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Arboricultural Assessment of Effects and Tree Protection Plan

For
Stormwater improvements including new pipes, culverts, and swale drains – STAGE 1

at
Tui Street and surrounding roads, Blackpool, Waiheke Island

Prepared for	**Jesse Peters** *Healthy Waters* Level 17 135 Albert Street Auckland	**Prepared by**	**Andrew Benson (Ph.D., BSc, FdSc)** Urban tree ecophysiologist
		Date	3 June 2025
		Job ref #	2998

Table of contents

1. Instructions

1.1 Healthy Waters propose to carry out improvements to the stormwater infrastructure in Blackpool, Waiheke Island, to improve flood resilience. The Tree Consultancy Company have been instructed by Jesse Peters of Healthy Waters to provide an arboricultural assessment of effects of the proposal as this relates to protected trees. For this assessment, a 'protected' tree refers to a tree for which a Resource Consent is required to undertake activities to and around it that may affect its wellbeing. The scope of services is as follows.

- Review the information provided by the client or their representative
- Carry out a site visit and undertake an arboricultural site survey of the potentially affected trees
- Prepare an arboricultural assessment of effects including a scaled site plan depicting the trees, the arboricultural constraints and the key proposed site features, as well as recommendations for tree protection / mitigation as required
- Lodge an application for tree owner approval

2. Site description, project background, and proposed activities

2.1 The subject site comprises the road reserve environment of Tui Street, Nikau Road, and Moa Avenue, in Blackpool, Waiheke Island. Additionally, the site encompasses part of Blackpool Beach, at the southern end of Tui Street. According to the Haruaki Gulf Islands District Plan, the site is within the Local Road and Secondary Road, as well as a small section of the site near Blackpool Beach being within the Open Space 1 zone. The private properties in these streets are in the Island Residential 1 zone (Figure 1).

2.2 There are houses on both sides of the streets at the site, with ample grass berms either side of the roads in which trees are growing. Additionally, in some of the berms, there are narrow stormwater channels in places around these streets, often abutting the property boundaries.

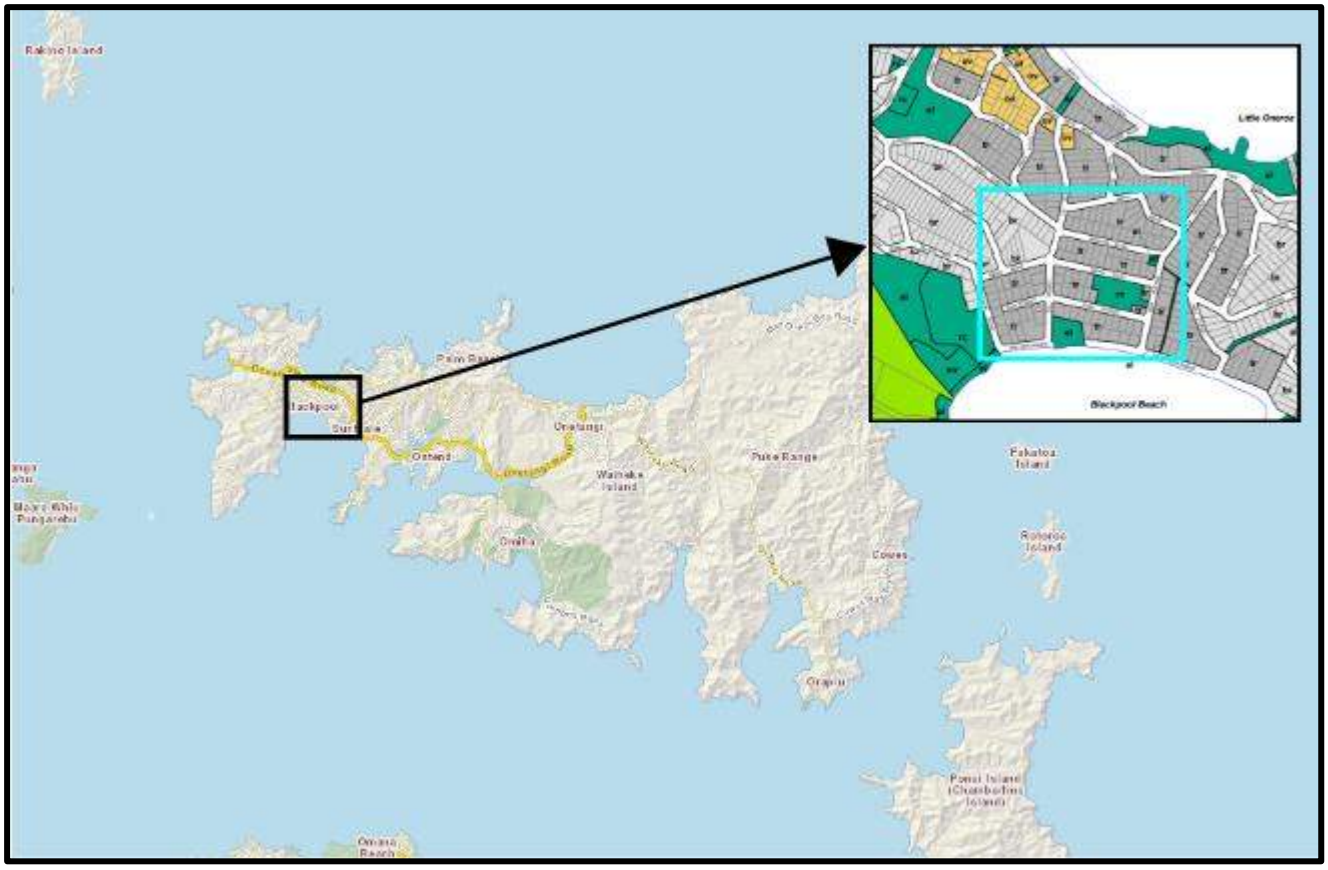

Figure 1: Site location (black rectangle – main image; blue outline – inset). Source – Auckland Council GeoMaps

2.3 Healthy Waters have identified that the site area is prone to flooding and that improvements to the stormwater infrastructure are necessary to improve flooding resilience. The proposed improvements involve new 1,800 mm-diameter pipes, manholes, graded open channels, and culverts, as well as grading at the beach to expand an existing outlet channel. Grading of the channels is necessary to establish adequate conveyance volume at peak flow (e.g., during heavy rainfall). Several power poles will be relocated to accommodate the new graded channels. Existing power poles that are in locations where grading and channel formation are proposed will be relocated to the top of the channel batter next to the carriageway (away from private properties). Jesse Peters (Healthy Waters specialist, Auckland Council) has confirmed that the proposed civil work will be carried out by way of open trenching, although there is an opportunity to directionally drill one section of proposed new pipe between numbers 3 and 13 Moa Avenue. The proposal is depicted on the information referenced below which has been relied upon to inform this assessment of effects.

- Healthy Waters Design Office Design Report, *BLACKPOOL STORMWATER IMPROVEMENTS STAGE 1* (N.007799.60.01.G001)

3. Site investigations and assessment

3.1 I visited the site on the 30th of May 2024 to undertake an arboricultural site survey at the site. For each principal tree (i.e., not shrubs and small ornamental trees), I recorded its location with the GPS capability of a smartphone, recorded species, tree height, trunk circumference at 1.4 m, and canopy radius. For trees on public land, tree height with measured with a digital laser rangefinder (Nikon Forestry Pro II), and trunk circumference was measured with a tape measure. For trees on private land, if a clear view of the base and top of the tree was possible, height was measured with the rangefinder, otherwise it was estimated. Trunk circumference was estimated for all trees on private land to avoid entering private property, and all crown radii were estimated. Occasionally, some trees were recorded as a group (e.g., a row of the same species). In those cases, the dimensions of the trees were estimated.

3.2 I also applied the British Standard (BS5837) tree categorisation system to grade the trees based on their arboricultural attributes (British Standards Institute, 2012). The categorisation system places trees in one of four categories, being A, B, C, and U, in descending order of quality. It is an objective means of grading trees and a useful means of characterising trees to better understand the impacts of a particular project.

3.3 Trunk circumference measurements are used to ascribe structural root zone (Coder, 1996) and tree protection zone radii (Standards Australia, 2009) which are planning and design tools to help inform setbacks and clear zones around trees. The structural root zone is the area around a tree within which the tree's main supporting, structural roots are found. The tree protection zone is the area around a tree within which there is a sufficient volume of soil and roots to sustain healthy tree function. For private trees whose trunk circumference was estimated, the structural root zone and tree protection zone must be interpreted as a guide only. The configuration of the structural root zone and tree protection zone have been adjusted to reflect local impediments to root growth and discontinuous soil areas (e.g., deep water channels, retaining walls, kerbs.

4. Summary of tree details

4.1 Within the grass berms on either side of the streets at the site – which may be as wide as 8 m in places – there are native and exotic trees in varying age classes growing. The broad range of species composition and age classes are indicative of an informal street tree asset. That is, I suspect many of these trees have been planted at the site by homeowners. Predominantly (72%), the trees of of moderate quality, being Category C, although there are 12 Category B trees (14%) and 7 Category A trees (8%) The trees, tree groups, and the key site features are shown on the site plans (2998_000 to 005_A) in Appendix D with the arboricultural information for each tree presented in the tree inventory in Appendix E using corresponding numbering.

5. Arboricultural assessment of effects

5.1 All construction projects carry an inherent risk of damage to nearby trees. Such damage can be caused by machine tracking through tree root zones, soil churning and soil compaction in tree root zones, overhead branch strikes, spillage, or discharge of phytotoxic substances such as petrol or diesel. These sorts of collateral impacts can, in extreme cases, cause damage to trees, but can be practicably managed through an arboricultural work specification. A critical component of this is to appoint an appropriately qualified and experienced supervising arborist to assist with the work. The assessment of effects in this section is predicated on the recommended tree protection measures in Appendix A being implemented on site during construction.

