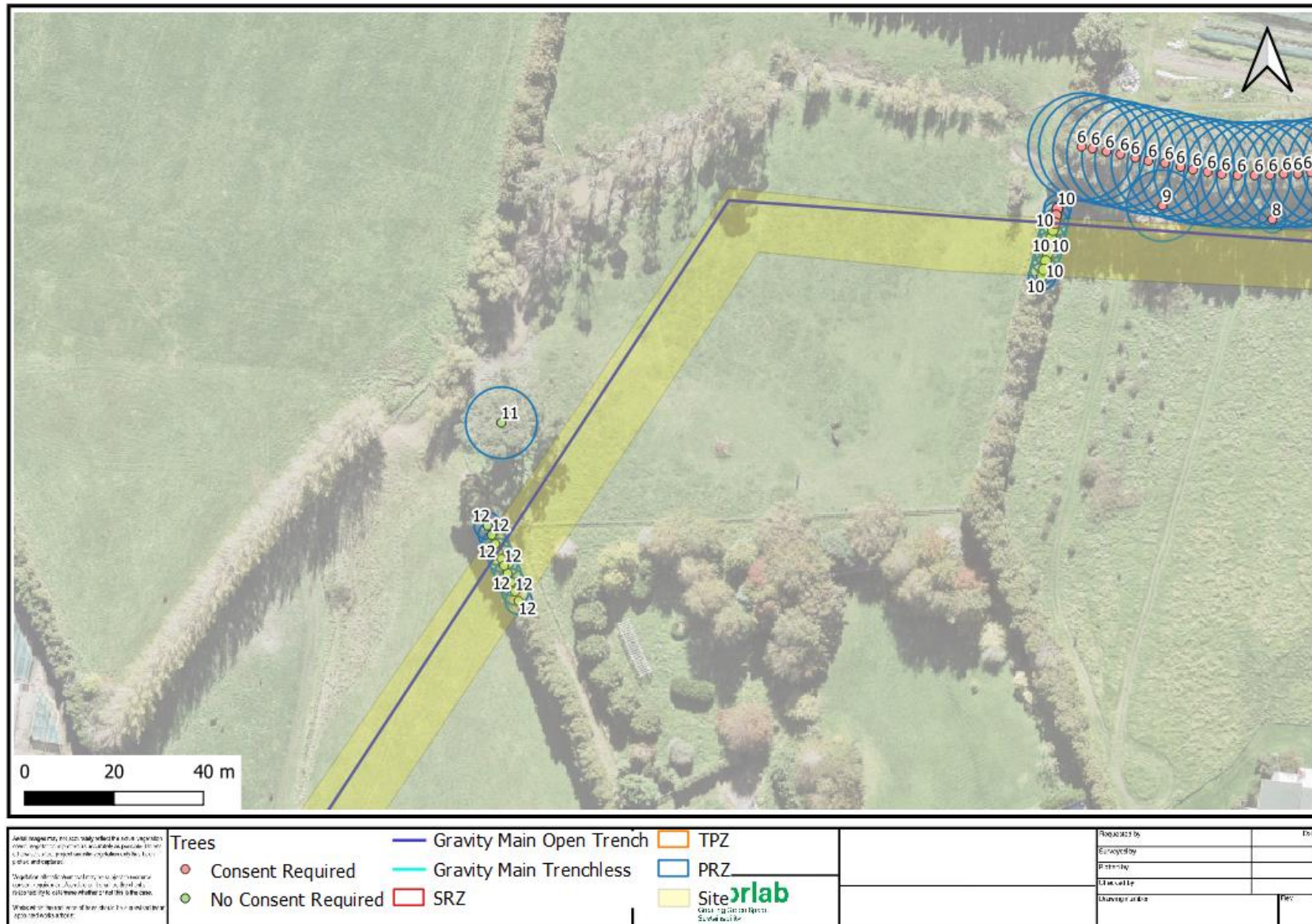


Figure 4: Aerial image outlining the area of the proposed works (yellow) and tree locations



