

Before the Board of Inquiry
Waterview Connection Project

in the matter of: the Resource Management Act 1991

and

in the matter of: a Board of Inquiry appointed under s 149J of the Resource Management Act 1991 to decide notices of requirement and resource consent applications by the NZ Transport Agency for the Waterview Connection Project

Statement of evidence of David Slaven (Terrestrial Vegetation) on behalf
of the **NZ Transport Agency**

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STATEMENT OF EVIDENCE OF DAVID SLAVEN ON BEHALF OF THE NZ TRANSPORT AGENCY

INTRODUCTION

- 1 My full name is David Charles Slaven. I am a Director of the consulting company Boffa Miskell Ltd (*BML*). I hold the qualifications of Master of Arts (Honours) and Master of Science (Honours) from Auckland University. I have been a professional ecologist specialising in botany for the past twenty years.
- 2 I currently head the Ecology Section of the Auckland office of BML. Previously, I have worked for the World Wide Fund for Nature (Manager Conservation Science), the Bay of Plenty Regional Council (Senior Planner), Ecology Specialist Services (Director), the Department of Conservation (Flora Conservation Officer) and the Auckland Regional Authority (Ecologist).
- 3 My specialist skills lie in botany, and I appear before the Board of Inquiry (*BOI*) as an expert botanist. I have undertaken numerous botanical surveys in differing types of ecosystems and habitats, including wetland, inter-tidal, forest and scrub. These surveys have involved identification of the flora present and an assessment of the botanical conservation values of the site(s) in question. In many instances they have also involved an assessment of the effects of a proposed project on the botanical values of that project area.
- 4 I have appeared before Council Hearings (and on occasion before the Environment Court previously) as an expert witness on earlier new highway projects, including the SH20 Mt Roskill extension, the SH1 Northern Gateway Toll Road, the Northern Busway, and the SH25 Upgrade. I have also worked on the Additional Waitemata Harbour Crossing Study (both the Route Selection and the Preparation of Designations and Plan Change projects), the SH1-SH20 Link, the Eastern Corridor Strategy Study, SH1 ALPURT Sectors A and B1, and the SH18 Realignment.
- 5 My evidence is given in support of notices of requirement and applications for resource consents lodged with the Environmental Protection Authority (*EPA*) by the NZ Transport Agency (*NZTA*) on 20 August 2010 in relation to the Waterview Connection Project (the *Project*). The Project comprises works previously investigated and developed as two separate projects, being:
 - 5.1 The State Highway 16 (SH16) Causeway Project; and
 - 5.2 The State Highway 20 (SH20) Waterview Connection Project.
- 6 I am familiar with the area that the Project covers, and the State highway and roading network in the vicinity of the Project. I have

been working on the SH20 Waterview Connection part of the Project since 2000, and on the SH16 Causeway part of the Project since early 2010.

- 7 I have read the Code of Conduct for Expert Witnesses as contained in the Environment Court Consolidated Practice Note (2006), and agree to comply with it. In preparing my evidence, I have not omitted to consider material facts known to me that might alter or detract from my opinions expressed.

SCOPE OF EVIDENCE

- 8 My evidence will deal with the following:
- 8.1 Executive Summary;
 - 8.2 Background and role;
 - 8.3 Summary of assessment;
 - 8.4 Post-lodgement events;
 - 8.5 Comments on submissions; and
 - 8.6 Proposed vegetation conditions.

EXECUTIVE SUMMARY OF EVIDENCE

- 9 There are four species of flora which are considered to be "at risk" within the Project footprint. The presently undescribed species *Geranium* aff. *retrosum* "Oakley Creek" may turn out to be an adventive (non-native) species but is included as an "at risk" species as a precaution. It will either need to be translocated or replacement material propagated in a nursery for later planting in appropriate locations. Similarly, the coastal herb *Mimulus repens* should be translocated, with recipient sites having been selected and translocation trials already underway in this regard. Two species (the fern *Doodia squarrosa* and the aquatic moss *Fissidens berteroi*) are considered to be sufficiently well enough away from construction activities to not be affected.
- 10 An additional species that is not presently classified as being threatened but which is nevertheless not particularly common within Auckland is the coastal tree daisy (*Olearia solandri*). While the Project will result in the loss of a few dozen or so specimens, the Waterview Inlet is a stronghold for the species, with >1,000 specimens remaining unaffected by the Project.
- 11 In total, in the construction phase there will be 17.94ha of vegetation lost along the SH16 Causeway component of the Project.

This will reduce to 13.6ha in the operational phase. The great majority of the vegetation lost is existing highway verge plantings (i.e. 61%). The remaining vegetation (5.22ha) is comprised of freshwater, saline and maritime flora.

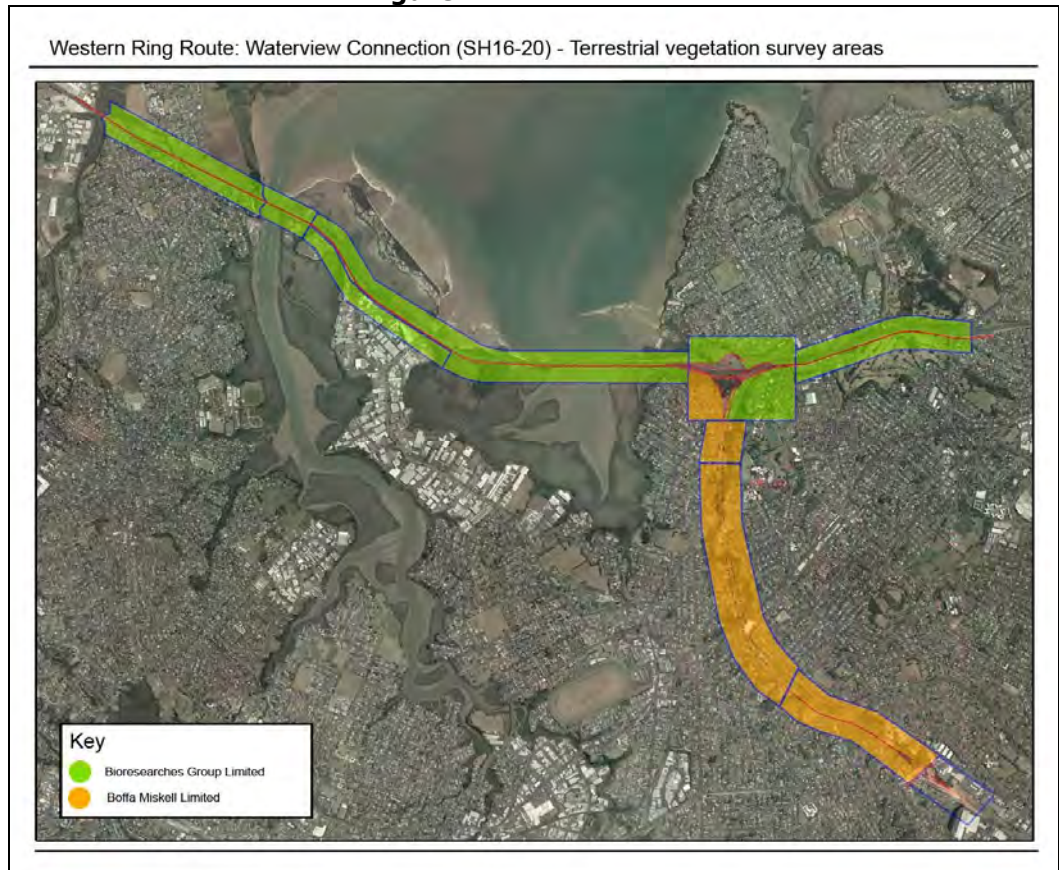
- 12 The difference between the two footprints (i.e. construction vs operational) will be returned to the original vegetation type either by natural processes of colonisation (below MHWS) or more direct revegetation (above MHWS).
- 13 With the exception of the aforementioned "at risk" species, there are no affected species or vegetation types *per se* that are considered to be of particular botanical importance. However, the presence of eco-tone sequences at Traherne Island is considered to be significant. The Project will result in the loss of 1.85ha of these eco-tones (representing 14.5% of the total extent of eco-tones at Traherne Island). This loss will be specifically mitigated by creating replacement eco-tones within the Project area.
- 14 Substantial mitigation planting is proposed as part of the Project. These include revegetation (using native species) along the entire new causeway margins, the creation of a new rock forest at the mouth of Oakley Creek, the creation of new (replacement) eco-tones adjacent to Eric Armishaw Park and extensive riparian restoration (involving both bank re-shaping and planting) alongside Oakley Creek in Hendon Park.
- 15 I consider that the matters and issues pertaining to the indigenous vegetation and flora within the Project area, and in particular that likely to be affected by Project-related works, have been adequately identified and addressed. The potential adverse effects of the Project on indigenous vegetation and flora will be either avoided or sufficiently mitigated. Following completion of the Project there would be no loss of plant biodiversity, and there would be substantial new vegetated areas.

BACKGROUND AND ROLE

- 16 The NZTA retained BML as part of a consortia team to assist with the investigation, engineering and planning of the Project. I was asked to undertake an assessment of the terrestrial vegetation effects of the SH20 Waterview Connection. At the same time Dr Rhys Gardner of Bioresearches Group Limited (*BGL*) was retained to assess the terrestrial and maritime vegetation effects of the SH16 Causeway widening and upgrade. **Figure 1** illustrates the two components of the Project surveyed separately by BML and BGL respectively.
- 17 After the Causeway and Waterview Connection projects were merged, I familiarised myself with the flora and vegetation

associated with the SH16 Causeway component of the Project, and with the Project works that would impinge upon that flora and vegetation. Dr Gardner and I then prepared an Assessment of Terrestrial Vegetation Effects (*the Report*)¹.

Figure 1



- 18 The Report was lodged with the EPA in August 2010 as part of the overall Assessment of Environmental Effects (AEE) (specifically, Part G, Technical Report G.17). Subsequently NZTA retained my services to act as the Project's expert botanist for the BOI hearing.
- 19 Mr Grant Sirl of Arbour Advice Limited prepared an assessment of the trees affected by the Project, which is attached as Appendix E.7 to the AEE (*the Tree Schedule*). The Tree Schedule assesses the amenity value of potentially affected trees within the existing NZTA designation footprint, rather than considering their botanical conservation values. The Tree Schedule is separate from my Report and not addressed in this statement of evidence.

¹ Dr Sharon De Luca's evidence deals with mangroves, since they are clearly in the intertidal area (i.e. below MHS). My evidence includes the "marginal" maritime vegetation (i.e. that growing more-or-less on the line of MHS) such as salt scrub, saltmarsh and salt meadow, as well as freshwater wetlands and terrestrial vegetation.