5.2 Excavating to form graded open channels will inherently impact trees. Any trees that are growing in the proposed open channel alignments will necessarily need to be removed. Since the open channels are proposed to occupy the entire width of the grass berms, all the trees that are growing within those grass berms that are subject to grading and channel formation will require removal. This will impact 35 individually recorded trees, and three groups of trees (group 2 – karo, and group 67 – karo, group 76 – mixed species ornamental trees). Following iwi consultation in the early part of 2025, one pōhutukawa (*Metrosideros excelsa*) (tree 34) and 14 nīkau palms (*Rhopalostylis sapida*) (trees 36, 39, 42, 43, 44, 54, 55, 56, 57, 59, 61, 63, 65, 66) on Nikau Road will be relocated to Blackpool Park, also on Nikau Road.

5.3 In terms of impacts for trees that are removed (i.e., felled, chipped, and taken away), these can be understood in terms of lost ecosystem services. Ecosystem services are the direct and indirect contributions of ecosystems to human wellbeing (Brouwer *et al.*, 2013). Examples of ecosystem services provided by trees are, carbon sequestration, pollutant adsorption, oxygen production, stormwater interception, urban heat island mitigation, wildlife habitats, and food sources. Software such as iTree (The i-Tree Development Team, 2024) can quantify these ecosystem services with reasonable precision with input of basic information about the tree.

5.4 When a tree is removed there is an ecosystem services deficit. What is lost is all the future benefits that tree would provide, since all benefits up to the date of removal have already been received (Nowak & Aevermann, 2019). To understand ecosystem services deficits, either a knowledge of the remaining lifespan of the tree is required, or there is a known point in time to which the deficits can be tied. For example, if a tree is removed today and its anticipated remaining lifespan is 100 years, then what is lost when the tree is cut down, is all the future ecosystem services that tree would provide for the next 100 years. However, 100 years is a long time and often intangible to humans, and in particular when we think about the environmental consequences of tree removal and other environmental impacts. A more tangible timeframe would be to 2050, where the New Zealand Government has set a net-zero carbon emissions target for (New Zealand Government, 2019), and when Auckland Council has set a 30% canopy cover target for (Auckland Council, 2019). So, when understanding ecosystem service deficits, calculating the anticipated future lost carbon sequestration up to 2050 establishes a tangible, and quantifiable means of understanding the calculable impacts. In the case of the tree removals for the Blackpool Stormwater project, the current, combined canopy cover is approximately 409 m^2 based on iTree Eco. And the anticipated lost future carbon sequestration for the next 25 years is in the order of 33 tonnes. Therefore, the impacts of the tree removals will be an immediate loss of approximately 409 m^2 of canopy cover from the road reserve, and an approximate carbon sequestration deficit of 33 tonnes.

5.5 With respect to the impacts of relocating the pōhutukawa and nīkau trees, the potential impacts are that the trees will experience a sudden and dramatic drop in water status because of lost root zone (roots and soil). The success of tree relocation first lies in extracting a sufficient volume of the tree's root system, and later, a period of aftercare that involves watering and mulching. For the pōhutukawa, the extracted root ball diameter would ideally be more than 8 m and its depth approximately 1 m. However, the berm is only 5 m wide, which will inherently limit the volume of the root system that could be extracted. A Before U Dig analysis reveals no buried services in the berm where the pōhutukawa and nīkau are located, although the overhead utility wires will need to be temporarily removed to extract the trees. A detailed on-site service location exercise is required to determine precisely what is and isn't underground.

5.6 Overall, the impacts to the pōhutukawa from relocation will be a sudden and dramatic drop in water status, likely becoming chronic for several years, even if irrigation is applied (Benson *et al.*, 2019a, Benson *et al.*, 2019c). This is largely driven by restrictions on extracting a sufficiently large root ball. The long-term impacts will only be truly realised when the volume of extracted root ball is understood, but there will be likely be a five to seven period of curtailment in aboveground growth as the root to shoot ratio is restored (Sudmeyer *et al.*, 2004, Geisler & Ferree, 1984), and perhaps some crown sparseness as the tree attempts to regulate its transpirational surface area (Benson *et al.*, 2019b).

5.7 Regarding relocating the nikau palms, these are much smaller than the pōhutukawa and so an adequate root ball diameter can be extracted. However, nikau and other palms / monocots typically have a deep, central taproot which needs to be extracted undamaged. If the taproot is damaged during extraction, the chances of survival begin to diminish. That is not to say that the palms will die, but the chances of survival become less.

5.8 In terms of other impacts, earthworks to install pipes, form drains and graded channels, in combination with tracking and manoeuvring of machinery, can all have impacts to tree root systems. Such impacts can result in damage to and loss of roots and soil, which in turn can place trees under chronic stress (Benson et al., 2019c, Fini et al., 2020), or negatively affect stability, if root losses are sufficiently extensive (Fini et al., 2020, Smiley et al., 2014). In the case of the trees at the site not being removed, the extent of the damage to the root systems is insufficient to cause acute instability, in my opinion. However, some of the impacts have the potential to initiate a root loss-induced water stress in some trees. Typically, the trees affected in this way are growing in private properties along the property frontage and abutting the berm, and not separated by an existing stormwater drain.

5.9 Excavations in the berm outside number 11 Rata Street will impact the root systems of a willow myrtle (*Agonis flexuosa*) (tree 4) and a pōhutukawa (*Metrosideros excelsa*) (tree 5). Woody roots (approx. 50 mm diameter) from these trees were seen in the grass berm, which provides an indication of what will likely be encountered when the proposed graded channel and a culvert under Rata Street are constructed. The impacts to both trees will be a root loss-induced water stress, likely affecting the willow myrtle more severely than the pōhutukawa, because the willow myrtle is closer to the proposed excavations (e.g., more of its root system will be impacted) and the willow myrtle is less tolerant to root cutting than the pōhutukawa, in my experience. The willow myrtle may show signs of localised crown sparseness in the five or so years following the works.

Figure 2: Willow myrtle tree (tree 4)

5.10 At number 28 Nikau Road there are two springfire pōhutukawa trees (*Metrosideros collina* 'Springfire'), (trees 40 and 41) and at number 30 Nikau Road there is one sweetgum (*Liquidambar styraciflua*) (tree 47). Both trees are on the front boundary of the respective properties, and the tree protection zone of each tree extends into the grass berm. There is a shallow drain separating the berm from the private property. From what I saw of the drain, it is insufficient to preclude or inhibit root growth, in contrast to a deep, water filled channel. Earthworks to form the graded channel will therefore take place in the tree protection zone these trees. I expect the impacts to the two pōhutukawa to be brief (one growing season at most) water stress. And the impacts to the sweetgum to be more severe, but from which it will recover within two growing seasons.

5.11 In a public reserve at 19 Moa Street, there is a 13 m-tall *Eucalyptus* tree near the southern boundary (tree 70). According to the design drawings, an 1,800 mm-diameter concrete pipe will be installed in this location with a 2.6 m-deep invert level. This will mean the trench will need to be shored, which will involve placing steel trench shields either side of the trench to prevent collapse. In contrast to shallow trenches where small (100 mm diam.) pipes and ducts can be carefully installed beneath surface roots of nearby trees, trench shields and other shoring systems preclude this, as all roots spanning the trench need to be cut and removed to install the trench support system. For the *Eucalyptus* tree, this will mean indiscriminate root loss along the edge of the trench. The impacts to the *Eucalyptus* tree will be a severe and chronic root loss-induced water stress. The current vitality of this tree is fair, and I estimated that up to 15% of its live crown is missing, likely due to invertebrate parasitism. The consequences of the root loss to this tree will most likely initiate a protracted decline in overall vitality and its eventual demise, likely over the ten years following the works. During that time, as increasing volumes of deadwood emerge in the tree, it will need to be removed, particularly where it overhangs the adjacent utility wires and the road / private property.

Figure 3: Eucalyptus tree (tree 70)

5.12 Elsewhere, there are other trees near to proposed trenching works, but the alignment does not encroach into their tree protection zones (e.g., trees 71, 72 in the reserve at 19 Moa Street). Such trees may still be impacted by the proposed works in the sense that machine tracking and nearby may damage / disturb their root zones (roots and soil), or strike trunks and branches. Such impacts can be avoided by isolating these trees with construction exclusion fences / barriers that preclude construction access. This applies to all trees that are not being removed.

5.13 With reference to the section on Moa Avenue, between numbers 3 and 13, Mr. Peters has indicated that it is feasible to install the proposed 600 mm pipe by trenchless methods in this section. Pipe depth in this section is more than 1 m, according to the design drawings. Broadly, drilling at least 1 m below trees is unlikely to strike roots, and those that may be struck, will be few and minor in nature, and likely inconsequential to the tree. The main potential impact to trees from drilling is root impacts from launch / receive pit excavations. As with other excavations that remove roots, the consequences to the tree could range from brief and minor stress, to severe stress with protracted decline thereafter.

5.14 From previous experience, it is common to drill pipes in 100 m spans, which is usually the combined length of the drilling rods and the length of most rolls of pipe. According to the design drawings, there is a 90 m section of the proposed pipe between chainage 150 and chainage 240 (the end) where there are trees. At the downstream end (chainage 150), there is a clear footpath outside number 9 where a drill pit could be excavated without impacting nearby trees (e.g., tree 82, poplar). At the upstream end, there is an area of vegetation, including established trees. The upstream end is within private property. The highest value tree near the upstream end is a mature pōhutukawa (tree 85) in the road reserve outside number 3 Moa Avenue.

5.15 If this section of the pipe can be installed by trenchless methods in a single drill shot, then the impacts to trees will likely involve minor vegetation clearance at the upstream end (small shrubs, occasionally weeds) in number 3 Moa Avenue and 166 Ocean View Road, to establish machinery access and a drill pit. Additionally, collateral root impacts to nearby established trees such as monkey apple (*Syzigium smithii*) trees (86-88). The road crossing from number 3 Moa Avenue to a catchpit outside number 2 Moa Avenue will likely necessitate the removal of a pencil cypress (*Cupressus sempervirens* 'Stricta') (tree 84) and root impacts to tree 86, but with minimal consequence, likely some brief (less than one growing season) and mild water stress from which the tree will swifty recover.