Figure 5: Aerial image outlining the area of the proposed (yellow) and tree locations

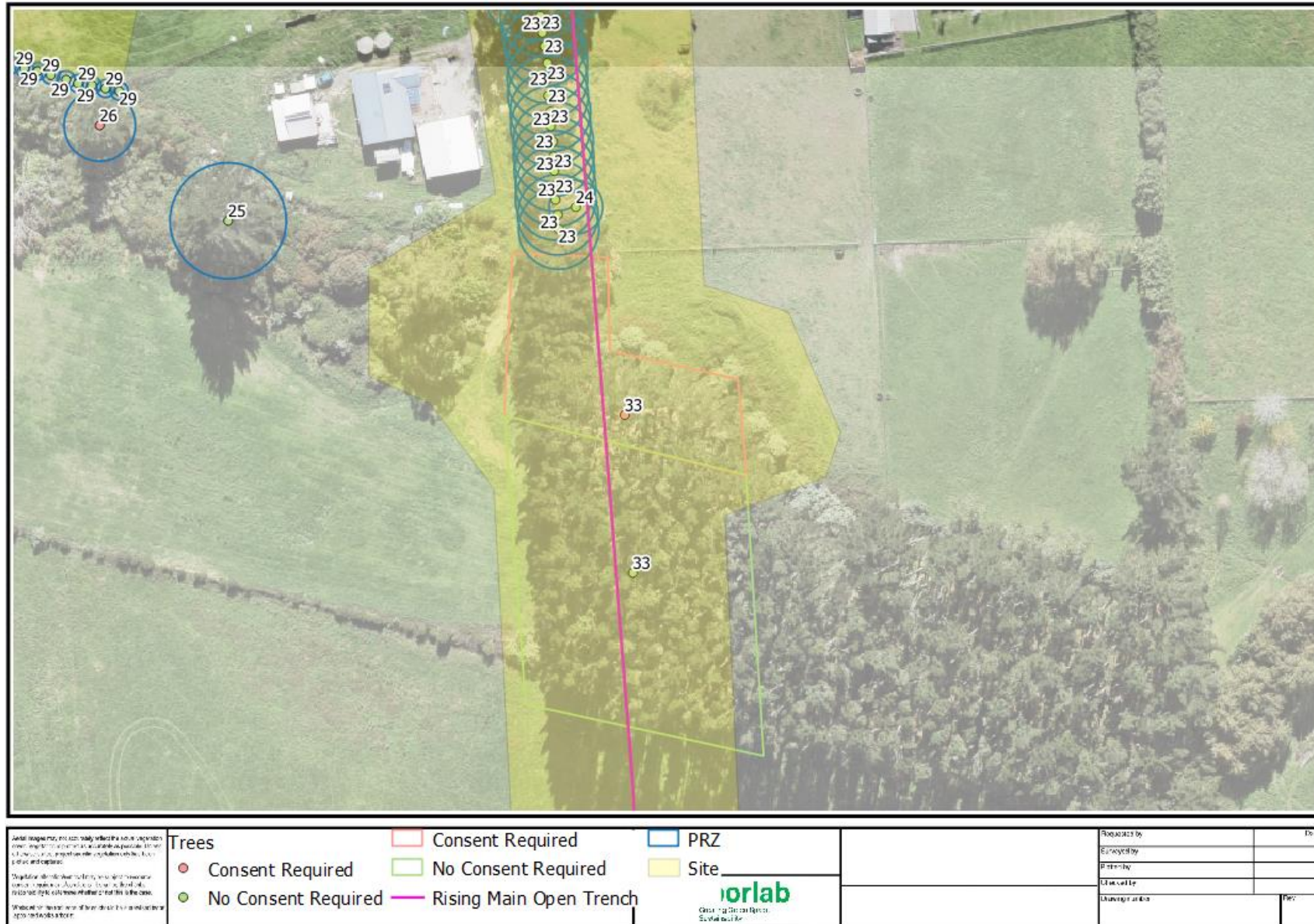


Figure 7: Aerial image outlining the area of the proposed (yellow) and tree locations