SUMMARY OF ASSESSMENT

20 In this section of my evidence I will describe the methodology and key conclusions of the Report.

Methodology

21 The vegetation assessment methods utilised for the Report² included both analyses of recent high resolution aerial photography and field investigations. The latter involved my personally walking the entire route of the Project, and assessing the vegetation present, its condition and its botanical conservation values. Complete coverage of the Project area was achieved in this field investigation.

22 In addition to field work, a literature review was undertaken to identify any records of "at risk" species of flora that had been previously recorded within the Project area. Four species were identified as a result, with these being discussed in the Report.

23 In addition to "at risk" species of flora³, the literature review also investigated the presence of rare or uncommon vegetation types within the wider Project area. Only one such vegetation type was identified, being 'rock forest', which is discussed in the Report.

24 Further to the above, from analysis of the aerial photography it was evident that the SH16 Causeway widening would impinge upon saline wetlands, including mangroves, salt scrub, salt marsh and salt meadow, as well as flaxland wetlands.

25 As a result of the analyses described above, a distinction was made between three different vegetation categories, as follows:

25.1 Significant Vegetation – all officially listed "at risk" flora;

25.2 Valued Vegetation – all vegetation that is of botanical interest and value (i.e. maritime communities and rock forest);

25.3 All other vegetation which is neither Significant Vegetation nor Valued Vegetation.

26 The reason for the distinction between these three types is to identify that vegetation and flora which are sufficiently significant to require the avoidance of adverse effects (i.e. the Significant Vegetation), as compared to that vegetation and flora which are sufficiently valued to require the minimisation of adverse effects to the fullest extent practicable where avoidance is not possible (i.e.

² Set out in Section 2 of the Report.

³ As defined in P. de Lange, D. Norton, S. Courtney, P. Heenan, J. Barkla & E. Cameron (2009) "*Threatened and Uncommon Plants of New Zealand (2008 Revision)*". NZ Jnl. Bot. 47: 61-96.

the Valued Vegetation), as compared to that vegetation and flora which are of no particular botanical conservation value.⁴

Summary of Assessment of Existing Terrestrial Vegetation

27 In this section of my evidence I will describe the key conclusions of my assessment of existing vegetation within the Project area, focussing first on Significant and Valued Vegetation.⁵

"At Risk" Flora (Significant Vegetation)

28 In relation to the Significant Vegetation, the Report identified four "at risk" species potentially present within the Project area:

28.1 Maori musk (*Mimulus repens*), classified as 'Naturally Uncommon' and 'Regionally Endangered'. Two small colonies are present in Sector 4. Both are small colonies (in the order of 2m²) growing in roadside ditches.

28.2 *Doodia squarrosa*, a small endemic fern classified as 'Naturally Uncommon' and 'Regionally Sparse'. A very small colony (3 individual plants) is present in a basalt rock outcrop adjacent to Oakley Creek in Hendon Park (Sector 9) just outside the Project footprint (**Plates 1 & 2**).

28.3 *Fissidens berteroi*, an aquatic moss classified as 'Nationally Endangered' had historically been found growing in Oakley Creek within Hendon Park (Sector 9), and in Meola Creek (at some distance below Sector 6). However, two surveys undertaken in 2010 failed to find this species within Hendon Park. A survey in 2010 confirmed the continued existence of the Meola Creek population, but well downstream of the Project area (i.e. 230m below the proposed works).

28.4 *Geranium* aff. *retrosum* "Oakley Creek", a small tap-rooted geranium, grows alongside Oakley Creek in Hendon Park (Sector 9). As noted in the Report, the taxonomic position, origins and consequent 'rarity status' of this plant are presently uncertain. **Plate 3** shows a specimen of the species and **Plate 4** depicts its typical growing location and environment in Hendon Park, being largely restricted to the banks of the creek.

⁴ The sites of Significant Vegetation and Valued Vegetation are mapped in Figures 3A to 3E of the Report.

⁵ A full assessment is set out in Section 3 of the Report.

Plate 1 – *Doodia squarrosa* Habitat, Oakley Creek (Basalt Outcrop)



Plate 2 – *Doodia squarrosa* colony, Oakley Creek



Plate 3 – *Geranium aff. retrorsum* "Oakley Creek" Specimen



Plate 4 – Specimen and Habitat of *Geranium aff. retrorsum* "Oakley Creek"



Status of Geranium

- 29 Even amongst respected botanical taxonomists who have studied and published scientific papers on some of the Australasian *Geranium* genera there is an absence of consensus as to the taxonomic and consequent rarity status of *Geranium* aff. *retrosum* "Oakley Creek". Some consider it to be an adventive species from Australia, citing its only-recent discovery and its very restricted distribution (i.e. being confined to Hendon Park despite similar and suitable habitat in the local area and wider environs) as evidence of its recent (most-likely human-assisted) arrival.⁶ On the other hand, others believe that there is no reason not to consider it an indigenous species, and one of a number of *Geranium* species shared between Australia and New Zealand.⁷
- 30 If the plant is indeed an indigenous species, it will likely be a "Threatened" or "At Risk" species due to its limited distribution. However, if it is adventive (introduced from Australia), it will be of little (if any) conservation concern.
- 31 In keeping with the principles of a precautionary approach, I consider it prudent to assume that it is an "at risk" indigenous species, and the Project works need to recognise this and avoid adverse effects on it. A survey in November 2010 counted a total of >200 individuals of this species present within Hendon Park. These are mapped in **Annexure A**, attached to my evidence. All were growing within 1m of the Oakley Creek channel with most closer than 0.3m. Some specimens are also growing on the water's edge (**Plate 5**) and others in the blockwork walled sections of the creek (**Plate 6**).

Valued Vegetation

- 32 Two areas of 'rock forest' were identified within the Project area, at the mouth of Oakley Creek⁸ and at Harbutt Reserve.⁹ Rock forest is an uncommon vegetation type generally considered to be of botanical conservation value.
- 33 The Oakley Creek site is primarily exotic and would normally have little botanical value, but the fact that it is rock forest elevates its significance. Scattered copses of native species (particularly karaka) within the rock forest provide the key areas of botanical value.

⁶ For example, Dr Rhys Gardner, *pers. comm.*

⁷ For example, Dr Peter Heenan, *pers. comm.*

⁸ Refer Section 3.5.1.1 of the Report.

⁹ Refer Section 3.7 of the Report.

**Plate 5 – *Geranium aff. retrorsum* “Oakley Creek” Specimen
Growing on Waters Edge**



**Plate 6 – *Geranium aff. retrorsum* “Oakley Creek” Specimen
Growing on Blockwork Wall**



- 34 The other Valued Vegetation type within the Project area is the freshwater wetlands and saline wetlands/maritime scrub communities associated with the existing SH16 Causeway and the wider Pollen Island Marine Reserve.¹⁰
- 35 In particular as noted in the Technical Addendum Report¹¹ (*the Addendum*), this vegetation is most valued where it forms intact eco-tone sequences – distinct “bands” of vegetation types that are found in a progression that reflects local habitat/niche differences. In the SH16 case these eco-tones grade from freshwater wetlands into salt scrub, into salt marsh and then into inter-tidal mangroves. Intact examples of such eco-tone sequences are relatively uncommon in the Auckland Region, and those located within the Pollen Island-Traherne Island area are highly representative examples of excellent quality, and as a whole would be of regional botanical significance. The Project footprint affects the margins of some of the eco-tones present on Traherne Island, as shown in **Annexure B** attached to my evidence.
- 36 The presence of *Olearia solandri* (coastal tree daisy) within the Project area and its wider environs is also of note. This species of maritime scrub is not recognised as an “at risk” species, but is nevertheless considered by some botanists to be of a localised distribution within the Auckland Region. There are >1,000 specimens in the Traherne Island and Pollen Island area. A small number of these are within the Project footprint.

Other Vegetation

- 37 Aside from the species and vegetation types described above, the remainder of vegetation within the Project area is either grassland (e.g. Hendon Park and Alan Wood Reserve), weedfields (e.g. to the east of Richardson Road), a mixture of exotic and native plantings (e.g. along the SH16 causeway) or exotic forest with mixed exotic-native understorey (e.g. along the lower length of Oakley Creek). These will either not be affected by the Project or are of little botanical conservation value.¹²

Assessment of Project effects on vegetation Clearance or Loss of Vegetation

Causeway Section – Sectors 1 to 4

- 38 In the construction phase there will be 17.94ha of vegetation lost along the SH16 Causeway component of the Project. This will reduce to 13.6ha in the operational phase.¹³ I consider that the

¹⁰ Refer Section 3.4 and Figures 3A to 3C of the Report; and Technical Addendum Report G.31, Appendix 6 (in particular, the “SH16 Detailed Vegetation Maps” which are appended to Appendix 6).

¹¹ Technical Addendum Report G.31, Appendix 6.

¹² Refer Section 3 of the Report.

¹³ Refer to the “SH16 Detailed Vegetation Maps” attached to the Addendum, which depict the construction and operational footprints on vegetation plans for the

difference between the two footprints (i.e. construction vs operational) will be returned to the original vegetation type either by natural processes of colonisation (below MHWS) or by way of more direct revegetation (above MHWS) as Project mitigation. Given this, the figures and percentages referred to below relate to the permanent loss of vegetation as defined by the operational phase footprint.

- 39 About 61% of the vegetation lost to the operational phase is not of botanical conservation value, especially the terrestrial types (i.e. the highway verge plantings and exotic tree and weed infestations).
- 40 The vegetation of greater concern is that which comprises the saline, maritime and freshwater communities. About 5.22ha of this vegetation will be lost.¹⁴ This includes 0.94ha of flaxland wetlands, 0.27ha of glasswort and needlegrass, 2.79ha of mangroves, 0.26ha of salt marsh, 0.45ha of salt scrub and 0.51ha of salt marsh-salt scrub. In total these account for 38% of the vegetation within the operational phase footprint.
- 41 The great majority of the affected vegetation types are ubiquitous within the Waterview Inlet (and wider Waitemata Harbour) area, in particular the mangroves and salt marsh communities. The quantum of these that will be permanently lost as a result of the causeway widening are not considered to constitute an adverse botanical effect of more than a minor and localised nature.¹⁵
- 42 However, the flax wetlands (all 3 types) and the *Olearia*-dominated salt scrub located on Traherne Island are not so ubiquitous.
- 43 In relation to the specific flaxland vegetation type, the Project will result in the permanent loss of 0.1ha of this vegetation type at Traherne Island, which represents 7.1% of flaxland within the wider Waterview Inlet or 24.4% of the existing flaxland at Traherne Island.
- 44 In relation to the flaxland with emergent wattle, this is the dominant vegetation type of Traherne Island, and within the wider Waterview Inlet it is only found at this location. It occupies an area of 5.51ha. The operational phase footprint will permanently occupy 0.54ha or 9.8% of this vegetation type.

wider Waterview inlet. Table 1 to the Addendum lists the extent of the affected vegetation types for each phase.