5.16 If the section of pipe is installed by open trench methods, then tree 85 will likely sustain far greater root impacts, and the period of stress will be protracted for two, or perhaps three growing seasons, with a drop in vitality in years to come, manifest with crown sparseness. A small magnolia (*Magnolia grandiflora*) (tree 83) would need to be removed, as well as probably the poplar tree at number 9 Moa Avenue (tree 82) because of the collateral root impacts. Tree 84 will still need to be removed.

5.17 Other trees at the site not immediately exposed to construction work, such as trees on the opposite side of the road to where pipes and channels will be installed, are less likely to be impacted, but may still be vulnerable to construction damage. For example, parking vehicles and storing machinery / equipment nearby can cause root and soil damage or trunk and branch strikes. The project's construction management plan must include measures to avoid such impacts, such as construction exclusion fencing and good work practices that ensure vehicles, machinery, and equipment are not stored or operated under or near these trees.

6. Replacement planting

6.1 Since ecosystem services are intrinsically associated with canopy cover (Nowak & Aevermann, 2019), remediation planting can be ascribed using a canopy cover replacement model based on iTree Eco (v6.0.35) canopy cover growth forecasts of 64 medium- to large-growing, 45 L-grade trees commonly planted in urban areas by Auckland Council. Taking account of Auckland Council's citywide canopy cover targets for the year 2050 (Auckland Council, 2019), the replacement planting required to remediate the lost canopy cover needs to equate to, or exceed the lost canopy cover no later than 2050.

6.2 Accounting for a 5% attrition rate in the first three years, the required number of medium- to large-growing, climate-ready (Kendal. D, 2022) trees that need to be planted, is 23. The available space in the berms will be substantially reduced by the grading and associated pipework and infrastructure, and so alternate locations nearby to plant the new trees is required. For example, Blackpool Park, Te Hurui Reserve, Alison Park, and vacant road berms in the surrounding streets. If these locations aren't suitable, or unable to support all 23 trees, locations further afield may be sought elsewhere on the island. Remediating the environmental consequences of tree removal does not need to be spatially constrained.

7. Statutory assessment

7.1 The assessment has demonstrated that vegetation removal, including native and exotic species, as well earthworks in the root zones of trees, are proposed in an open space zone, in a road (zone), and in a residential zone, in Blackpool, Waiheke Island. Chapter 10c of the Hauraki Gulf Islands Plan (the plan) contains the rules for vegetation alteration in Open Space zones.

7.2 According to Rule 10c.5.1.1, removal, pruning, and works within the dripline of exotic vegetation is a Permitted Activity, as too is the pruning, removal, or works within the dripline of indigenous vegetation smaller than 3 m tall. According to rule 10c.5.1.2, pruning, removal or any works within the dripline of native vegetation not provided for as a Permitted Activity (e.g. native trees shorter than 3 m), is a Restricted Discretionary Activity. Therefore, where native trees taller than 3 m need to be removed, or where there are earthworks that may affect the roots, a Resource Consent is required as a Restricted Discretionary Activity. This applies to trees in open space zones and in the residential zone.

7.3 According to Rule 10c.5.2.1, removal, pruning, and works within the dripline of exotic vegetation growing in the legal road (zones), is a Permitted Activity, as too is the pruning, removal, or works within the dripline of indigenous vegetation smaller than 3 m tall. According to rule 10c.5.1.2, pruning, removal or any works within the dripline of native vegetation not provided for as a Permitted Activity (e.g. native trees shorter than 3 m), is a Restricted Discretionary Activity. Therefore, where native trees taller than 3 m need to be removed need to be removed from the road reserve, or where there are earthworks that may affect the roots, a Resource Consent is required as a Restricted Discretionary Activity. This applies to trees in growing in the legal road.

7.4 Overall, from a vegetation alteration perspective, the proposal to install new pipes, culverts, and form graded channels is a Restricted Discretionary Activity. The following rules of the Hauaki Gulf Islands District Plan apply.

Part 10c - Development controls for land units and settlement areas

Rule 10c.5.1.2

1) The pruning, removal or works within the dripline of indigenous vegetation not provided for as a permitted activity.

Rule 10c.5.5.2

1) The removal or works within the dripline of indigenous vegetation greater than 3 m in height.

8. Conclusions

8.1 Healthy Waters propose to improve the stormwater infrastructure in several streets in Blackpool, Waiheke Island, because the area is prone to flooding. The improvements involve new pipes, culverts, and graded channels in the road reserve and open space zone. The impacts of the upgrade works will necessitate the removal of 20 trees, as well as three groups of karo trees, both growing as a hedge, or row. Additionally, impacts to adjacent trees involve earthworks in the root zones and damage to roots. For some trees, this will be an inconsequential impact with little effect. For others, such as the large *Eucalyptus* at 19 Moa Avenue, the impacts are sufficient to severely compromise the tree's vitality. And finally, one mature pōhutukawa and 14 nikau palms will be relocated to Blackpool Park. The impacts to the pōhutukawa will depend on the volume of roots that are extracted and the level of aftercare provided but are anticipated to be a sudden and dramatic drop in water status becoming chronic for five years. Impacts to the nikau will depend on how much of the root ball, and specifically the tap root, is extracted. If the tap root is damaged, the chances of survival decrease. A Resource Consent for vegetation alteration is required as a Restricted Discretionary Activity.

8.2 The consequences of the tree removal yield an approximate 33 tonne carbon sequestration deficit over the next 25 years and an immediate 409 m^2 canopy cover deficit. Twenty-three new trees need to be planted to remediate those and other consequences of tree removal.

9. Recommendations

9.1 It is recommended that the section of 600 mm pipe on Moa Avenue between Chainage 150 and Chainage 243 be installed using trenchless methods (e.g., directional drilling).

9.2 It is recommended that a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist'), be engaged at the start of the project. The role of the supervising arborist will be to coordinate and document activities on the site that may affect vegetation, e.g., vegetation clearance, earthworks, etc.

9.3 Subject to approvals, it is recommended that vegetation removal be limited to the trees listed in the tree inventory in Appendix D with the word 'Remove' listed in the Impact column.

9.4 It is recommended that vegetation removal be carried out by trained and competent arboricultural professionals in a careful and controlled manner that avoids any damage or disturbance to any retained vegetation and their root zones.

9.5 Subject to approvals, it is recommended that the nikau palms and the mature pōhutukawa (tree 34) on Nikau Road be relocated to Blackpool Park per the tree relocation methodology in Appendix C, including aftercare.

9.6 It is recommended that in addition to following the relocation and aftercare methodology in Appendix C, that the relocated trees be inspected annually by a trained and experienced arboricultural professional (this can take place at the same time as aftercare such as mulch replenishment is taking place), to check for signs of stress, dieback, deterioration, or any other indication that any of the trees are failing. In the event that, within the five-year period, any of the trees should show signs of irrecoverable deterioration, chronic stress, is dead, or otherwise looks to be in a mortality spiral, it is to be replaced with trees selected from the list in 9.12. Nīkau palms are to be replaced at 4:1 (four new trees for each nīkau that fails / dies), and the pōhutukawa is to be replaced with eight new trees.

9.7 Prior to works commencing, construction exclusion fences are to be erected around the trees as shown on the appended site drawing (2998_001 to 005_A) and in accordance with detail TP-01 in Appendix B. The fence must remain in place for the duration of works. There is to be no storage or stockpiling of materials, tools and equipment within the area enclosed by the fence. The protective fence may only be removed / relocated at the direction of the appointed works arborist.

9.8 No person vehicle or machinery are to enter the area enclosed by the fence unless otherwise authorised to do so by the supervising arborist. If for any reason it becomes necessary to move the protective fence, then the area previously enclosed by the fence shall be regarded in the same way as if the fence were still in place.

9.9 Suitably visible weather-resistant signs are to be hung on each face of the fence, translated as necessary to read.

CONSTRUCTION EXCLUSION ZONE
PROTECTED TREES
KEEP OUT

9.10 Silt and sediment control measures are to consist of aboveground methods when within the root zone of trees, as per GD05 recommendations[1], e.g., a filter sock.

9.11 It is recommended that the tree protection methodology in Appendix A be adhered to at all times during the project.

9.12 Within the first planting season after works are complete (May-September), 23 climate-ready trees must be planted on public land in Blackpool or the surrounding suburbs of Waiheke Island. Public land refers to streets, parks, and reserves. Trees are to be planted according to the specification in Appendix F and maintained for a period not less than three years. If any tree should become damaged, die, decline, or otherwise fail to perform, a new tree must be planted *like-for-like* in its place and maintained thereafter for three years. Suitable climate-ready species are:

- *Corymbia citriodora*
- *Fraxinus griffithii*
- *Jacaranda mimosifolia*
- *Liquidambar formosana*
- *Quercus ilex*
- *Lophostemon confertus*

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[1] "***Do not*** *install silt fences across watercourses or in areas of concentrated flows. Avoid trench excavations within the root zones of protected trees and trees that are to be retained."* – Section F-Sediment control practices. P113

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The i-Tree Development Team (2024) i-Tree Eco. USA: USDA Forest Service.

Appendix A – Tree protection methodology

1. Tree protection must form a part of any site-specific hazard management and is to be included in daily toolbox meetings and all site inductions.

2. No work shall take place within the root zone of the trees without prior approval from the supervising arborist. Any amendments to the tree protection methodology shall require prior written approval from the supervising arborist. (see 3).

Pre-start

3. The person or organisation who has ultimate responsibility for the project is to engage the services of a suitably qualified and experienced on-site supervisory arborist (the 'supervising arborist'), who is to supervise and coordinate all works and activities within the root zone of protected trees.

4. Prior to any works commencing on site, the person or organisation who has ultimate responsibility for the project is to arrange a site meeting with the supervising arborist, council's monitoring officer, council's arborist and the contractor who has overall responsibility of the works. The purpose of this meeting is to discuss conditions of consent. At this meeting, the contractor responsible is to confirm to the satisfaction of the supervising arborist and council the following:

    - Programming of works
    - Vegetation clearance
    - Site access and transportation of materials
    - Temporary storage areas for materials
    - Silt and sediment controls
    - Tree protection measures including fences
    - When the supervising arborist is required to be present

Reporting

5. At the completion of works, the supervising arborist at their discretion shall 'sign off' the work of the contractor, and if requested, provide a brief account of the project to the council arborist (if necessary, with photos). The account of works shall include, but not be limited to:

    - The effects of the works to the subject trees
    - Any remedial work which may be necessary

Silt and sediment control

6. Silt and sediment control measures are to consist of aboveground methods when within the root zone of trees, as per GD05 recommendations[2], e.g., a filter sock.