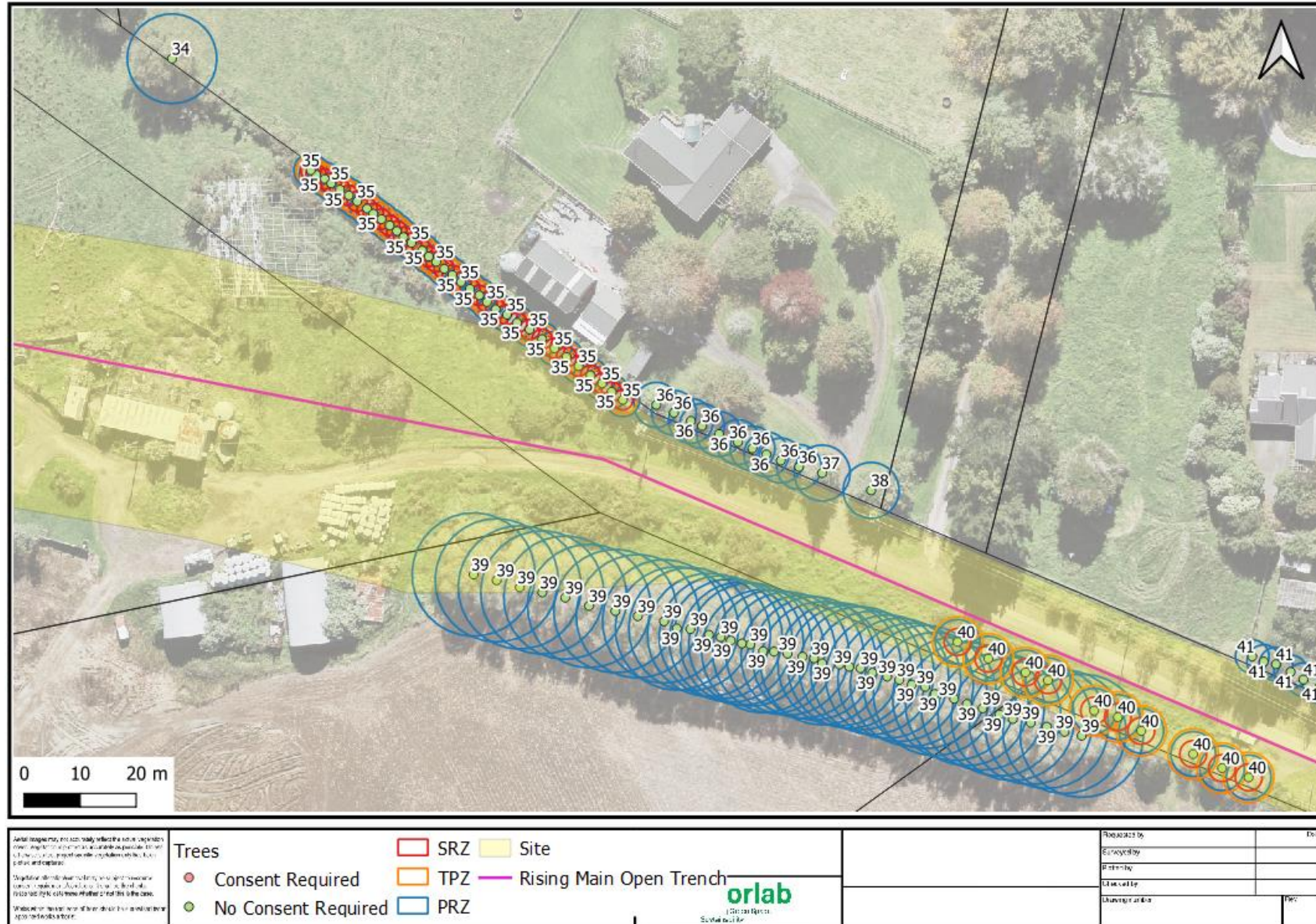


Figure 8: Aerial image outlining the area of the proposed (yellow) and tree locations