¹⁴ Refer Addendum – Appendix 6, Table 1, for a detailed analysis of the extent of areas of specific vegetation types affected by the SH16 construction and operational footprints.

¹⁵ I note also that the evidence of Mr Graham Don and Dr Sharon de Luca demonstrate that most of the affected areas of coastal vegetation do not support significant avifauna populations nor marine organisms respectively.

- 45 In relation to the flax-cabbage tree wetlands, a total of 0.99ha of this vegetation type is to be found within the Waterview Inlet, being restricted to the southern portion of Traherne Island (in that area closest to the existing SH16 highway, and measuring 0.55ha) and in Eric Armishaw Park (part of which is in Sector 5). The latter site is unaffected by the Project, while at Traherne Island 0.17ha (i.e. 17.2% of this vegetation type within the wider Waterview Inlet) will be permanently lost.
- 46 Despite these effects, some 90% of the existing flax wetlands (i.e. all 3 types combined) will be retained within the Waterview Inlet in the operational phase of the Project. In this context, the loss of the flax wetlands is an adverse effect of moderate-low to moderate significance, and will need to be mitigated..
- 47 Similarly, the *Olearia*-dominated salt scrub on Traherne Island will also suffer some (modest) permanent loss, being 0.22ha (representing 11% of the total extent of this vegetation type on the Island and 2.5% from the wider Waterview Inlet.)¹⁶ However, this vegetation type is well established in other unaffected parts of Traherne Island and the wider inlet, and some 97.5% of the existing *Olearia*-dominated salt scrub here will be retained. In this context, the loss of the *Olearia*-dominated salt scrub is an adverse effect of less than minor significance.
- 48 While the impacts of the causeway widening on the vegetation types *per se* (i.e. in isolation) are not considered to be unduly significant, the impacts on the eco-tone sequences at Traherne Island are of more concern. A total of 1.85ha (or 14.5% of the total extent of eco-tone sequences on Traherne Island) will be permanently lost. These eco-tones include mangroves, salt marsh, *Olearia* salt scrub, flaxland, flaxland with emergent wattle, flax-cabbage tree wetland, salt marsh-salt scrub, salt scrub (*Plagianthus*), needlegrass and shell banks.
- 49 I consider that this loss of 1.85ha of eco-tone sequences is a loss of vegetation of high botanical conservation value which will need to be mitigated.
- 50 Notwithstanding this loss however, I note that while the extent of some of the vegetation types comprising these eco-tone sequences may be reduced there will be no loss of any of the eco-tone sequences *per se*.
- 51 In addition to the above, the proposed translocation of the *Mimulus repens*¹⁷ will avoid adverse effects on this species. With the exception of the vegetation discussed above, there are no other

¹⁶ Refer Addendum, appendix 6, page 6-7 and Table 1.

¹⁷ Section 4.1 of the Report.

plant species or vegetation types of any botanical conservation significance that would be impinged upon by the proposed works in Sectors 1 to 4. While there will be some loss of mangrove, salt scrub, salt marsh and salt meadow communities alongside the causeway, the extent of this loss is relatively small and (outside of the eco-tone sequences discussed above) would not constitute an adverse botanical effect. Furthermore, I anticipate that these plant communities will re-establish along the new shoreline relatively quickly.

St Lukes and Waterview Connection Section – Sectors 5-9

- 52 In Sector 5¹⁸ an area of rock forest on the north bank of Oakley Creek will be affected by the ramps and bridges of the Waterview Interchange traversing through and across it. The construction of the piers for these structures will involve the clearance of some of this vegetation, for both the piers themselves and temporary haul roads and crane platforms.
- 53 While this bush is presently dominated by tree privet (an exotic species), it also supports key areas of representative (although relatively young) indigenous rock forest including, in particular, karaka. The effects of the Project on this rock forest area will need to be mitigated.
- 54 In Sector 6, the vegetation affected is highway-verge landscape plantings and self-introduced exotic and weed species. While the Meola Creek culvert is in this sector it will not require extensions to accommodate the widened SH16 here. Sediment generated from the works will be effectively treated prior to discharge to Meola Creek and will not, in my opinion, affect the aquatic moss *Fissidens berteroi* which is present some 230m downstream of the works. This prediction is supported by the habitat preferences of this species, preferring fast flowing reaches of streams (where sediment cannot accumulate to smother aquatic plants) rather than pools (which would be natural areas of sediment deposition). Given the above, the effects of the Project on the botanical values of this Sector are considered to be less than minor.
- 55 In Sectors 7 and 8, the Project involves cut-and-cover and driven tunnels. It is anticipated that there will be no direct adverse effects on terrestrial vegetation as a result of these activities.¹⁹
- 56 In Sector 9,²⁰ the area to the east of Richardson Road is dominated by weeds and exotic species, while the area to the west of Richardson Road (within Hendon Park and Alan Wood Reserve) is

¹⁸ See Section 4.1.5 of the Report.

¹⁹ Potential indirect effects such as changes to the existing groundwater regime and/or possible ground settlement are discussed separately.

²⁰ See Section 4.1.8 of the Report.

mainly grassland, with some amenity plantings and weedfields. With the exception of the *Geranium* aff. *retrosum* "Oakley Creek" and the fern *Doodia squarrosa*, the botanical conservation values associated with Sector 9 are negligible, and the loss of this vegetation does not constitute an adverse botanical effect.

Shading and Rain Shadow Effects

- 57 I have considered the elevation of the proposed bridge structures at the mouth of Oakley Creek²¹ and, in my opinion, there will only be adverse shading and/or rain shadow effects on vegetation underlying Ramp 2 (tunnel to West-bound). That vegetation is comprised of exotic trees (mainly tree privet) and other woody/shrubby weeds. As such the effects of shading on terrestrial vegetation are considered to be minor for Ramp 2, with no adverse shading or rain shadow effects being associated with the other 3 ramps.

Edge Effects

- 58 I have also considered edge effects,²² which refer to the differences in micro-climatic conditions, vegetation composition and structure between forest margins and forest interior.
- 59 In this case there are likely to be few issues with such effects, since there is unlikely to be any habitat interior present within the affected bush patches. Any new edges will be created within existing edge-dominated portions of the affected patches of vegetation.

Loss of Vegetation through Changes to Groundwater

- 60 A significant portion of the new highway will be below ground level. While there is potential for it to affect the local groundwater regime, (by potentially causing a draw-down effect within the immediately adjacent soils) terrestrial vegetation (excluding wetlands) is dependent upon soil moisture (derived from direct precipitation) as opposed to permanent groundwater. Given this, there are no adverse botanical effects anticipated as a result of any potential changes to groundwater.²³

Loss of Vegetation through Ground Settlement

- 61 As noted in the Assessment of Ground Settlement Effects²⁴ the degree of ground settlement that is estimated to occur as a result of the excavation of the tunnels is between 0 - >200mm, and is restricted to the immediate vicinity of the tunnels.

²¹ See Section 4.3 of the Report.

²² See Section 4.4 of the Report.

²³ See Section 4.5 of the Report.

²⁴ AEE: Technical Report, Appendix E (figure E14).

- 62 The resultant effects on vegetation are considered to be negligible, and in any event the vegetation directly within the settlement zones is predominantly exotic. The solitary stand of Valued Vegetation within the zone of estimated settlement is the small vestige of rock forest (mahoe-dominated) present within Harbutt Reserve. This is located some 70m to the east of the eastern tunnel, with estimated settlement in this area being between 20-50mm. Given this, I consider it very unlikely that ground settlement will affect this small stand of rock forest.

Avoidance and Mitigation
"At Risk" Species

- 63 In Sector 4, the populations of *Mimulus repens* will be physically uplifted and translocated to appropriate and safe alternative locations. I note that the New Zealand Plant Conservation Network describes the species as "*easily grown from rooted pieces, stem cuttings and fresh seed*"²⁵, and further note that earlier transplanting trials have been very successful²⁶. With this mitigation, the potential adverse effects of the Project on this species will be avoided.
- 64 In Sector 9, the small colony of *Doodia squarrosa* will be left *in situ* and remain undisturbed by the highway construction. The Alan Wood Reserve stormwater treatment device (i.e. the one in close proximity to the *Doodia*) will have its discharge outlet set downstream of this colony, thereby avoiding any potential effects on it that may be associated with the discharge from that device. While this colony is located within an area where creek bank re-shaping is proposed, its specific location is within a basalt rock outcrop (see **Plate 1 above**), which would be retained *in situ* as part of any bank re-shaping works here, thereby avoiding any potential adverse effects.
- 65 Areas of *Geranium* aff. *retrosum* "Oakley Creek" that are outside the Project footprint will be clearly demarcated as no-go zones for construction activities. Within the Project footprint however, it will not be possible to avoid this species given both the stream realignments and the proposed rehabilitation works (including channel re-shaping). Approximately 172 specimens will be affected by these works. These specimens will need to be uplifted and translocated to an appropriate and safe place elsewhere within Hendon Park. An initial trial has confirmed that the plants transplant readily (see **Plate 7**).²⁷ Alternatively, an experienced nursery will need to be commissioned to collect and propagate new plant material sourced from the Hendon Park population, with this material being grown-on and eventually planted out at appropriate

²⁵ www.nzpcn.org.nz

²⁶ Dr. Rhys Gardner, *pers. comm.*

²⁷ *pers.obs.*

new locations within that park. These options have been carried through into the proposed Conditions of Consent.²⁸

**Plate 7 – Transplanted Specimen of *Geranium aff. retrorsum*
“Oakley Creek”**



66 Should the status of this species be confirmed prior to the Project works commencing, and should it be determined to be an introduced species (i.e. a weed), then no such special management measures will be necessary.

67 As noted above (para 56), no adverse Project-related effects are anticipated in relation to the aquatic moss *Fissidens berteroii* in Meola Creek.

Rock Forest

68 In Sector 5 the rock forest at the mouth of Oakley Creek will be retained as far as is practicable. Notwithstanding this however, some of this rock forest will be lost, and this effect needs to be mitigated.

69 The mitigation will involve the conversion of this rock forest from one that is presently dominated by exotic species (especially tree privet) to one with a far greater native component. Given that a healthy (i.e. breeding) population of copper skink reside in this bush

²⁸ Specifically condition V.12.

it will not be possible to clear-fell the exotic vegetation in its entirety and start afresh from scratch (although this will be the case in relation to the haul roads and crane platform areas following completion of the construction phase in this area). With regards to the remainder of this site (i.e. that which is outside of the haul road and crane platform areas), the process will involve the thinning of the exotic trees (by way of selective felling) coupled with weed removal in the ground tier, and the placement of native plants within the cleared areas. A provisional concept plan for this area is attached as **Annexure C** to my evidence.