Protective fencing

7. Prior to works commencing, a construction exclusion fence is to be erected around the trees as shown on the appended site plans (2998_001 to 005_A). The fence is to be erected in accordance with the specification TP-01 in Appendix B.

8. The fence must remain in place for the duration of works. There is to be no storage or stockpiling of materials, tools and equipment within the area enclosed by the fence. The protective fence may only be removed / relocated at the direction of the appointed works arborist.

[2] "***Do not*** *install silt fences across watercourses or in areas of concentrated flows. Avoid trench excavations within the root zones of protected trees and trees that are to be retained."* – Section F-Sediment control practices. P113

9. No person vehicle or machinery are to enter the area enclosed by the fence unless otherwise authorised to do so by the supervising arborist. If for any reason it becomes necessary to move the protective fence, then the area previously enclosed by the fence shall be regarded in the same way as if the fence were still in place.

10. Suitably visible weather-resistant signs are to be hung on each face of the fence, translated as necessary to read.

CONSTRUCTION EXCLUSION ZONE
PROTECTED TREES
KEEP OUT

Ground protection

11. No material is to be stored, emptied or disposed of in or around the tree protection zone of any tree unless otherwise authorised to do so by the supervising arborist. Any material which is to be stored or temporarily placed in or around the tree protection zone of any tree shall be stored carefully on an existing or temporary hard surface such as asphalt or plywood sheets, respectively.

12. If, during the course of the works, machinery or vehicle access / manoeuvring is required in or around the root zone of any of the trees, then those areas are to be covered with a protective overlay sufficient to protect the ground from being muddied, compacted, churned up or otherwise disturbed (for example 'Track Mats', or plywood sheets).

13. If machinery / vehicles are to be operated or stored within the root zone area on an existing or temporary load-bearing surface, then the machinery / vehicle shall not cause any detrimental effect to the tree(s) through compaction, physical damage, spillage of lubricants and fuels or discharge of waste emissions.

Excavations in and around root zones

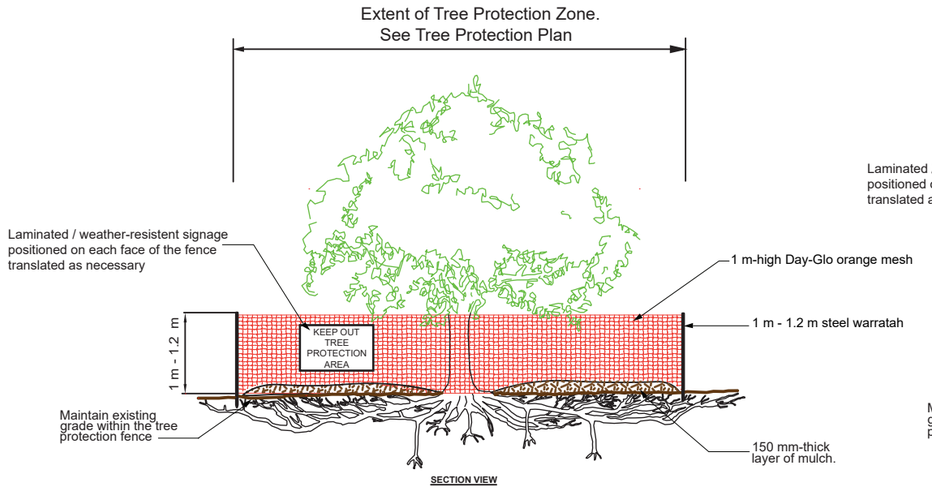
14. All excavations which are to take place in or around the root zone of any of the trees shall be done so in conjunction with the supervising arborist, through a careful combination of hand digging, hydro-excavation, pneumatic excavation, and machine excavation and to the satisfaction of the supervising arborist. Where the supervising arborist deems it likely that roots will be encountered in the areas, then these areas shall first be explored using or hand tools only to check for the presence of such roots.

Protecting and pruning roots

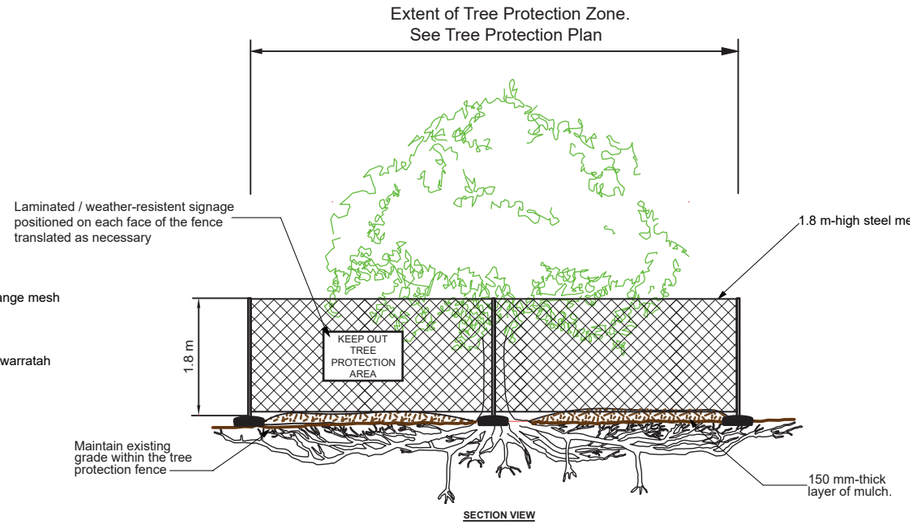
15. Every effort shall be made to avoid root severance from all trees by exploring on-site alternatives to construction / engineering. Where root severance is unavoidable, the severance of any root is to be carried out by the supervising arborist, who shall select the most appropriate implement for the task. Roots shall be cut cleanly to ensure that the traumatic cambium is able to initiate new root growth as effectively as possible, and the exposed cut faces should be covered over immediately with moist soil.

16. Where roots to be retained are encountered, and there is need for these roots to remain exposed in order that works are not impeded, then those roots shall be covered with a suitable protective material (such as moist Hessian, or a wool mulch) in order to protect them from desiccation and/or mechanical damage until such a time as the area around the root can be backfilled with the original material. The wrapping or covering of any roots shall be undertaken by the supervising arborist.

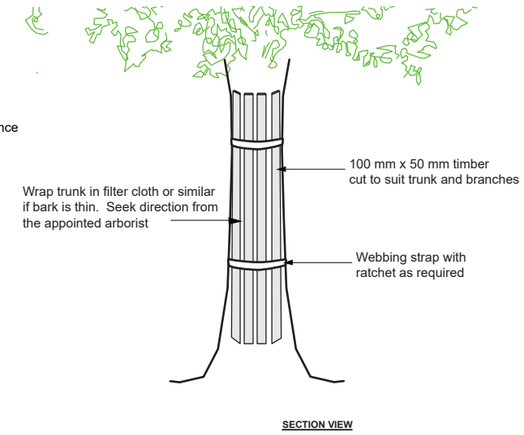
Appendix B – Tree protection details



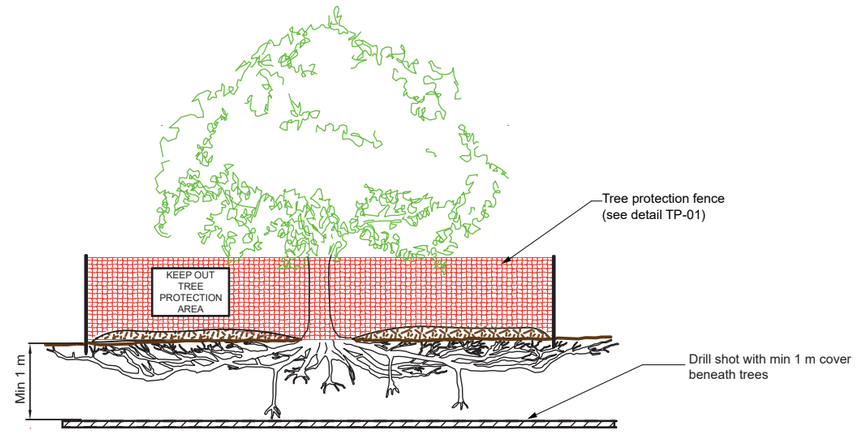
TP-01 TREE PROTECTION - TREE PROTECTION FENCING



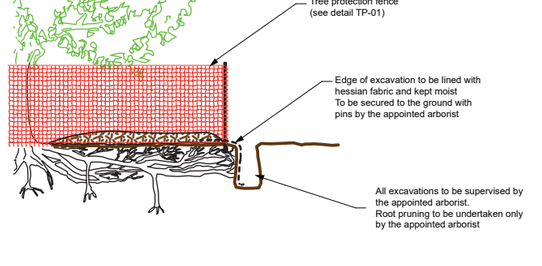
TP-02 TREE PROTECTION - TREE PROTECTION FENCING



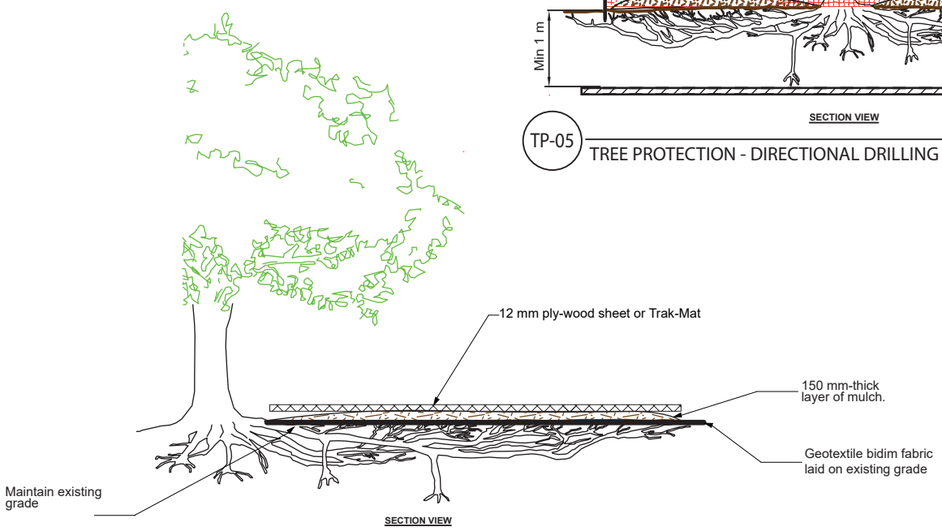
TP-03 TREE PROTECTION - TRUNK PROTECTION