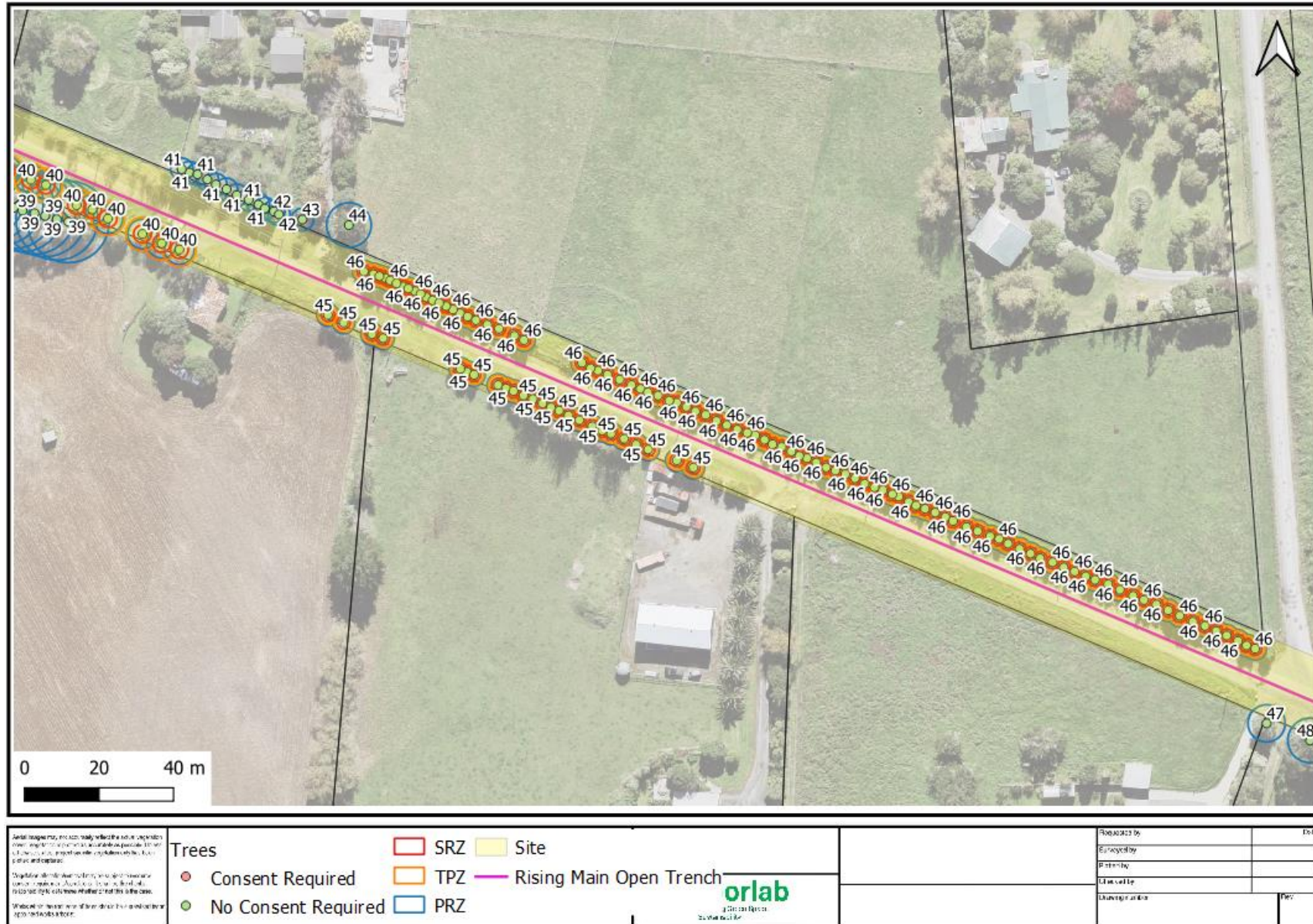


Figure 9: Aerial image outlining the area of the proposed (yellow) and tree locations