- 70 In this way, while some exotic trees (in particular tree privet) will likely persist in this bush for some time it will be transformed from a predominantly exotic forest to a predominantly native rock forest of a type that typifies these vegetation communities.

Eco-Tone Sequences

- 71 As noted above, the SH16 causeway widening will result in the loss of about 1.85ha of native vegetation which is considered to be of high botanical conservation value, as a consequence of its contribution to the eco-tone sequences of Traherne Island.
- 72 The mitigation proposed for the loss of these eco-tones is replacement planting of new similar eco-tones adjacent to Eric Armishaw Park in Sector 5, within the Waterview Inlet area. A plan showing this area is attached to my evidence as **Annexure D**. I note that this mitigation proposal has been developed post-lodgement.

POST-LODGE MENT EVENTS

- 73 Following lodgement of the Project application documents, subsequent work was undertaken to refine the level of detail incorporated in the vegetation maps included in those documents, specifically in relation to the SH16 component of the Project. These maps were ground-truthed by way of detailed field surveys, and included in the Addendum together with a discussion of the vegetation types identified, including the eco-tone sequences. The preceding discussion of vegetation in my evidence has relied upon the final version of the vegetation maps lodged in that Addendum.
- 74 Work has also been ongoing, with Auckland City Council and the Department of Conservation (*DOC*) to establish trial plots of *Mimulus repens* (from transplanted specimens) and to establish a back-up population at a local nursery. The trials are presently underway (and I am involved with them) and the back-up population has been established.²⁹

²⁹ Mr Stephen Benham (DOC), *pers. comm.*

- 75 Similarly, an initial post-lodgement trial involving the transplanting of a specimen of *Geranium* aff. *retrosum* "Oakley Creek" has been successfully undertaken, with the individual concerned thriving in its new location (see **Plate 7**).
- 76 As noted above, the eco-tone replacement planting site is a proposal that was developed post-lodgement. Previously the restoration area concerned had been scheduled in the Urban Design and Landscape Plans as proposed coastal forest. However, that has since changed and it is now proposed that this area be revegetated to include salt scrub, flax, flax-cabbage tree and coastal forest eco-tones.
- 77 Presently the area supports a cover of grass, exotic trees and two patches of flax-cabbage tree wetland (being 188m² and 1,253m² respectively). The total area of this land, excluding the area that is already in an existing cover of flax-cabbage tree wetland, is 1.54ha. It is proposed to expand the extent of flax-cabbage tree wetland here (the fact that one of the predominant exotic trees present here is willow suggests that freshwater wetlands would flourish here). It is further proposed that salt scrub would be planted in appropriate locations, and where soil conditions would preclude the establishment of either freshwater or salt scrub vegetation then coastal forest would be planted.
- 78 The area proposed to replace the lost eco-tones measures less than the extent of that loss, being 1.54ha compared to 1.85ha respectively. In light of this, discussions are presently underway with Auckland Council in relation to the possibility of including two adjacent areas of Council-owned land (both zoned Open Space 2 and seemingly part of Eric Armishaw Park) in the proposed eco-tone replacement area. This land is presently in a cover of grass, willow and other (predominantly) exotic trees. With the inclusion of this land (subject to discussions with Auckland Council), the proposed eco-tone replacement plantings would total 2.12ha.
- 79 In the event that Auckland Council do not want this area re-planted, I consider that, given the substantial new plantings proposed as part of the Project (including the creation of new significant habitat such as the rock forest at the mouth of Oakley Creek), the residual effects of any such discrepancy would have been adequately addressed.

COMMENTS ON SUBMISSIONS

- 80 I have read submissions lodged on the Project that raise vegetation or related issues relevant to my area of expertise. In this section of my evidence, I will address these submissions to the extent not already covered in my evidence or earlier assessment.

Auckland Conservation Board

- 81 The Auckland Conservation Board³⁰ noted that "*trials are planned for protection of Mimulus, and we expect the management of this plant will be informed by this work.*"
- 82 I can confirm that this is indeed the case. The trial plantings of this herb include a range of habitat variables (in particular in relation to the extent of inundation). A DOC officer is involved in these trials and was party to the selection of the trial sites. The DOC officer and myself are continuing to monitor the health of the transplanted *Mimulus* colonies, and the results of these trials will inform the major *Mimulus* relocation programme prior to Project works commencing.

Department of Conservation

- 83 The DOC³¹ requested changes to two of the proposed conditions relating to vegetation. The first was an amendment to proposed vegetation condition V.8, requesting an increase from 2 years of weed management within the designation (following construction) to a period of 5 years³². I do not consider this change to be necessary, as the Auckland Motorway Alliance is contracted by NZTA to carry out highways maintenance within the Auckland area including weed control for the next several years.
- 84 The second change requested by DOC is to the proposed vegetation condition V.11, which relates to the translocation of the *Mimulus*. In its submission DOC seek to make it explicit in this condition that NZTA will be responsible for the costs of the translocation and reinstatement. I consider this is already the effect of the proposed condition.

Friends of Oakley Creek – Te Auaunga

- 85 The Friends of Oakley Creek – Te Auaunga submission³³ identifies a number of vegetation issues and seeks a range of relief in relation to vegetation, which I respond to below.

85.1 *Topic 2 – SH16 Causeway Expansion : (c) That planting of appropriate native plant species be carried out along the corridor in stages, to mitigate loss of vegetation and connectivity of wildlife habitat.*

³⁰ Submitter No. 209.

³¹ Submitter No. 32.

³² Submitter No.s 179 (Friends of Oakley Creek – Te Auaunga -see topic 7(k) of that submission); 217 (the Forest and Bird Motu Manawa Restoration Group) and 185 (North Western Community Association) also sought ongoing weed control.

³³ Submitter No. 179.

Planting of appropriate native plants will be undertaken along the causeway, in accordance with the Urban Design and Landscape Plan series.

- 85.2 *Topic 4 – Waterview, Great North Road, Waterview Glades and Oakley Creek Reserves : (a) That existing native plantings in the reserves be protected during construction.*

The footprint of the construction works (including construction yards) largely avoids areas with existing native plantings. Very minor exceptions to this are Construction Yard 7 in the lower Oakley Creek area, where a few individual (and peripheral) specimens of planted native species (such as young puriri) may be impinged upon, and Construction Yard 3 which will also impinge upon a small stand of maturing native trees (located within the existing highway designation). I note that proposed vegetation condition V.4 requires NZTA to minimise as far as practicable the amount of vegetation to be cleared.

- 85.3 *Topic 4 – Waterview, Great North Road, Waterview Glades and Oakley Creek Reserves : (i) That a mitigation planting plan be prepared prior to any construction commencing, and that additional native plantings be undertaken prior to construction commencing.*

An extensive and detailed mitigation planting plan has already been prepared for the Project.³⁴

- 85.4 *Topic 6 – Owairaka : (a) That threatened/rare/unique species are protected and that any populations translocated must be to appropriate habitat with ongoing monitoring and maintenance.*

This submission presumably relates to the *Doodia squarrosa* and *Geranium* aff. *retrosum* "Oakley Creek" found in Hendon Park. Protection and/or translocation of these species is central to the Project plans, as I have described earlier in my evidence. Monitoring of any translocations will be undertaken in accordance with the ECOMP.

- 85.5 *Topic 6 – Owairaka : (b) That existing native plantings in the reserves be protected during construction.*

Again, the footprint of the construction works (including construction yards) largely avoids areas with existing native plantings. Exceptions to this are Construction Yard 10 (in Alan Wood Reserve), where a Park boundary planting of

³⁴ The Urban Design and Landscape Plan series.

maturing ngaio, tarata and *Coprosma* hybrids may need to be cleared.

85.6 *Topic 7 - Whole Project : (i) That all planting be ecology based rather than amenity based ...*

The Urban Design and Landscape Plan series are ecologically based where it is feasible to do so (which is across the majority of the Project area). The selection of plant species is appropriate to the locality and the type of habitat intended to be created. With specific regard to riparian planting, this will be in accordance with the Oakley Creek Re-alignment and Rehabilitation Guidelines³⁵ and the Urban Design and Landscape Plan series, rather than adhering to a strict 20m width rule, since the intention is to integrate ecology with amenity, visual, recreational and community values and purposes. I note that the requested 20m planted riparian width is also not consistent with the ARC Technical Publication (TP) 148 'Riparian Zone Management', which states a desired width of 15m and a minimum of 10m. Where ecological considerations are at the fore then the riparian planting widths adjacent to Oakley Creek will be in general accordance with TP 148, but bearing in mind the need to also factor in amenity, visual, recreational and community values and purposes.

Forest and Bird Motu Manawa Restoration Group

86 The Forest and Bird Motu Manawa Restoration Group³⁶ submission includes a request for the retention and rehabilitation of the existing SH16 causeway culvert at Rosebank Peninsula. One of the reasons given for this is that this site, were the culvert to be rehabilitated, would be an ideal location for the re-siting of the *Mimulus*. I do not agree with that proposition. *Mimulus* is a shade-intolerant herb, and in my opinion the site proposed by the submitter would be too shaded by ever-increasing mangroves.

87 Additionally, were the culvert to be rehabilitated there would be a period of time while the local hydrology adjusted to the new regime, with this period likely to include phases of erosion and deposition – such processes may threaten the existence of any *Mimulus* that had been translocated to the site.

³⁵ Appendix C – Technical Report G.6 (Assessment of Freshwater Ecological Effects).

³⁶ Submitter No. 217 at 4.2.

- 88 The submission³⁷ also comments on the composition and maintenance of the native vegetation replanting along the SH16 causeway. I address the specific comments below:
- 88.1 *Eco-source the revegetation plants from the Waterview Inlet*³⁸ – this is not necessary. Best practice accepts eco-sourcing from the local Ecological District (in this case being Tamaki) or, in some circumstances, even from within the wider Ecological Region (Auckland). Additionally, there may be difficulty in eco-sourcing from within the Waterview Inlet area some of the species included in the Urban Design and Landscape Plan series, or indeed with some of the species that the submitter recommends (i.e. sand kanuka).
- 88.2 *Use a predominance of manuka and kanuka* – while there is nothing wrong with a predominance of manuka and kanuka in revegetation plantings, I consider that the species proposed in the Urban Design and Landscape Plans are also appropriate for their intended purpose.
- 88.3 *Employ a preference for Waitemata [sic] (sand) kanuka* – while this may be acceptable from a botanical perspective, I am uncertain whether this species exists within the Waterview Inlet (for eco-sourcing purposes). I am also uncertain whether this species would thrive in the engineered soils of the reclamation and causeway (but otherwise I have no objection to this particular submission).
- 88.4 *Do not use weed mat but use mulch or similar for initial weed control* – I concur with this particular submission and I note that this is already addressed in the Project’s landscaping specifications.

