

Waitītiko - Meola Creek Enhancement Plan

Watercare Central Interceptor Project



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1.0 Introduction

Watercare Services Limited (Watercare) has been granted designation and resource consent to make improvements to key wastewater infrastructure in the Auckland isthmus area. Referred to as the Central Interceptor (CI), the CI project aims to allow for growth in the area, increase wastewater network resilience and reduce wet weather wastewater overflows.

The CI project will include construction of a 13km tunnel (4.5m in diameter) which will run below central Auckland. Extending from Western Springs to a new pump station at the Mangere Wastewater Treatment Plant, the project will also include subterranean passage under the Manukau Harbour.

The CI project will provide a number of environmental and social benefits to the wider community, including:

- Improving water quality – the current wastewater network is an ageing system and overflows into local waterways during rainfall event. The project will effectively reduce overflow volumes by 80%, reducing contaminant levels within impacted waterways, including Meola Creek.
- Supporting future growth – the project will help support Auckland's growing population by providing increased wastewater capacity and enabling future upgrades to the network.
- Reducing environmental risks – the existing pipeline under the Manukau Harbour is over 50 years old and poses a significant risk to the harbour's marine ecology. The project will greatly reduce this risk and includes additional measures for risk prevention.

It is expected that construction will begin in 2019 and continue until 2025.

This Waititiko – Meola Creek Enhancement Plan has been prepared to describe various enhancement activities that Watercare proposes to undertake in local green areas adjacent to Meola Creek to mitigate the effects of vegetation removal at the Lyon Avenue construction site (refer to Section 2.2).

2.0 Context

2.1 Waititiko – Meola Creek Enhancement Plan

The CI project alignment passes underneath urban areas in Auckland's western suburbs and requires surface works at a number of public parks/reserves (open spaces). In order to mitigate the impacts of the project, Watercare must prepare and implement a number of management plans under the Project's designation conditions. This includes the preparation of a 'Roy Clements Treeway Enhancement Plan' under designation condition 12.0 (refer below):

12.0 *Roy Clements Treeway Vegetation Enhancement Plan*

12.1 *A Roy Clements Treeway ("RCT") Enhancement Plan shall be prepared that sets out proposed works that the Requiring Authority will undertake within the RCT, or in another local area in the vicinity of Meola Stream [Creek], to mitigate effects of vegetation removal at the Lyon Avenue construction site. The Plan shall be prepared by a suitably qualified person.*

12.2 *The RCT Enhancement Plan shall be prepared in consultation with the owners of land on which the mitigation works are to be carried out, the Council, the Albert–Eden Local Board, mana whenua, and established community groups or environmental organisations having an interest in restoration and enhancement works on the land. The objectives of the Plan shall be to enhance amenity and ecological values of either the Meola Stream [Creek] riparian habitats and vegetation between Fergusson Reserve and Alberton Avenue, or other local areas in the vicinity of Meola Stream [Creek] which would provide a similar area and level of vegetation enhancement to that which would be achieved between Fergusson Reserve and Alberton Avenue. The mitigation works to be set out in the Plan may include planting and weed control, and shall be integrated with any other works planned in this*

area by the Council. New planting shall use eco-sourced native plants,

- 12.3 *The RCT Enhancement Plan shall be submitted to the Council for approval (such approval not to be unreasonably withheld) within two years of the date on which this designation is included in the district plan.*
- 12.4 *The Requiring Authority shall use its best endeavours to obtain agreement for the proposed works from the owners of the land on which the work is to be undertaken.*
- 12.5 *The works described in the RCT Enhancement Plan (excluding those within the designated area at the Lyon Avenue construction site) shall be implemented within two years of the Plan being approved, subject to the agreement of the owners of land on which the work is to be undertaken and subject to the Requiring Authority obtaining all necessary approvals or consents required to undertake the works described.*
-

The purpose of the Roy Clements Treeway Enhancement Plan is to outline the actions Watercare will undertake to mitigate the loss of ecological values within the Roy Clements Treeway as a result of surface works at the CI Lyon Avenue construction site (Refer to Section 2.2).