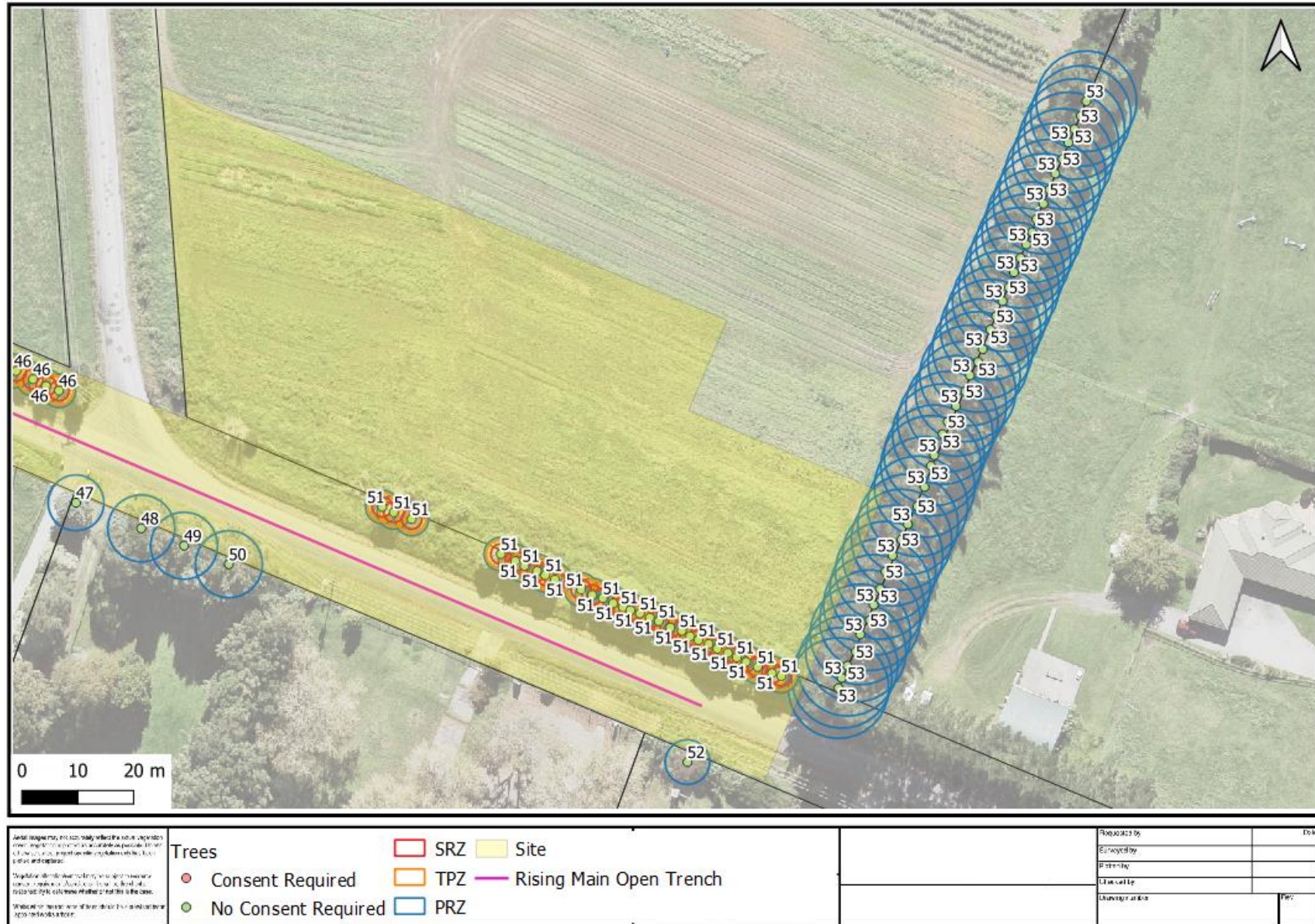


Figure 10: Aerial image outlining the area of the proposed (yellow) and tree locations