Waitakere City Council

- 89 The Waitakere City Council (WCC) submission³⁹ seeks that the revegetation proposals of the Project integrate with the North West Wild Link. This is a concept that seeks to provide an ecological corridor between the Waitakere Ranges and Hauraki Gulf Islands, by protecting and enhancing open space and bush habitats principally within the North Shore and Waitakere Cities. The North West Wild Link includes Henderson Creek. The proposed new SH16 highway verge plantings will enhance the Henderson Creek corridor.
- 90 The WCC submission also requests that the proposed seawall (i.e. rock revetment) of the SH16 upgraded causeway utilise design

³⁷ Submitter No. 217 at 4.3.

³⁸ Other Submitters including Submitter No.s 179 (the Friends of Oakley Creek) and 207 (Auckland Regional Council) also sought eco-sourcing using local species.

³⁹ Submitter No. 212 at 3.3.4.

solutions to soften its “hard edge”. Such solutions have been incorporated into the conceptual design of this structure where conditions allow for such (i.e. in the lower wave-energy environments). These areas are shown in the Urban Design and Landscape Plan series for the Project. While the final design solutions at this stage need to be kept open to allow for innovation in the successful construction Alliance’s detailed design phase for the Project, **Annexure E** attached to my evidence provides an illustration of how this might be achieved.

- 91 The WCC submission⁴⁰ also requests that the Council’s eco-sourced plant selection audit process be applied in the supply of eco-sourced seed and plant stock for the Project. While I acknowledge that this may be an appropriate audit to use, others may be equally as valid and I do not concur that a condition of consent should necessarily tie the successful Alliance contractor to any one specific auditing tool.

Clendon, Hughes & Hague (Green Party)

The submission of Clendon, Hughes and Hague (Green Party)⁴¹ include concerns in relation to the effects of the Project on “rare mosses” in “the Oakley Creek area”. However, the only rare moss that has been recorded in the recent past in the vicinity of the construction footprint here is *Fissidens berteroi* – in this regard, two intensive surveys in 2010 have confirmed that this species is no longer present here.

- 92 Should the submission be also referring to other rare species of flora within the footprint in the Oakley Creek area (i.e. *Mimulus repens*, *Doodia squarrosa* and *Geranium aff. retrorsum* “Oakley Creek”), I have discussed each of these earlier in my response to submissions.

Auckland Regional Council

- 93 The Auckland Regional Council (ARC) submits⁴² that the loss of salt marsh vegetation “in a regionally significant ecological area of urban Auckland including impacts on threatened flora species” has not been sufficiently mitigated in the proposed mitigation proposals. I do not agree with this submission (which I infer relates to the *Mimulus repens* and the eco-tone sequences). In my opinion, the degree of mitigation being proposed is adequate to off-set the loss of the regionally significant vegetation.
- 94 Firstly, the *Mimulus* will be translocated, as has been described earlier in my evidence. Secondly, the actual quantum of eco-tone loss at Traherne Island is not excessive (i.e. leaving 85.5% intact) and will be appropriately mitigated by replacement planting.

⁴⁰ Submitter No. 212 at 3.3.2.

⁴¹ Submitter No. 156.

⁴² Submitter No. 207 at paragraph 4.5.13.

- 95 The ARC request⁴³ that a number of issues be addressed through the ECOMP. I address each of these below:
- 95.1 *That areas of indigenous vegetation (including rare species) be clearly identified* - I concur with this and note that the proposed vegetation conditions (V.3 and V.5) require this.
- 95.2 *A more comprehensive restoration and mitigation plan be prepared* – I do not agree that any additional restoration and/or mitigation over and above that which is presently proposed is required. It is my opinion that the restoration and mitigation programme which is presently proposed will result in significant benefits to the local ecology of the Project area (as well as to the local communities) which more than off-sets any adverse botanical effects.
- 95.3 *Further detail is required of the rock forest restoration area* - this is provided in **Annexure C** attached to my evidence.
- 95.4 *That proposed condition V.10 require eco-sourcing from the Tamaki Ecological District and that ecological sequences are restored and replaced* – The eco-sourcing issue has been addressed earlier in my response to submissions, and the replacement of lost eco-tones is addressed in paragraphs 76-79 of my evidence.
- 96 The ARC submission⁴⁴ supports replacement plantings to mitigate the loss of saline vegetation. This concept is not supported, given that the existing causeway has resulted in the establishment of saline communities along its margins over time, and I consider that the same outcomes will manifest as a result of the new (simply widened) causeway. I note that the Auckland City Council submission⁴⁵ also anticipates that mangroves and saltmarsh communities affected by the construction “*should recover naturally over the course of a few years*”. I note that Dr De Luca makes the same point in relation to the regeneration of mangroves in her evidence.

Auckland City Council

- 97 The Auckland City Council (ACC) submission⁴⁶ generally concurs with my terrestrial vegetation assessment, noting that “*where damage to valued indigenous flora is unavoidable, the proposed mitigation measures are likely to be sufficient to offset the effects*”. The submission⁴⁷ does, however, call for the establishment of rock

⁴³ Submitter No. 207 at paragraph 4.5.23.

⁴⁴ Submitter No. 207 at paragraph 4.6.3(g).

⁴⁵ Submitter No. 111, at paragraphs 276-277.

⁴⁶ Submitter No. 111, at paragraph 280.

⁴⁷ Submitter No. 111, at paragraphs 311 and 313.

forest vegetation at the Oakley. The Project already provides for the establishment of rock forest at the Oakley Creek mouth as set out in **Annexure B** to my evidence.

- 98 The submission⁴⁸ also requests more detail on the methods for monitoring significant and valued vegetation – this detail is provided in the ECOMP.
- 99 The submission⁴⁹ seeks the use of ecological opportunities provided by motorway landscape works, stream restoration and existing ecological networks to support Council’s Urban Forest Plan. This has been achieved already by virtue of the ‘Oakley Creek Re-alignment and Rehabilitation Guidelines’⁵⁰ and the Urban Design and Landscape Plan series.

Ngati Whatua o Orakei

- 100 The submission of Ngati Whatua o Orakei⁵¹ identifies the existing degraded nature of Te Auaunga (Oakley Creek) and its rehabilitation potential. I note that, as part of the Project, riparian margins and stream channel of Te Auaunga are proposed to be rehabilitated within Hendon Park, in accordance with the ‘Oakley Creek Re-alignment and Rehabilitation Guidelines’ and the Urban Design and Landscape Plan series.
- 101 The submission also notes the cultural and ecological importance of historic (but now reclaimed) wetlands - Te Wai o Rakataura. While these reclaimed wetlands *in toto* are excluded from any specific restoration treatments associated with the ‘Oakley Creek Re-alignment and Rehabilitation Guidelines’ or the Urban Design and Landscape Plans, a sizeable (and ecologically functional) stormwater treatment wetland is proposed to be located within their historic footprint.
- 102 In combination, these two measures should go at least in part to meeting the ecological aspirations as expressed in the submission of Ngati Whatua o Orakei.

Loss of an Existing Ecological Corridor

- 103 Several submitters⁵² express concern that the Project will lead to the loss of (or disruption to) an existing ecological corridor which connects with a wider network. I assume the corridor being referred to concerns the forested margins of Oakley Creek.

⁴⁸ Submitter No. 111 at paragraph 313.

⁴⁹ Submitter No. 111, at paragraph 315.

⁵⁰ Appendix C – Technical Report G.6 (Assessment of Freshwater Ecological Effects).

⁵¹ Submitter No. 170.

⁵² Including Submitter Nos. 170, 206 and 229.

Presently this vegetated corridor ceases in Alan Wood Reserve. It is already truncated by New North Road to the west, with the majority of the forested corridor being downstream of that arterial route.

- 104 Rather than resulting in the loss of this corridor, the Project will actually increase its size, extending it from its present termination point (in Alan Wood Reserve) to the confluence of Oakley Creek and the Stoddard Road tributary. This will be done in accordance with the 'Oakley Creek Re-alignment and Rehabilitation Guidelines'.

Concerns Over Vegetation Loss and Requests for Planting of Native Trees

- 105 Several submitters⁵³ have raised general concerns in relation to the loss of trees from existing reserves, the use of native species in the revegetation programme, and/or in the planting of the treatment wetlands. In response I can confirm that the actual extent of tree clearance within existing public reserves is very limited, and the Urban Design and Landscape Plan series illustrate clearly the substantial amount of replanting that will be undertaken, using predominantly native species. While the extent of terrestrial vegetation clearance along the SH16 causeway will be substantial, that vegetation is largely within an existing highway designation, and it will be replaced with appropriate native plantings. I can also confirm that the treatment wetlands will be planted with native wetland species.

Negative Effects on Ecology, Biodiversity and Flora

- 106 Several submitters⁵⁴ express concerns in relation to "ecology", "biodiversity" and "native flora" or sought better mitigation to preserve biodiversity. In my opinion, the existing local biodiversity of the Project area in terms of terrestrial vegetation, will actually be increased rather than decreased. This is perhaps nowhere more evident than in relation to the creation of the rock forest at the mouth of Oakley Creek, which will add new rock forest species to the local biodiversity. In addition, the proposed revegetation along most of the route will substantially increase the extent of indigenous biomass within the Project area.

Retain Oakley Creek Bush

- 107 Two submitters⁵⁵ request the retention of the bush environment along Oakley Creek. I can confirm that the Project will impinge upon only very small and discrete portions of this bush at very few localities. Additionally, as already noted in my evidence, the extent of riparian bush cover along Oakley Creek will actually increase as a

⁵³ Including Submitter Nos. 25, 96, 122 and 142.

⁵⁴ Including Submitter Nos. 13, 44, 121, 126, 162, 169, 185, 186, 191, 192, 199, 203, 213, 214, 223, 225, 228, 230 and 241.

⁵⁵ Submitter Nos. 115 and 119.

result of the proposed mitigation programme, in particular in Hendon park.