Condition 12.1 states that proposed works should occur within Roy Clements Treeway or elsewhere within the vicinity of Meola Creek. Over the past 30 years, community groups have undertaken extensive enhancement work within the Roy Clements Treeway (refer to Section 3.3). It was considered further works in the treeway would have provided few benefits to the ecology of Meola Creek. As such, alternative sites along Meola Stream had to be sought.

Through consultation (refer to Section 2.3), Watercare has identified three alternative areas directly associated with Meola Creek where ecological gains could be achieved: Norwood Reserve (refer to Section 3.4), Mt Albert Grammar School (MAGS) farm (refer to Section 3.5) and Te Kura Kaupapa Maori O Nga Maungarongo (refer to Section 3.6). As such, the Roy Clements Treeway Enhancement Plan has been renamed the Waititiko – Meola Creek Enhancement Plan.

Reinstatement of open space areas and associated infrastructure directly impacted by project works within the construction sites will be addressed in site-specific Open Space Restoration Plans as required under condition 13.0 of the designation.

2.2 Lyon Avenue construction site

The Lyon Avenue construction site is located in an eastern corner of the treeway (owned by the Ministry of Education) and the southwest corner of Morning Star Place (refer to Appendix A). The construction site covers an area of approximately 0.35ha and will require works within the Roy Clements Treeway and a private lot containing residential apartments (refer to Figure 1).

2.2.1 Proposed works

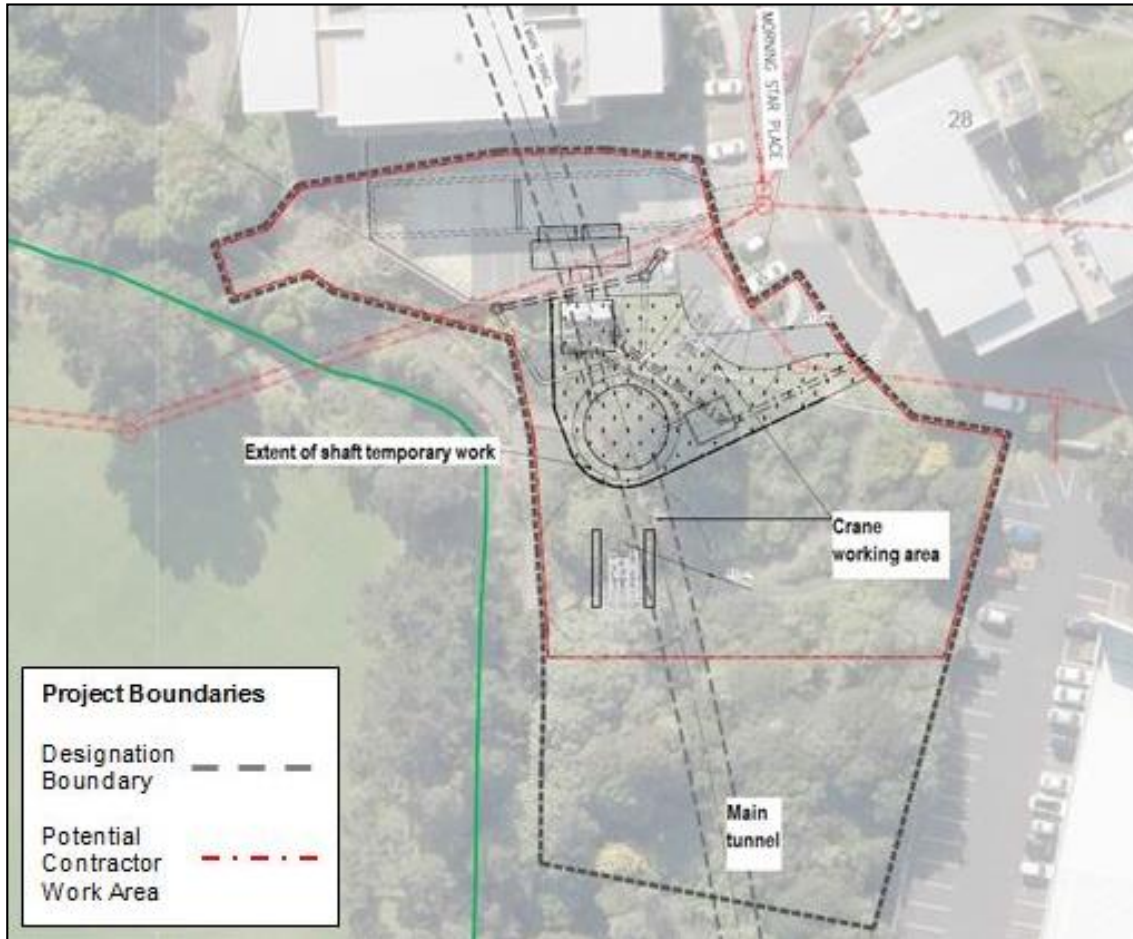
Proposed permanent works at the Lyon Avenue construction site include:

- Interception of an existing overflow on the Edendale Relief Branch Sewer;
- Installation of a control chamber with a flow control device and an above ground plant room to house the device's power supply and control equipment;
- Construction of an emergency overflow weir within the existing spillway;
- A maintenance shaft to the main tunnel;
- Replacement of a section of the existing Edendale Relief Branch to facilitate construction;
- Construction of associated underground chambers, sewers and service ducts; and
- Raising of ground levels and construction of a retaining wall (approximately 3m high) around the new wastewater infrastructure.

Temporary works will also include temporary diversion of the existing boardwalk within the treeway. This will be reinstated following construction.

The duration for works at the Lyon Avenue construction site is anticipated to take approximately three years; however, this is subject to contractor's sequence of work upon award of the contract.

Figure 1 Overview of the Lyon Avenue construction site



2.3 Consultation

This Waititiko – Meola Creek Enhancement Plan has been prepared in consultation with local community stakeholders. Watercare initiated a series of workshops, site visits, meetings and online discussions with the following stakeholders between June 2016 and November 2018:

- Auckland Council: Healthy Waters and Parks, Sports and Recreation;
- Albert – Eden Local Board;
- Mana whenua;
- St Lukes Environmental Protection Society (STEPS);
- MAGS; and
- Others members of Meola Stream Community Liaison Group (MS-CLG).

The feedback received during discussions was considered during preparation of the Waititiko – Meola Creek Enhancement Plan. A final draft of the plan was presented to stakeholders for feedback at a CI community liaison meeting on the 28 November 2018 and meetings with the local board on 3 and 5 December 2018. The feedback received was considered during preparation of this plan.

3.0 Background

3.1 Mt Albert

Mt Albert is located in the western suburbs of central Auckland and has been highly modified by urban development. As such, original vegetation in the area has been largely lost, with remaining habitat highly fragmented.

Mt Albert is located in the Tamaki Ecological District. The wider district was historically covered by lowland type habitat with abundant taraire (*Beilschmiedia tarairi*) and puriri (*Vitex lucens*) (McEwen 1987); however, forest cover in the Mt Albert area was dominated by puriri forest. Classified as forest ecosystem WF7 by Auckland Council (Singers et al. 2017), the puriri forest consisted of broadleaved species with abundant puriri and occasional podocarps, and was dominant in the lava rock forests. Historically, the area would have supported a diverse range of invertebrates, amphibians, reptiles, birds and bats (Singers et al. 2017).

Remaining examples of this forest type are small and highly fragmented and suffer from edge effects and weed invasion; however, plant species which are considered typical of this ecosystem can be seen in Withiel Thomas Reserve, Mt Eden.

3.2 Meola Creek

Meola Creek flows for approximately 5.2km from Mt Albert to Point Chevalier in the northwest (refer to Appendix A). The creek's catchment encompasses approximately 20km² and is the largest single catchment in the Auckland isthmus (Sinclair Knight Merz 2002). Referred to as Waititiko by local Maori, the creek is of cultural significance to iwi and once provided a variety of life-supporting resources for resident Maori.

Meola Creek was once fed by a large wetland spring in its headwaters; however, since European settlement in the mid-1800s, the catchment has undergone dramatic change. Wetlands have been drained, original vegetation cover and habitat has been lost and Meola Creek has been heavily modified. Approximately 60% of the creek is now lined with concrete or basalt blocks and almost 20% of the reach has been culverted to improve stormwater conveyance and minimise erosion (Clarke & Sharman 2012; Coup et al. 2012). A large proportion of the catchment is now impervious. Although the creek is still fed by a number of springs, it receives significant inputs from overland surface flows and the stormwater network (Clark & Sharman 2012), and periodically receives wastewater overflow from the combined sewer system which the CI project is looking to improve.