6. Discussion

- 6.1 The proposal requires cut and fill earthworks and excavations, which will compromise trees growing within the works footprint where the open excavations occur. All trees within this area should be cleared prior to the works commencing.
- 6.2 Trees 2, 3, 4, 6 and 9 will be unaffected by the works. This is due to the fact that they are all growing on the northside of a stream, where the excavations are proposed to be undertaken on the southern side. It is unlikely that roots from these trees extend beyond the stream the southern escarpment.
- 6.3 Trees 18 and 19 includes a row of pines and Japanese cedars. The works propose to remove topsoil within three metres for their base, given the size of the trees it is likely there will be long-term adverse effects to their health, however structurally the trees are unlikely to be compromised, if excavations are required closer of the trees, they should be removed prior to the works commencing.
- 6.4 Tree No.33 references a crop of pine trees. A portion of these trees are growing inside the works footprint and will need to be removed. Although this project requires the removal of a section of the pine crop, it should be noted newly exposed trees can elevate the probability of failure pines exposed to wind. This is due to the fact that the pines have developed in a group environment and that the removal of edge trees, which bear the wind loading, will be now exposed. Given that the central trees have not developed a root system or the wood properties to withstand these forces, there is a chance that failure can occur. Given that, it is recommended that either the entire stand is removed, or all trees within fall range of the work site removed.
- 6.5 Trees 1, 14 – 17, 35, 40, 45, 46 and 51 are growing within land zoned as road reserve or open space and are Council owned. Consent for the removal of these trees has been proposed, however, the intention is to retain where possible. If it is determined during the operation that the effects of works will be more than minor, the trees will be removed.
- 6.6 The loss of non pest plant trees growing within public land and the riparian margin is proposed to be remedied/mitigated by a planting ratio of 1 for 1.5 or by agreement with the Community Facilities arborist. Total trees proposed to be planted to mitigate the removal is 310.
- 6.7 Overall, it has been assessed that there are no significant individual trees that should be retained. The majority of the mature trees are of exotic species and/or pest plants which could ultimately be replaced with native species.

7. Conclusion

- 7.1 Provided the tree protection measures and protocols recommended in this report are implemented and replacement planting is undertaken with agreement of the Community Facilities arborist, it is considered the potential adverse effects of the works will be managed and mitigated to a level where any adverse effects will be negligible long-term.

8. Recommendations

- 8.1 Removal of any vegetation should be undertaken by qualified arborists implementing modern arboricultural techniques.
- 8.2 Trees growing within council land will require Tree Owner Approval from the Community Facilities arborist.
- 8.3 The removal of public trees shall only be undertaken where the onsite arborist is satisfied that the works will have more than a minor effect on the trees. All works near public trees is to be audited and recorded. All reporting is to be supplied to the Community Facilities arborist. The replacement tree total will be outlined.
- 8.4 Mitigation planting plan should be developed based on the total trees to be replaced or by agreement with the Community facilities arborist. The planting is to be implemented in the first planting season following the completion of earthworks within the site.
- 8.5 Auditing reports should be compiled by an Appointed Arborist.

Appendix A: Tree Protection Methods

Pre-works

1. An arborist (appointed arborist) experienced in tree protection systems, protocols and construction methodologies around trees, is to be engaged to manage the trees within the construction area of the site.
2. Prior to works commencing, the consent holder is to arrange a pre-start meeting with the works principal, contractor, Council arborists and the appointed arborist. The pre-start meeting is to identify:
 - Areas where the appointed arborist will need to be on site for monitoring works.
 - The expected work timings near trees.
 - Work methodologies required adjacent to trees.
 - Tree removals and methodology.
 - Access to the site for vehicles and equipment and potential for storage of the equipment in relation to trees.
 - Onsite audit recording method and final report requirements.
 - Areas where imported mulch can be applied to assist with affects mitigation.
3. The construction area, SRZ, TPZ and PRZ areas, and areas where excavations will be required near trees are to be identified prior to construction.