PROPOSED VEGETATION CONDITIONS

- 108 In the documentation lodged with the AEE, the NZTA included a set of Proposed Consent Conditions (see Part E, Appendix E.1). This included proposed vegetation conditions which I recommended would be appropriate to attach as conditions to the designations sought. A copy of the proposed conditions is contained in **Annexure F** to my evidence. I consider that those conditions are still appropriate, but recommend clarification to one, being proposed vegetation condition V.6. This clarification would amend that condition to read:

*"The NZTA shall replace any **terrestrial** Valued Vegetation that is required to be removed as a result of construction activities, in accordance with the ECOMP and the Urban Design and Landscape Management Plans."*

- 109 This is consistent with my prediction that inter-tidal vegetation will naturally (and rapidly) recolonise the disturbed areas that lie below MHWS. I note that this prediction is also shared by Dr De Luca in her evidence and by ACC's ecologists.⁵⁶



Dave Slaven
November 2010

Annexures

Annexure A: Geranium aff. retrorsum "Oakley Creek" Distribution

Annexure B: Location of Eco-Tone Sequence Losses

Annexure C: Rock Forest Provisional Concept Plan

Annexure D: Eco-Tone Replacement Planting Area

Annexure E: Conceptual Rock Revetment Planting Designs

⁵⁶ Submitter No. 111, paras 276-277.

Annexure F: Recommended Amendment to Proposed Vegetation
Conditions

**ANNEXURE A: *GERANIUM* AFF. *RETRORSUM* "OAKLEY CREEK"
DISTRIBUTION**

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Geranium Locations (accuracy +/- 5m)

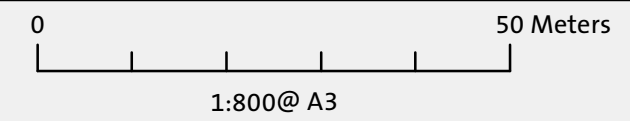
- Unaffected by Project Works
- Within Highway Footprint
- Within Proposed Mitigation Areas



Distribution of Geranium aff. retrorsum "Oakley Creek"

Map 1 of 3

Data Sources: ALGGi (2008 Aerials), Boffa Miskell
File: A09178_Geranium_Locations.mxd
Printing Date: 08/11/2010
Author: mattd



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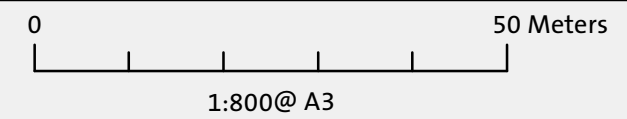
- Geranium Locations (accuracy +/- 5m)
- Unaffected by Project Works
 - Within Highway Footprint
 - Within Proposed Mitigation Areas



Distribution of Geranium aff. retrorsum "Oakley Creek"

Map 2 of 3

Data Sources: ALGGi (2008 Aerials), Boffa Miskell
File: A09178_Geranium_Locations.mxd
Printing Date: 08/11/2010
Author: mattd



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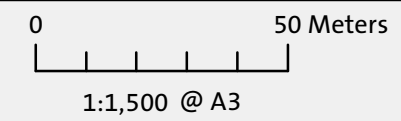
- Geranium Locations (accuracy +/- 5m)
- Unaffected by Project Works
 - Within Highway Footprint
 - Within Proposed Mitigation Areas



Distribution of Geranium aff. retrorsum "Oakley Creek"

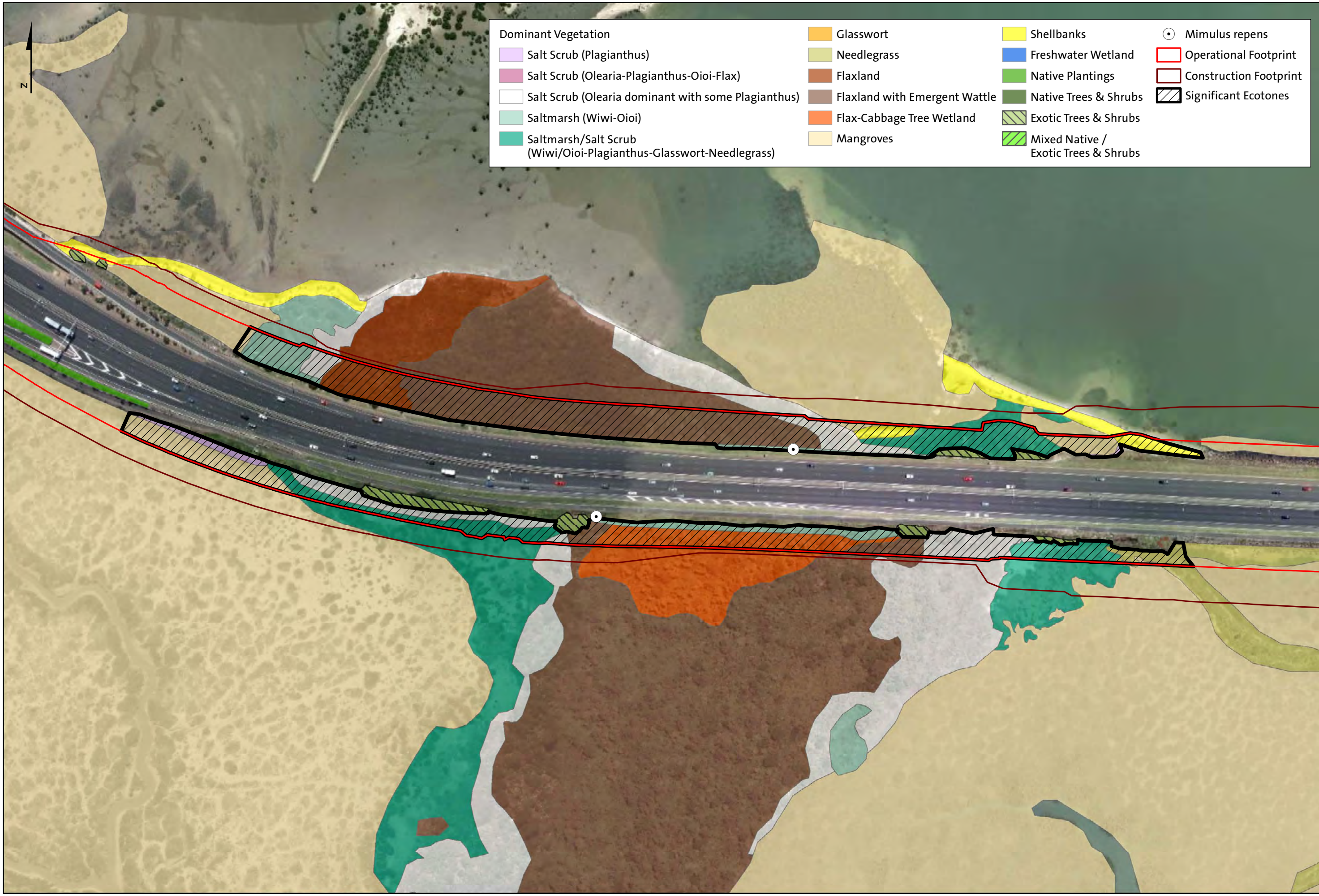
Map 3 of 3

Data Sources: ALGGi (2008 Aerials), Boffa Miskell
File: A09178_Geranium_Locations.mxd
Printing Date: 08/11/2010
Author: mattd



ANNEXURE B: LOCATION OF ECO-TONE SEQUENCE LOSSES

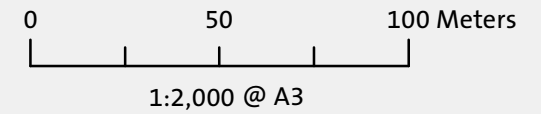
These plans have been produced as a result of information provided by the client and/or sourced by or provided to Boffa Miskell Limited by a third party for the purposes of providing the services. No responsibility is taken by Boffa Miskell Limited for any liability or action arising from any incomplete or inaccurate information provided to Boffa Miskell Limited (whether from the client or a third party). These plans are provided to the client for the benefit and use by the client and for the purpose for which it is intended.



Dominant Vegetation	Glasswort	Shellbanks	Mimulus repens
Salt Scrub (Plagianthus)	Needlegrass	Freshwater Wetland	Operational Footprint
Salt Scrub (Olearia-Plagianthus-Oioi-Flax)	Flaxland	Native Plantings	Construction Footprint
Salt Scrub (Olearia dominant with some Plagianthus)	Flaxland with Emergent Wattle	Native Trees & Shrubs	Significant Ecotones
Saltmarsh (Wiwi-Oioi)	Flax-Cabbage Tree Wetland	Exotic Trees & Shrubs	
Saltmarsh/Salt Scrub (Wiwi/Oioi-Plagianthus-Glasswort-Needlegrass)	Mangroves	Mixed Native / Exotic Trees & Shrubs	

SH16 Causeway Significant Ecotone Loss

Data Sources: ALGGi (2008 Aerials), Aurecon, Boffa Miskell
 File: A09178_Vegetation_Significant_Ecotones_20101108.mxd
 Printing Date: 08/11/2010
 Author: mattd



ANNEXURE C: ROCK FOREST PROVISIONAL CONCEPT PLAN

SH16 Waterview

Basalt Rock Forest: Proposed Planting

PREPARED FOR NZTA

BY **Boffa Miskell Limited**

November 2010

INTRODUCTION

This report outlines the planting proposals and associated management techniques required to re-establish basalt rock forest on the lava flow substrates of the Mount Albert (Owairaka) effusion as part of the proposed SH20 Western Wing Route Northern Portal arrangement at Waterview.

1.1 Background

A dense canopy of tree privet covers much of the existing extent of lava flow on the northern banks of Oakley Creek in this location, associated with unusually diverse assemblages of ferns, mosses, bryophytes and liverworts, as well as a number of exotic weeds (Gardner and De Lange 2008). While native trees and shrubs are present, they are few in numbers and localised in their distribution. Representative rock forest species that are present include Karaka, Lemonwood, Mahoe, Hangehange and Mapou.

The construction of on/off ramps at the proposed intersection of SH20 with the existing SH16 at Waterview will involve clearance of substantial areas of this existing vegetation, with the opportunity to re-establish representative rock forest species. The residual areas of privet forest that are to be retained will also provide an opportunity to plant enrichment forest plantings directly beneath the existing forest canopy, while retaining important populations of ferns, mosses, bryophytes and liverworts. This approach will also maintain functional habitat for the resident population of the native copper skink at this site.

1.2 Provisional Planting Proposals

Two core planting mixes are proposed, based on the planting scenarios identified above involving:

- A. planting directly into clearfelled areas of basalt lava substrate; and
- B. underplanting retained areas of privet forest with a diversity of native forest species.

1.2.1 Basalt Rock Forest: Clear Fell Planting Areas

The species mix identified in Table 1 below is comprised of a select range of hardy nursery species that will establish quickly to form a canopy cover into which more sensitive forest

diversity plantings may be planted in subsequent years. This two staged technique to establishing diversity amongst native revegetation plantings is now widely accepted best practice, in conjunction with extended maintenance periods.