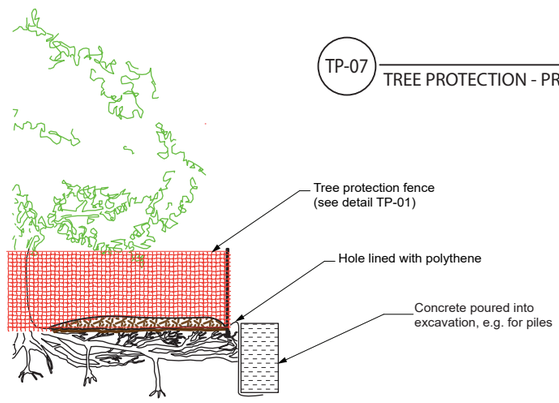
TP-05 TREE PROTECTION - DIRECTIONAL DRILLING



TP-07 TREE PROTECTION - PROTECTING ROOTS



TP-04 TREE PROTECTION - GROUND PROTECTION



TP-06 TREE PROTECTION - EXCAVATIONS CONTAINING ROOTS

All works around trees are to proceed in strict accordance with the tree protection methods
All works around trees are to be supervised by an appointed works arborist
No pruning of branches or roots unless undertaken by the appointed works arborist
No equipment or material is to enter or be stored inside the protective fence
Details scaled as shown

STANDARD TREE PROTECTION DETAIL

The TREE CONSULTANCY – COMPANY –

Drawing TTCC- TP- 2020

Revision 001

Date 14-08-2020

Appendix C – Tree relocation methodology

1. Prior to tree relocation, there must be an on-site meeting with the urban forest specialist or other such representative from Auckland Council who has responsibility for the site to agree upon a new location for the tree. The new location must be selected such that it does not cause any detrimental effects to any other tree nearby, either by excavation of the pit, or through compaction of the soil during transport, or due to trunk / branch strikes during transport.

2. Tree relocation is to be carried out by qualified and experienced arborists who have specific experience with relocating trees.

3. Once determined, a pit is to be excavated at the new location for each tree that has a diameter of at least 2 m wider than the diameter of the extracted root ball, and approximately 1 m deep.

4. The root ball diameter of the pōhutukawa tree (tree 34) is to be as far as possible in the direction perpendicular to the direction of the road, and at least 8 m in the direction parallel to the road. For the nīkau palms, the root balls are to be 2 m in diameter and at least 1 m deep Preliminary excavations for root ball extractions should proceed at first using hand methods, pneumatic (Air Spade) or hydraulic (hydro-vac) soil displacement. These methods shall encroach no further to the tree than the identified root ball radii unless otherwise approved by the on-site supervising arborist. The depth of excavation should not be less than 0.8 m and not more than 1 m.

5. Once the root ball perimeters have been completely exposed, any roots shall be cut cleanly to ensure that the traumatic cambium is able to initiate new root growth as effectively as possible. The appointed arborist shall undertake all root pruning. The root ball is to then be wrapped in hessian (or similar product) to prevent it from drying out.

6. Suitable lifting tree frames are to be placed on top of the root ball as lifting points for the transplanting. The root ball is then to be secured with a chain that is under cut beneath the root ball and tensioned with webbing straps connecting the upper and lower supports. If necessary, steel I-beams can be driven under the tree for additional support, and the lifting frames secured to the I-beams.

7. Immediately prior to lifting, the base of the root ball is to be sliced away from the growing medium. This is typically carried out with a tensioned cable, by looping a wire rope / cable around the root ball at the bottom of the trench and cinching it tight by pulling with a digger. Once the root ball is fully prepared, the tree shall be lifted and transported to the new location. Anchorage for lifting is to be strictly from the tree frame or chain on top of the root ball. Anchorage from the trunk is strictly prohibited. The tree is to be transported to the new location on the back of flat-bed truck, unless it can be lifted directly from its current location with a crane and placed straight into its new location.

8. When the tree is being placed in the new location, it must be lifted in the same way as it was when it was extracted – using the frames. The tree is then lowered carefully into the pit at the new location, taking care to ensure that the trunk collar is between 0.2 and 0.3 m higher than the existing soil grade, to allow for settlement. Backfill using the native soil shall be used to achieve this. Once in place, any voids in the new pit are to be backfilled with the native soil and lightly compacted in 100 mm layers by hand.

9. Three or four wire rope guys are to be secured to the tree's trunks using webbing stops or similar. It is not acceptable to wrap wire cables around trunks and branches. The wire rope guys must then be affixed to suitable ground anchors approximately 1 m outside of the extracted root ball, and the wire ropes pulled taught, usually by incorporating heavy-duty tie-down straps into the system. The guys must remain in place for one year and be checked periodically to ensure they remain taught.

10. A layer of well-composted wood-chip mulch no less than 150 mm thick is to be laid over the extracted root ball and backfilled pit to help minimise soil drying and root desiccation. Irrigation is to be carried out between 06:00 and 07:00 and between 17:00 and 18:00 every second day in the first year after relocation during the months of November to April when there has been no natural precipitation for a consecutive 48-hr period (i.e., if it rains, then irrigation can cease for two days after the rain event). The mulch must be replenished every six months for five years.

Appendix D – Tree location and site works plans (2998_000 to 005, rev A)

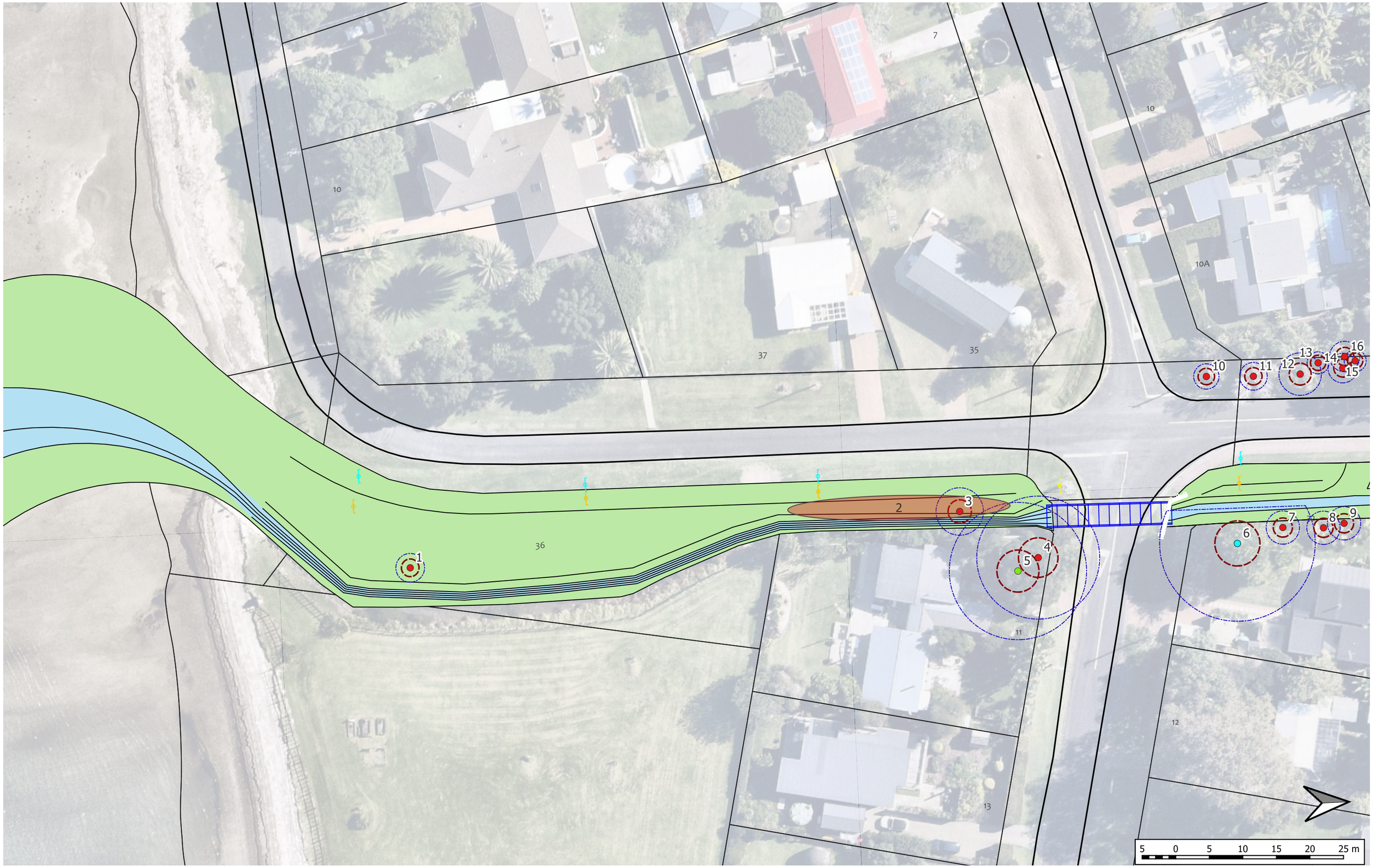
Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Drawing index plan

The TREE CONSULTANCY - COMPANY -

Project	
2998	
Drawing	Revision
000	A

15/08/2024



Trees
- Category A
- Category B
- Category C
- Category U

Structural root zone
Tree protection zone

Soft landscape batter
Channel

Concrete batter

Pipes

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Tree location and site works plan