During works

4. The appointed arborist will audit all works and effects on the trees.
5. The trees will be managed so that any potential adverse effects are minimised or mitigated.
6. It is assessed that a protective fence is not practical to this site, however, the following protocols must be adhered to;
 - a. No chemicals or harmful fluids are to be emptied or disposed of within any root zones.
 - b. Damage and/compaction to existing soil structure is to be avoided by excluding machinery, structures and vehicles from the tree's rootzone, unless kept on top of hard surfaces. Permeable aeras are protected with appropriate, fit for purpose, temporary load bearing surfaces.
7. The following protocols are to be used for excavations and root and tree retention.
 1. The trench layout and root zones are to be clearly marked out near the trees.
 2. Where practicable, all roots over 35mm in diameter are to be retained prior to any root removal decisions. Once all alternatives to root removal are exhausted, roots measuring 80mm in diameter or less can be severed (at the appointed arborists discretion).

3. The works outside the TPZ and PRZ can be undertaken by machine excavator.
4. Works within the TPZ and PRZ will be undertaken by a combination of hand-held tools, air or hydro excavation and machine excavator fitted with a 300mm, straight edge bucket. The edge closest to the tree will be carefully removed by approximately 50mm deep at a time.
5. Roots are to be exposed carefully and treated appropriately – if retained they will be wrapped in hessian, wool mulch or similar and protected. If they require removal, they will be cleanly cut at the edge of the excavation and covered with hessian, wool mulch or similar. If contamination could occur, a layer of polythene will be affixed to the side of the trench.
6. Once the roots are treated the remaining excavations can be undertaken by machine excavator.
7. All roots are to be exposed and retained until a determination by the appointed arborist on whether the root removal required to complete the pipe installation will compromise the tree can be carried out.
8. If the potential adverse effects will be detrimental to the long-term health or stability of the tree, removal will take place.
9. Where the appointed arborist is unsure on the likely outcome, a second opinion will be sought from a senior consulting arborist.
10. All aspects of the decision-making process will be recorded and photographs supplied.
11. If the tree is retained, the roots are to be treated as above.
12. Tree trimming will be undertaken by a qualified, council approved contractor in accordance with MIS308 which is an Arboricultural Australia and NZArb pruning standard publication.