Following ground preparations, nursery plantings should be established at the smaller Pb2 or Pb3 sizes.

The exposed edges of rock forest plantings, at their boundary with road margins, will require a ground-based mix of native species, as distinguished below.

Table 1 – Nurse Crop and Understorey Species

Botanical Name	Common Name	Planting Centres/ m	% Mix	Plant Grade
<i>Myrsine australis</i>	Mapou	1.0	30	Pb2/3
<i>Coprosma macrocarpa</i>	Mamangi	1.0	20	Pb2/3
<i>Pittosporum eugenioides</i>	Tarata/ Lemonwood	2.0	10	Pb2/3
<i>Pittosporum crassifolium</i>	Karo	2.0	10	Pb2/3
<i>Olearia furfuracea</i>	Akepiro	1.0	10	Pb2/3
<i>Macropiper excelsum</i>	kawakawa	1.0	10	Pb2/3
<i>Geniostoma ligustrifolium</i>	Hangehange	1.0	10	Pb2/3
Edge Plantings				
<i>Cordyline australis</i>	Cabbage tree	1.0	30	pb3/5
<i>Hebe stricta</i>	Koromiko			pb3/5
<i>Carex flagellifera</i>		1.0	30	pb3/5
<i>Carex lambertiana</i>	Bush sedge	1.0	30	pb3/5
<i>Phormium tenax</i>	Harekeke, Flax	1.0	10	pb3/5

1.2.2 Basalt Rock Forest: Infill/ Enrichment Plantings

Infill plantings will be selectively implemented beneath those areas of existing privet forest to be retained (but selectively thinned) at the mouth of Oakley Creek in conjunction with targeted weed control operations. Mainly comprised of forest canopy species representative of the rock forest type, the diversity plantings listed below will eventually establish a comprehensive forest structure, incorporating existing native understorey and ground cover species. This mix of species will also form the basis to specifying enrichment forest plantings amongst nursery forest plantings that have established successfully after several growing seasons, with a clearly defined canopy.

Infill/ enrichment plantings may be implemented at larger grades than nursery plantings, due to the more favourable growing environments created beneath an existing vegetation cover. Pb5 or Pb8 would be appropriate in this instance. Appropriate species are listed in Table 2 below.

Table 2 – Enrichment Species

Botanical Name	Common Name	Planting Centres/ m	% Mix	Plant Grade
<i>Melicytus ramiflorus</i>	Mahoe/ Whiteywood	3.0	40	Pb5/8
<i>Alectryon excelsus</i>	Titoki	3.0	20	Pb5/8
<i>Corynocarpus laevigatus</i>	Karaka	4.0	10	Pb5/8
<i>Dysoxylum spectabile</i>	Kohekohe	3.0	10	Pb5/8
<i>Vitex lucens</i>	Puriri	5.0	10	Pb5/8
<i>Litsea calicaris</i>	Mangeao	3.0	10	Pb5/8

1.2.3 Planting Notes

Both infill and clear fell areas of planting will extend above the northern banks of Oakley Creek through to SH16. Although the interior distribution of this planting across this profile should be even, the following species preferences should be noted:

- Karaka to be planted in groups of 3-5 plants
- Titoki, Kohekohe and Puriri should be planted in greatest numbers towards the Oakley Creek

In general plants should be located in natural clusters avoiding geometric grids and patterns.

1.3 Site Preparation and Management

1.3.1 Basalt Rock Forest: Clear Fell Planting Areas

The removal of existing privet forest from within the construction footprint of the Northern Portal in areas of proposed rock forest plantings should be carefully managed with the aim of conserving the existing epiphytic moss, fern, liverwort and bryophyte communities. This could be achieved by transferring host cut logs from within the clearfelled areas into the extent of privet forest to be retained. Clearfelling operations should ensure the removal of all existing weeds, including adventitious roots and suckers.

1.3.2 Basalt Rock Forest: Infill/ Enrichment Plantings

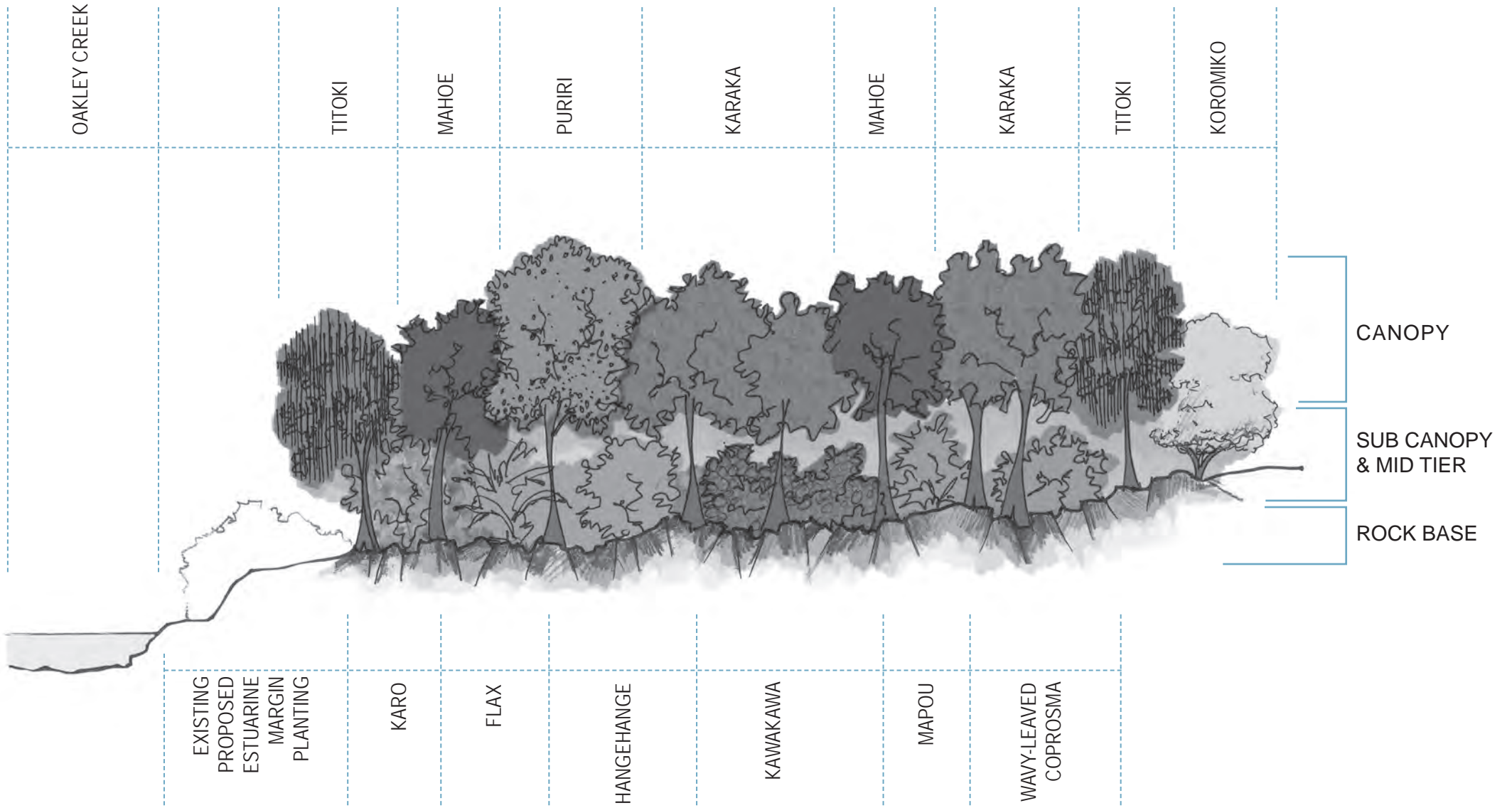
Areas of existing privet forest will be subject to extensive weed control operations and selective thinning in order to make room for the infill diversity plantings proposed. Existing trees supporting large numbers of epiphytes should be specifically retained, along with sufficient numbers of trees to retain a tree canopy beneath which diversity plantings may thrive. Both targeted weed control and thinning operations should be carried out with minimal disturbance to native ground flora and epiphytic plant communities.

1.4 Ongoing Management/ Maintenance Requirements

Following the successful establishment of infill/ enrichment plantings, retained privet trees should be selectively drilled for injection by poison. Leaving these trees to break down and decay naturally *in situ* over time will provide important nutrient inputs to the developing forest through the resulting debris, while also minimising disturbance to epiphytic vegetation. It would also be beneficial if some epiphytic logs could be transferred across into the clearfelled planting areas as an additional source of forest diversity species. Native herpetofauna, such as copper skink, will also benefit from the provision of woody debris as potential habitat refuges.

The expectation over time is for both forms of forest plantings to develop into representative functional rock forest habitat of a similar structure and diverse species composition (including epiphytic plants) and capable of supporting native wildlife populations including lizards.

Ongoing weed control operations will be an important aspect of maintaining both types of forest plantings through their developing stages.



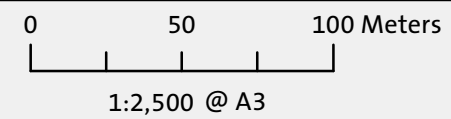
ANNEXURE D: ECO-TONE REPLACEMENT PLANTING AREA

These plans have been produced as a result of information provided by the client and/or sourced by or provided to Boffa Miskell Limited by a third party for the purposes of providing the services. No responsibility is taken by Boffa Miskell Limited for any liability or action arising from any incomplete or inaccurate information provided to Boffa Miskell Limited (whether from the client or a third party). These plans are provided to the client and for the purpose for which it is intended.