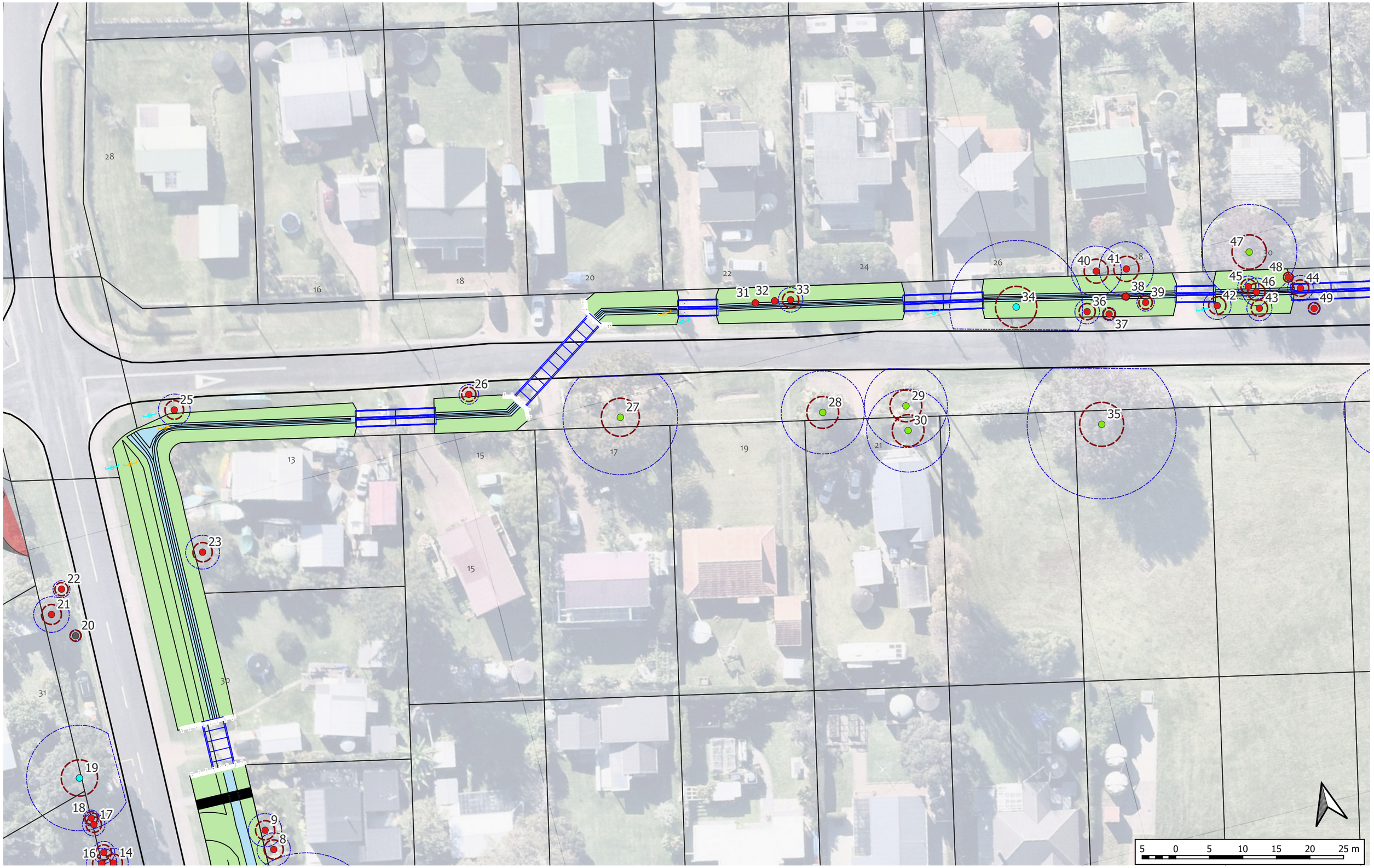
The TREE CONSULTANCY – COMPANY –

Project 2998

Drawing 001

Revision A

13/08/2024



Trees
- Category A
- Category B
- Category C
- Category U

- Structural root zone
- Tree protection zone
- Soft landscape batter
- Channel
- Concrete batter
- Pipes

Healthy Waters Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Tree location and site works plan

The TREE CONSULTANCY COMPANY

Project	
2998	
Drawing	Revision
002	A

13/08/2024

Trees
- Category A
- Category B
- Category C
- Category U

- Structural root zone
- Tree protection zone
- Soft landscape batter
- Channel
- Concrete batter
- Pipes

Healthy Waters Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Tree location and site works plan

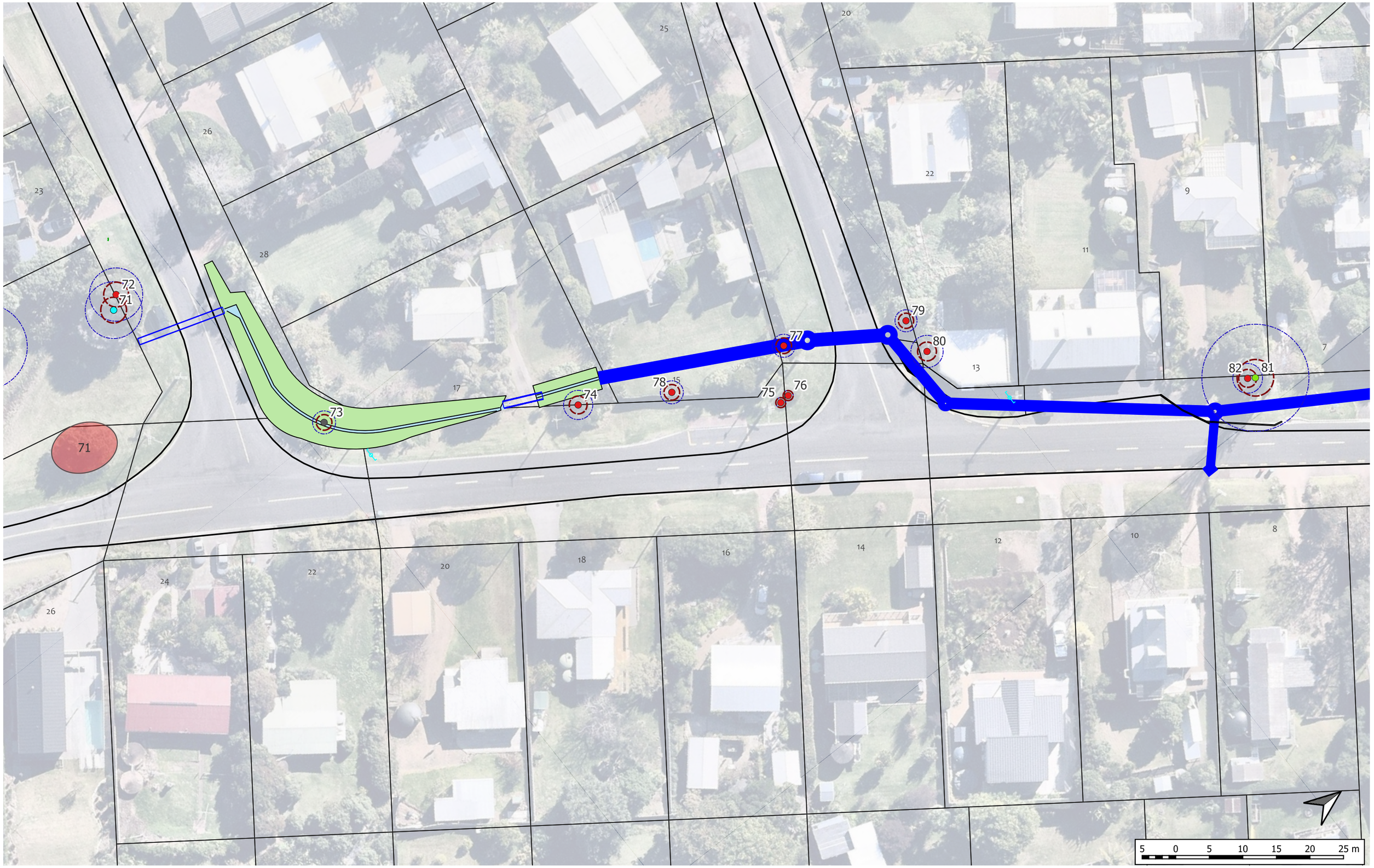
The TREE CONSULTANCY - COMPANY -

Project 2998

Drawing 003

Revision A

13/08/2024



Trees
- Category A
- Category B
- Category C
- Category U

- Structural root zone
- Tree protection zone
- Soft landscape batter
- Channel
- Concrete batter
- Pipes

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Tree location and site works plan