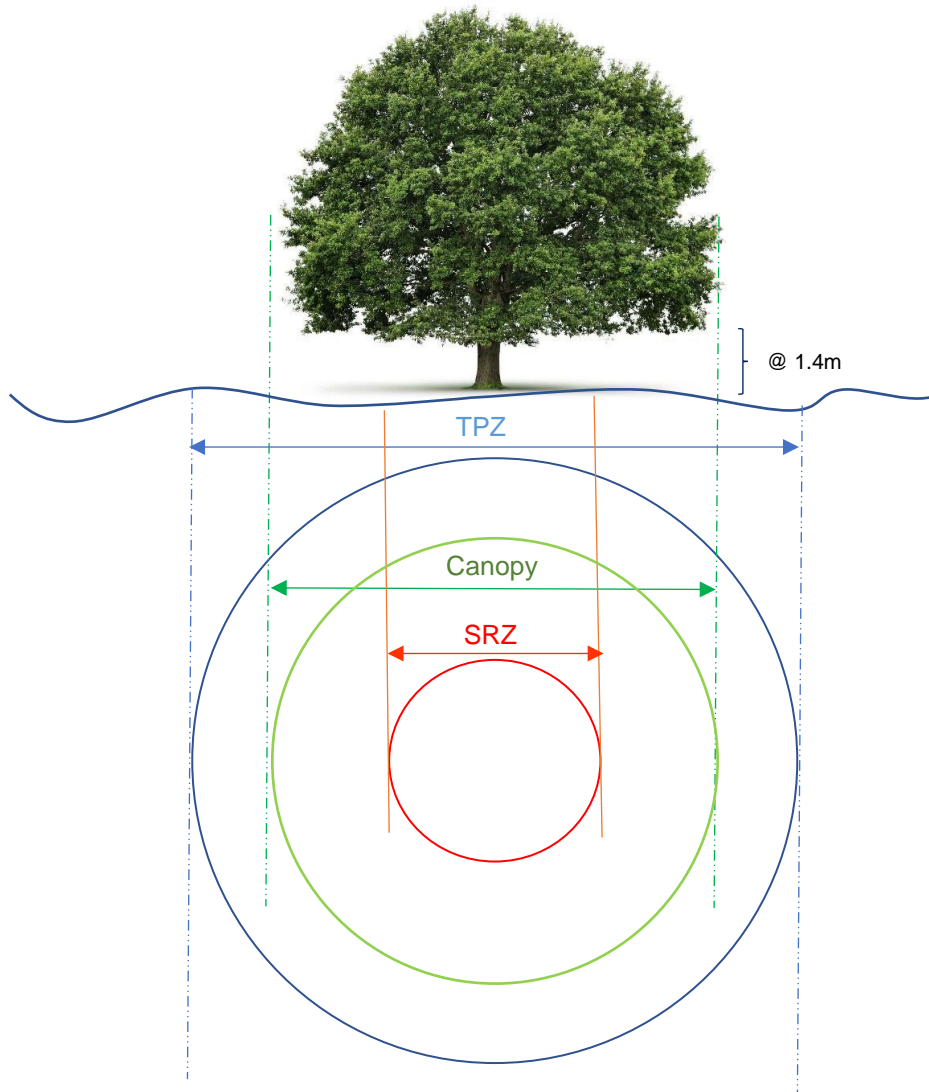
Post works

8. Detailed auditing reports are to be compiled by the appointed arborist.



Appendix B: Tree Protection Zone (TPZ) & Structural Root Zone (SRZ).

The Australian Standard AS 4970-2009 - *Protection of trees on development sites* is used for the allocation of tree protection zones. This method provides a TPZ that addresses both tree stability and growth requirements. TPZ distances are measured as a radius from the centre of the trunk at ground level.



Appendix C: Auckland Unitary Plan Operative in part, J1 Definitions

Protected root zone: “The circular area of ground around the trunk of a protected tree, the radius of which is the greatest distance between the trunk and the outer edge of the canopy. For columnar crown species the protected root zone is half the height of the tree”.

Figure J1.4.5 Protected root zone A

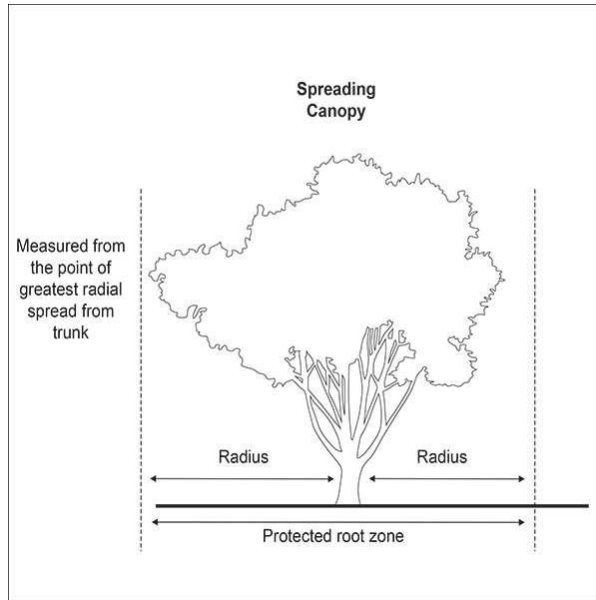


Figure J1.4.6 Protected root zone B