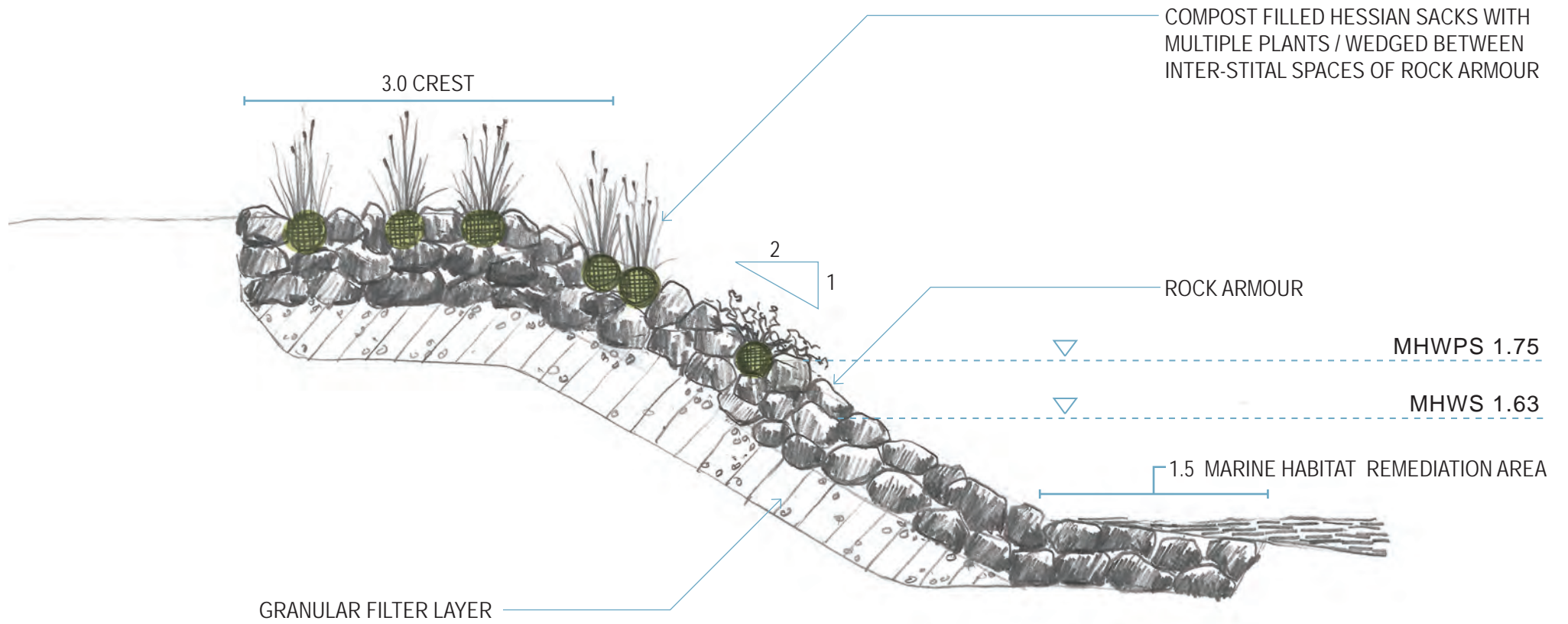


Proposed Ecotone Revegetation Site

Data Sources: ALGGi (2008 Aerials), Aurecon, Boffa Miskell
 File: A09178_Ecotone_Reveg.mxd
 Printing Date: 08/11/2010
 Author: mattd

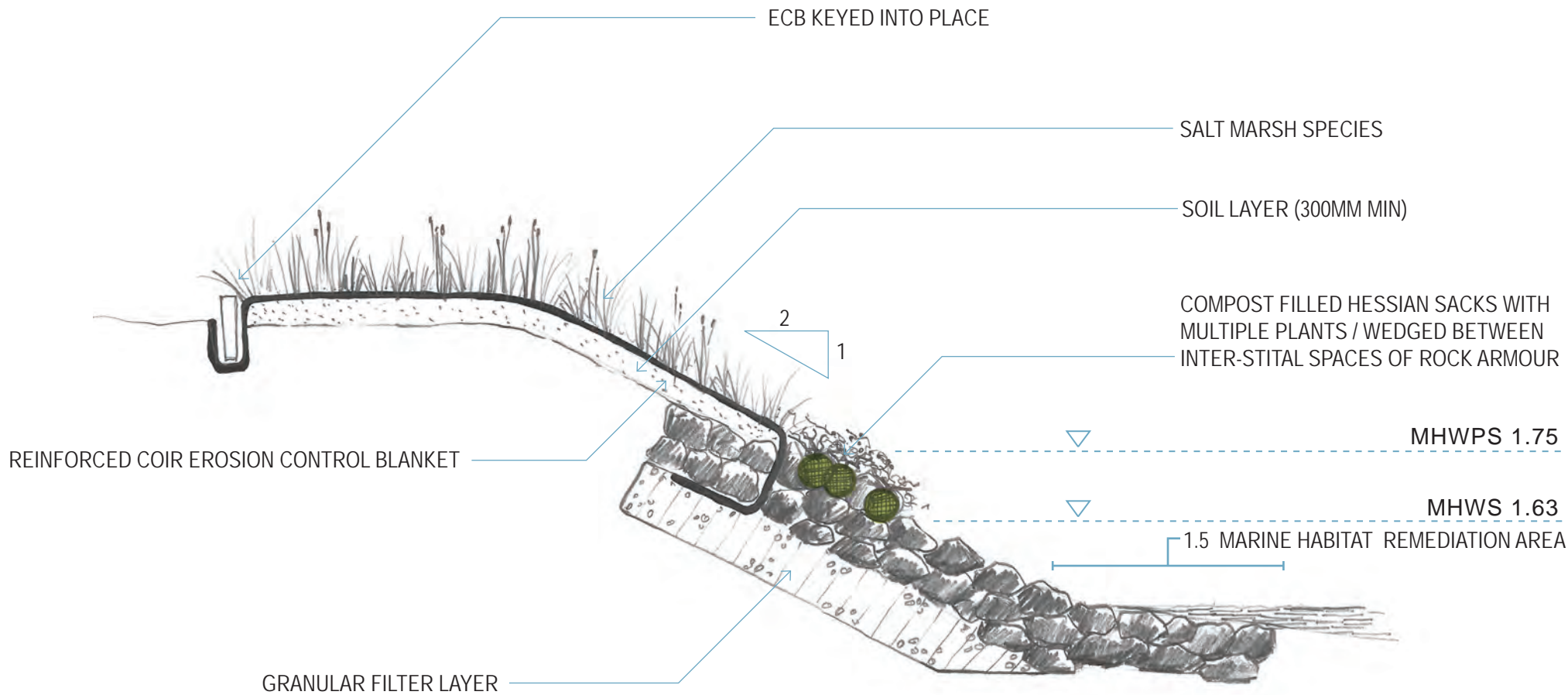


ANNEXURE E: CONCEPTUAL ROCK REVETMENT PLANTING DESIGNS



revised detail 3

REFERENCE: AURECON DWG 20.1.11-3-D-C-510-110 (DATED 07.07.10)



revised detail 4

REFERENCE: AURECON DWG 20.1.11-3-D-C-510-110 (DATED 07.07.10)

ANNEXURE F: RECOMMENDED AMENDMENT TO PROPOSED VEGETATION CONDITIONS⁵⁷

V.1	<p>The NZTA shall finalise the Ecological Management Plan (ECOMP) submitted with this application, prior to works commencing on site. The ECOMP shall be implemented through the CEMP. The ECOMP shall clearly identify the location and identity of:</p> <p>(a) All Significant Vegetation within the designation that is to be fully protected or relocated; and</p> <p>(b) All Valued Vegetation within the designation that is to be protected as far as is practicable.</p> <p>Note: Significant and Valued Vegetation shall be as defined in the ECOMP.</p>
V.2	<p>The NZTA shall employ a suitably experienced botanist ('nominated botanist') for the duration of the works to monitor, supervise and direct all works affecting or otherwise in close proximity to the Significant Vegetation and Valued Vegetation identified in the ECOMP.</p>
V.3	<p>Prior to any site works commencing, a pre-commencement site meeting shall be held so that the conditions of designation that pertain to the Significant Vegetation and Valued Vegetation are explained by the nominated botanist to all contractors or sub-contractors who will be working on site within the close vicinity of that vegetation.</p>
V.4	<p>The NZTA shall minimise as far as practicable the amount of vegetation which is to be cleared within the designation. All vegetation clearance shall be undertaken in accordance with the measures set out in the ECOMP.</p>
V.5	<p>The NZTA shall install protective fencing around, or otherwise clearly demarcate, all of the Significant Vegetation identified in the ECOMP as requiring full protection, under the supervision of the nominated botanist.</p>
V.6	<p>The NZTA shall replace any <u>terrestrial</u> Valued Vegetation that is required to be removed as a result of construction activities, in accordance with the ECOMP and the Urban Design and Landscape Management Plans.</p>
V.7	<p>The nominated botanist shall supervise all trimming, pruning and relocation work associated with the Significant Vegetation and Valued Vegetation required as part of the works.</p>
V.8	<p>Prior to planting, and for a period of 2 years following completion of construction, the NZTA shall undertake weed management of any plants within the designated areas that are identified as plant pests in the Auckland region by the Auckland Regional Council (including Total Control/Containment Pests/Surveillance Pests and Research Organisms).</p>

⁵⁷ Contained in Appendix E.1, pages 31 - 32.

V.9	<p>The nominated botanist shall undertake a monitoring program throughout the construction period, including monitoring of:</p> <ul style="list-style-type: none"> (a) The condition, repair and location of the temporary protective fencing or other forms of demarcation used to identify the Significant Vegetation; (b) Any works within the vicinity of the Significant Vegetation and Valued Vegetation; (c) The general health of the Significant Vegetation and Valued Vegetation (including any valued vegetation that has been relocated away from the works area; and (d) Compliance with the vegetation conditions of designation by way of fortnightly inspections during the construction period.
V.10	<p>Where practicable, any planting utilising native plants shall use plants genetically sourced from the Tamaki Ecological District or where this is not possible, then preferably from within the Auckland Ecological Region.</p>
V.11	<p>Prior to commencement of works adjacent to Traherne Island, the NZTA shall employ a suitably qualified and experienced plant translocation expert to uplift and protect all areas of <i>Mimulus repens</i> on Traherne Island that will be affected by the work. The <i>Mimulus repens</i> shall be relocated to suitable and safe habitat away from the works area, or otherwise held and protected for the duration of the works in the vicinity of their original location and be replanted back at that location (or in close proximity to it) upon completion of the works. The location of the recipient sites will be determined in consultation with the Department of Conservation and in general accordance with the Traherne Island Natural Heritage Restoration Plan (2009 – 2014).</p>
V.12	<p>Should the taxonomic and rarity status of the Geranium species growing alongside Oakley Creek in Hendon Park and Alan Wood Reserve not be confirmed before the commencement of works in this area, then this species shall be treated as Potentially Significant Vegetation and shall either be :</p> <ul style="list-style-type: none"> (a) Protected in full, if practicable; or (b) If protection in full is not practicable, relocated to a suitable and safe habitat elsewhere; or (c) If protection in full or translocation are not practicable, this population shall be cleared in locations where required to allow works to proceed, but replaced with an equal extent of replacement plantings of the same species (from propagated material sourced from the existing population) planted at a safe and suitable habitat nearby in Hendon Park/Alan Wood Reserve.
V.13	<p>Any clearance of the Geranium in accordance with Condition V.12 shall be restricted to the minimum necessary to facilitate the works.</p>