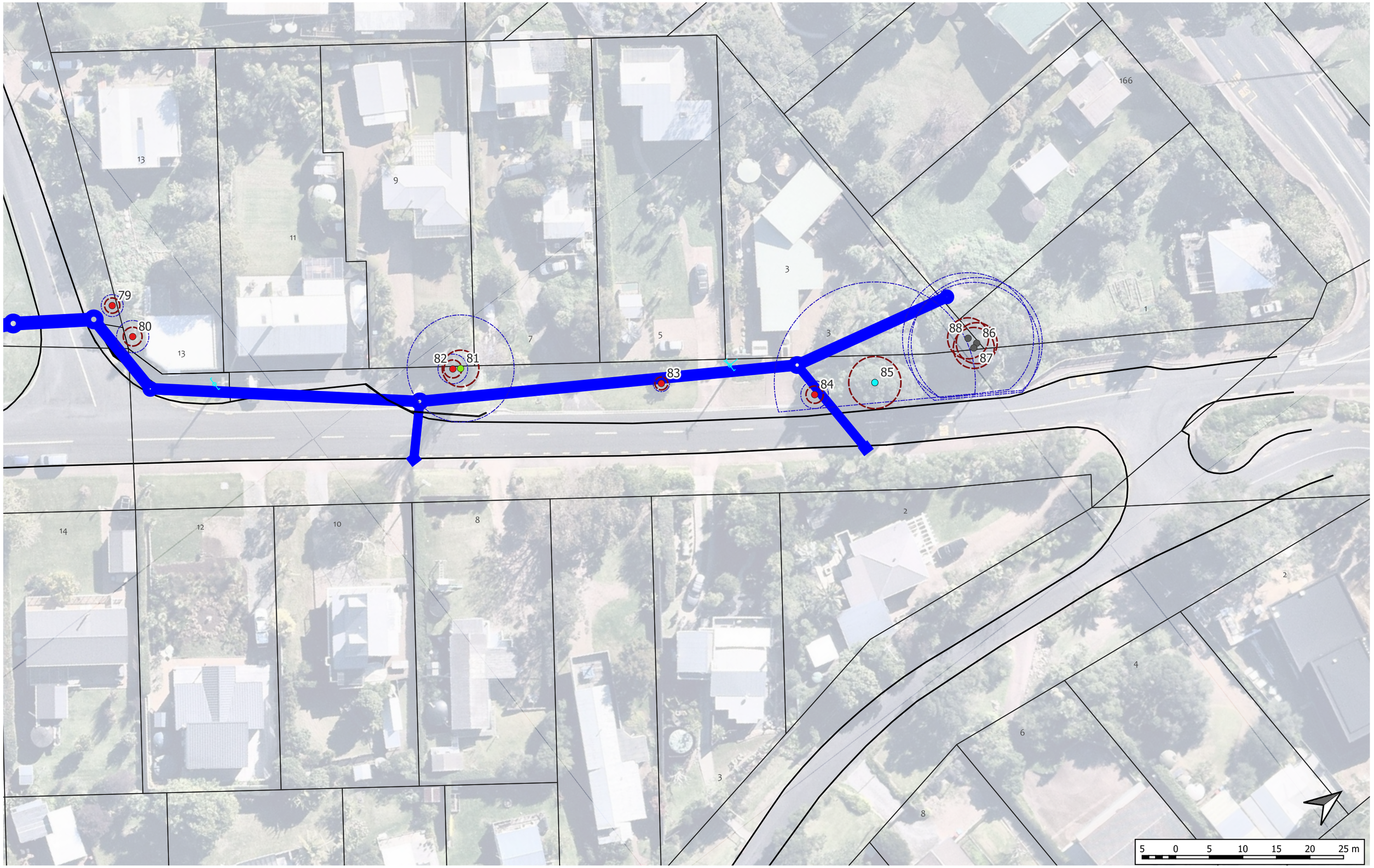
The TREE CONSULTANCY - COMPANY -

Project: 2998

Drawing: 004

Revision: A

13/08/2024



Trees
- Category A
- Category B
- Category C
- Category U

- Structural root zone
- Tree protection zone
- Soft landscape batter
- Channel
- Concrete batter
- Pipes

Healthy Waters
Design Office
AUCKLAND COUNCIL, LEVEL 3, BLEDISLOE HOUSE

Blackpool Stormwater Upgrades, Waiheke Island
Tree location and site works plan

The TREE CONSULTANCY - COMPANY -

Project 2998

Drawing 005

Revision A

13/08/2024

Appendix E – Tree inventory

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
1	*Pittosporum crassifolium* / Karo	3.5	17.8	1.3	2.1	Fair	95% - 99%	Fair	Good	Early mature	Category C	Remove
2	GROUP - *Pittosporum crassifolium* / Karo	4.2	19.7	1.4	2.4	Good	95% - 99%	Fair	Fair	Early mature	Category C	Remove
3	*Metrosideros excelsa* / Pōhutukawa	7.1	29.5	1.7	3.5	Good	100%	Fair	Fair	Early mature	Category C	Remove
4	*Agonis flexuosa* / Willow myrtle	7.3	76.4	2.9	9.2	Good	100%	Fair	Poor	Mature	Category C	Earthworks for culvert and swale. Root loss-induced ater stress anticipated
5	*Metrosideros excelsa* / Pōhutukawa	9.4	85.3	3.1	10.2	Good	100%	Fair	Good	Mature	Category B	Earthworks for culvert and swale. Root loss-induced ater stress anticipated
6	*Erythrina x sykesii* / Coral tree	9.5	96.7	3.4	11.6	Good	100%	Good	Good	Mature	Category A	Deep stream channel between tree and area of works. Nil impact
7	*Pittosporum crassifolium* / Karo	8.7	20.7	1.4	2.5	Good	100%	Fair	Fair	Mature	Category C	Deep stream channel between tree and area of works. Nil impact
8	*Pittosporum crassifolium* / Karo	5.6	20.7	1.4	2.5	Good	100%	Fair	Poor	Mature	Category C	Deep stream channel between tree and area of works. Nil impact
9	*Pittosporum crassifolium* / Karo	5.4	20.7	1.4	2.5	Good	100%	Fair	Poor	Mature	Category C	Deep stream channel between tree and area of works. Nil impact
10	*Metrosideros kermadecensis* / Kermadec pōhutukawa	4.3	15.7	1.2	1.9	Poor	40% - 45%	Fair	Poor	Juvenile	Category C	No works - follow tree protection methods
11	*Acacia longifolia* / Sydney golden wattle	4.3	17.2	1.3	2.1	Good	100%	Fair	Poor	Early mature	Category C	No works - follow tree protection methods
12	*Metrosideros kermadecensis* / Kermadec pōhutukawa	6.2	26.4	1.6	3.2	Good	95% - 99%	Fair	Fair	Early mature	Category C	No works - follow tree protection methods
13	*Griselinia lucida* / Akapuka	3.9	13.7	1.1	1.6	Good	100%	Fair	Poor	Juvenile	Category C	No works - follow tree protection methods
14	*Cordyline australis* / Cabbage tree	5.5	18.4	1.3	2.2	Good	100%	Good	Good	Early mature	Category C	No works - follow tree protection methods
15	*Cordyline australis* / Cabbage tree	6.9	13.7	1.1	1.6	Good	100%	Good	Good	Early mature	Category C	No works - follow tree protection methods
16	*Alectryon excelsus* / Titoki	6.6	18.9	1.4	2.3	Good	100%	Fair	Good	Early mature	Category C	No works - follow tree protection methods
17	*Alectryon excelsus* / Titoki	6.3	14.0	1.1	1.7	Good	100%	Fair	Good	Early mature	Category C	No works - follow tree protection methods
18	*Cordyline australis* / Cabbage tree	5.6	9.9	0.9	1.2	Good	100%	Good	Good	Early mature	Category C	No works - follow tree protection methods

DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
19	*Casuarina cunninghamiana* / She oak	12.3	65.6	2.7	7.9	Good	100%	Good	Good	Mature	Category A	No works - follow tree protection methods
20	*Malus domestica* / Apple	1.3	7.3	0.8	0.9	Poor	45% - 50%	Fair	Fair	Juvenile	Category U	No works - follow tree protection methods
21	*Yucca elephantipes* / Yucca	4.3	22.1	1.5	2.7	Good	100%	Good	Fair	Mature	Category C	No works - follow tree protection methods
22	*Castanea sativa* / Sweet chestnut	3	10.5	1.0	1.3	Good	95% - 99%	Good	Good	Juvenile	Category C	No works - follow tree protection methods
23	*Jacaranda mimosifolia* / Jacaranda	6.1	21.0	1.4	2.5	Good	95% - 99%	Fair	Fair	Early mature	Category C	No works - follow tree protection methods
24	Mixed species hedge (karo, Griselinea, Photinia)	3.8	16.6	1.3	2.0	Good	100%	Good	Good	Juvenile	Category C	No works - follow tree protection methods
25	*Rhopalostylis sapida* / Nikau	2.2	19.7	1.4	2.4	Good	85% - 90%	Good	Good	Juvenile	Category C	Remove
26	*Prunus sp.* / Cherry	2.8	12.1	1.1	1.5	Fair	90% - 95%	Poor	Fair	Early mature	Category C	Remove
27	*Quercus robur* / English oak	9	71.3	1.2	8.6	Good	95% - 99%	Fair	Fair	Mature	Category B	No works - erect tree fence
28	*Washingtonia robusta* / Washingtonia palm	12.1	51.6	2.4	6.2	Good	90% - 95%	Good	Good	Mature	Category B	No works
29	*Washingtonia robusta* / Washingtonia palm	11.8	51.6	2.4	6.2	Good	90% - 95%	Good	Good	Mature	Category B	No works
30	*Washingtonia robusta* / Washingtonia palm	12.3	51.6	2.4	6.2	Good	90% - 95%	Good	Good	Mature	Category B	No works
31	*Prunus sp.* / Cherry	2.2	2.5	0.4	0.4	Fair	65% - 70%	Fair	Fair	Juvenile	Category C	Remove
32	*Citrus x limon* / Lemon	0.9	2.4	0.4	0.4	Good	100%	Good	Good	Juvenile	Category C	Remove
33	*Pyrus calleryana* / Ornamental pear	4.4	15.3	1.2	1.8	Good	95% - 99%	Fair	Fair	Early mature	Category C	Remove
34	*Metrosideros excelsa* / Pōhutukawa	6.2	82.7	3.1	9.9	Good	95% - 99%	Fair	Good	Mature	Category A	Relocate to Blackpool Park
35	*Liquidambar styraciflua* / American sweetgum	12.4	92.6	3.3	11.1	Good	100%	Good	Fair	Mature	Category B	No works - erect tree fence
36	*Rhopalostylis sapida* / Nikau	3.8	15.3	1.2	1.8	Good	100%	Good	Good	Early mature	Category C	Relocate to Blackpool Park

DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
37	*Prunus sp.* / Cherry	4.1	8.3	0.9	1.0	Good	95% - 99%	Fair	Good	Juvenile	Category C	Remove
38	*Malus domestica* / Apple	2.6	3.4	0.5	0.5	Good	95% - 99%	Good	Good	Juvenile	Category C	Remove
39	*Rhopalostylis sapida* / Nikau	2.8	10.8	1.0	1.3	Good	100%	Good	Good	Early mature	Category C	Relocate to Blackpool Park
40	*Metrosideros collina* 'Spring Fire' / Springfire pōhutukawa	4.8	31.2	1.8	3.7	Good	90% - 95%	Fair	Fair	Early mature	Category C	Earthworks for culvert and swale. Root loss-induced ater stress anticipated
41	*Metrosideros collina* 'Spring Fire' / Springfire pōhutukawa	4.2	33.7	1.9	4.0	Good	100%	Fair	Fair	Early mature	Category C	Earthworks for culvert and swale. Root loss-induced ater stress anticipated
42	*Rhopalostylis sapida* / Nikau	4.7	17.2	1.3	2.1	Good	100%	Good	Good	Early mature	Category C	Relocate to Blackpool Park
43	*Rhopalostylis sapida* / Nikau	3.6	15.6	1.2	1.9	Good	100%	Good	Good	Early mature	Category C	Relocate to Blackpool Park
44	*Rhopalostylis sapida* / Nikau	3.8	15.9	1.2	1.9	Good	100%	Good	Good	Early mature	Category C	Relocate to Blackpool Park
45	*Pyrus calleryana* / Ornamental pear	3.8	13.1	1.1	1.6	Good	100%	Fair	Fair	Early mature	Category C	Remove
46	*Acacia baileyana* / Cootamundra wattle	1.7	17.2	1.3	2.1	Good	100%	Fair	Good	Mature	Category C	Remove
47	*Liquidambar styraciflua* / American sweetgum	14.1	59.2	2.6	7.1	Good	100%	Fair	Good	Mature	Category B	Earthworks for culvert and swale. Root loss-induced ater stress anticipated
48	*Cordyline australis* / Cabbage tree	2.6	6.0	0.7	0.7	Good	100%	Good	Good	Juvenile	Category C	Remove
49	*Cordyline australis* / Cabbage tree	1.9	7.6	0.8	0.9	Good	100%	Good	Good	Juvenile	Category C	Remove
50	*Quercus robur* / English oak	8.9	57.3	2.5	6.9	Good	100%	Good	Fair	Mature	Category A	No works - follow tree protection methods
51	*Quercus robur* / English oak	9.9	70.0	2.8	8.4	Good	100%	Good	Fair	Mature	Category A	No works - follow tree protection methods
52	*Fraxinus ornus* / Flowering ash	5.7	44.2	2.2	5.3	Good	95% - 99%	Good	Good	Mature	Category B	No works - follow tree protection methods
53	*Fraxinus ornus* / Flowering ash	5.1	29.8	1.7	3.6	Good	95% - 99%	Good	Good	Mature	Category B	No works - follow tree protection methods
54	*Rhopalostylis sapida* / Nikau	1.6	9.5	0.9	1.1	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park

DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
55	*Rhopalostylis sapida* / Nikau	1.6	9.5	0.9	1.1	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
56	*Rhopalostylis sapida* / Nikau	1.6	9.5	0.9	1.1	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
57	*Rhopalostylis sapida* / Nikau	3.1	15.6	1.2	1.9	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
58	*Prunus armeniaca* / Apricot	3.5	8.6	0.9	1.0	Good	100%	Good	Good	Juvenile	Category C	Remove
59	*Rhopalostylis sapida* / Nikau	2.9	11.5	1.0	1.4	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
60	*Pyrus calleryana* / Ornamental pear	2.1	5.1	0.7	0.7	Good	95% - 99%	Good	Good	Juvenile	Category C	Remove
61	*Rhopalostylis sapida* / Nikau	2.6	12.4	1.1	1.5	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
62	*Pyrus calleryana* / Ornamental pear	4	12.4	1.1	1.5	Good	100%	Fair	Fair	Juvenile	Category C	Remove
63	*Rhopalostylis sapida* / Nikau	2.4	11.5	1.0	1.4	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
64	*Metrosideros kermadecensis* / Kermadec pōhutukawa	6.9	85.6	3.1	10.3	Fair	80% - 85%	Fair	Good	Mature	Category B	No works - follow tree protection methods
65	*Rhopalostylis sapida* / Nikau	4.4	15.3	1.2	1.8	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
66	*Rhopalostylis sapida* / Nikau	2.2	10.5	1.0	1.3	Good	85% - 90%	Good	Good	Juvenile	Category C	Relocate to Blackpool Park
67	GROUP - *Pittosporum crassifolium* / Karo	5.8	17.2	1.3	2.1	Good	100%	Fair	Fair	Early mature	Category C	Remove
68	*Acacia longifolia* / Sydney golden wattle	6.2	19.7	1.4	2.4	Good	90% - 95%	Fair	Fair	Early mature	Category C	Remove
69	*Eucalyptus sp.* / Gum tree	13	78.0	3.0	9.4	Fair	85% - 90%	Fair	Fair	Mature	Category B	Severe root loss due to shored trench. Chronic water stress anticipated with protracted decline
70	*Podocarpus totara* / Tōtara	7.1	53.5	2.4	6.4	Good	100%	Fair	Good	Early mature	Category B	No works - erect tree fence
71	Mixed (karo. tapata, Olearia)	6.1	17.8	1.3	2.1	Good	95% - 99%	Fair	Fair	Early mature	Category C	No works - erect tree fence
72	*Kunzea robusta* / Kanuka	7.9	35.3	1.9	4.2	Good	100%	Fair	Good	Mature	Category A	Minor earthworks to connect culvert to discharge channel. Nil or almost nil long-term impacts. Erect tree fence

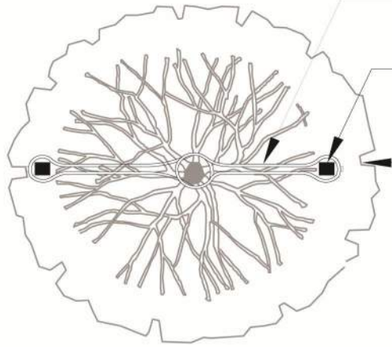
DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Tree number	Species / Common name	Height (m)	DBH (cm)	SRZ radius (m)	TPZ radius (m)	Vitality	Live crown volume	Form	Branch strutcure	Age class	Category	Impacts
73	*Podocarpus totara* / Tōtara	5.4	33.1	1.9	4.0	Good	100%	Fair	Poor	Early mature	Category C	Minor earthworks to connect culvert to discharge channel. Nil or almost nil long-term impacts. Erect tree fence
74	*Ligustrum lucidum* / Tree privet	4.5	14.3	1.2	1.7	Fair	90% - 95%	Fair	Fair	Early mature	Category U	Remove
75	*Cordyline australis* / Cabbage tree	5.7	18.1	1.3	2.2	Good	100%	Good	Good	Early mature	Category C	Remove
76	*Feijoa sellowiana* / Feijoa	1.5	6.4	0.7	0.8	Good	100%	Fair	Fair	Juvenile	Category C	No works - erect tree fence
76	Mixed species ornamental trees	4.5	14.3	1.2	1.7	Good	100%	Good	Good	Early mature	Category C	Remove
77	*Feijoa sellowiana* / Feijoa	1.5	6.4	0.7	0.8	Good	100%	Fair	Fair	Juvenile	Category C	No works - erect tree fence
79	*Eriobotrya japonica* / Loquat	4.5	13.7	1.1	1.6	Good	95% - 99%	Fair	Fair	Early mature	Category C	Minor earthworks to install pipe. Tree is behind a retaining wall - minimal impact only
80	*Yucca elephantipes* / Yucca	4.2	20.1	1.4	2.4	Good	100%	Fair	Good	Early mature	Category C	Minor earthworks to install pipe. Tree is behind a retaining wall - minimal impact only
81	*Populus nigra* 'Italica' / Lombardy poplar	21.3	66.5	2.7	8.0	Good	95% - 99%	Fair	Good	Mature	Category B	Dilling - minor root impacts only on periphery of root zone to form drill pit Trenching - severe root impacts, remove tree
82	*Pittosporum crassifolium* / Karo	6.33	18.5	1.3	2.2	Good	100%	Fair	Fair	Early mature	Category C	Dilling - minor root impacts only on periphery of root zone to form drill pit Trenching - more severe root impacts but will recover in
83	*Magnolia grandiflora* / Evergreen magnolia	3.8	10.2	1.0	1.2	Good	100%	Good	Good	Juvenile	Category C	Drilling - nil impact Trenching - remove tree
84	*Cupressus sempervirens* / Italian cypress	7	17.2	1.3	2.1	Good	100%	Good	Good	Early mature	Category C	Remove
85	*Metrosideros excelsa* / Pōhutukawa	11	126.1	3.9	15.0	Good	100%	Fair	Good	Mature	Category A	Drilling - minor root impacts for road crossing Nil long-term detriment Trenching - root impacts for pipe trench and road
86	*Syzygium smithii* / Monkey apple	14	81.5	3.1	9.8	Fair	85% - 90%	Fair	Good	Mature	Category U	Root impacts anticipated for excavations and machine access
87	*Syzygium smithii* / Monkey apple	14	81.5	3.1	9.8	Fair	85% - 90%	Fair	Good	Mature	Category U	Root impacts anticipated for excavations and machine access
88	*Syzygium smithii* / Monkey apple	14	81.5	3.1	9.8	Fair	85% - 90%	Fair	Good	Mature	Category U	Root impacts anticipated for excavations and machine access

DBH - [trunk] Diameter at Breast Height (1.4 m); SRZ - Structural Root Zone; TPZ - Tree Protection Zone

Appendix F – Tree planting specification

The TREE CONSULTANCY – COMPANY –



PLAN VIEW

Hessian tree ties.

Min. 50mm x 50mm untreated stakes

Prevailing wind.

Root ball surface shall be positioned to be one quater above finished grade.

Prior to mulching, light tamp soil around the root ball in 150mm lifts to brace tree. Do not over compact. When the planting hole has been backfilled, pour water around the root ball to settle the soil.

Existing site soil added to create a smooth transition from the top of the raised root ball to the finished grade at a 15% max. slope.

100mm layer of mulch. No more than 25mm of mulch on top of root ball

Original grade

Finished grade

Round-topped soil berm 100mm high x 200mm wide above root ball surface shall be constructed around the root ball. Berm shall begin at root ball periphery

Bottom of root ball rests on existing or recompacted soil.

Loosened soil. Dig and turn the soil to reduce compaction to the area and depth shown.

Existing soil.

3 x widest dimension of root ball

P-1 45L Grade Tree Planting Detail