Meola Creek is typical of most urban streams and is in poor ecological condition. This is due to changes in the surrounding catchment and flow regimes, as well as contaminant inputs, such as heavy metals (i.e. zinc and lead) and microbiological indicators (i.e. *E. coli*), from the urban catchment (Coup et al. 2012). The lower reaches (downstream of the Roy Clements Treeway) are considered to be of higher value than the upper reach (Coup et al. 2012; Coup & Pearce 2012). Overall, biodiversity function is low across the reach and is likely a result of poor water quality (Coup & Pearce 2012).

3.3 Roy Clements Treeway

The Roy Clements Treeway is located between Kerr-Taylor Park, off Fergusson Avenue, and Alberton Avenue in the suburb of Mount Albert (refer to Appendix A) and has been the focus of community-based initiatives since the 1980s. The treeway is owned by the Ministry of Education and managed by Auckland Council.

The treeway covers an area of approximately 2.4ha on the northwestern boundary of MAGS and was nothing more than an abandoned lot comprised of weeds in the 1940s. Restoration activities were first initiated by Roy Clements (then a teacher at MAGS) in the 1980s and began with clearing of weeds, followed by planting and construction of a concrete path (Morris 2018). Collaboration between local businesses and community volunteers over the past 30 years has restored the lava rock forest habitat within Roy Clements Treeway (Morris 2018). The area now consists of a mixture of mature native plant species; including species such as manuka (*Leptospermum scoparium*), totara (*Podocarpus*

totara), nikau (*Rhopalostylis sapida*), karaka (*Corynocarpus laevigatus*) and kahikatea (*Dacrycarpus dacrydioides*).

STEPS have played a large role in ensuring the treeway remains well cared for and largely free of weeds, and with the help of Auckland Council have become guardians of the treeway. STEPS have continually campaigned for improvements within the treeway and the wider Meola Creek and in 2008 a 550m boardwalk was built along the treeway in collaboration with Watercare, Auckland Council and Metrowater, to address public health risks associated with regular flooding of the treeway (Campbell et al. 2010).

Proactive community planting and weeding days organised by STEPS and Waicare continue to improve ecological values within the treeway and educational signage was recently updated to provide further public awareness of the area.

Approximately 0.2ha of the Roy Clements Treeway will be impacted by the CI Lyon Avenue construction site.

3.4 Norwood Reserve lava rock forest

The lava rock forest is located approximately 1.4km northwest of the Roy Clements Treeway, adjacent to Norwood Reserve in Mt Albert and is a remnant of the Auckland Volcanic Field's largest basalt lava flow which runs from Titiko - Mt St John to the Waitemata Harbour between Pt Chevalier and Westmere in the northwest (Gardner 2007). The forest is situated on the true right bank of Meola Creek and extends over approximately 1.7ha along the southern boundary of Chamberlain Park Golf Course, between Norwood and Rawalpindi reserves (refer to Appendix A).

The lava rock forest has been heavily degraded by modifications to Meola Creek, weed invasion and human neglect. Beyond the narrow flood terrace of Meola Creek is a slope of angular basalt boulders which forms the forest substrate. The forest canopy mainly consists of large tree privet (*Ligustrum lucidum*) and crack willow (*Salix fragilis*), with native canopy species infrequent. The understorey is largely comprised of weed species, with a small number of native shrubs and smaller trees, such as hangehange (*Geniostoma ligustrifolium*), kawakawa (*Piper excelsum*) and mahoe (*Melicytus ramiflorus*), present.

In addition to tree privet and crack willow, other weed species common within the lava rock forest include:

- Chinese privet (*Ligustrum sinense*);
- Ivy (*Hedera helix*);
- Climbing asparagus (*Asparagus scandens*);
- Wandering Jew (*Tradescantia fluminensis*);
- Woolly nightshade (*Solanum mauritianum*);
- Phoenix palm (*Phoenix canariensis*);
- Montbretia (*Crocasmia x crocosmiiflora*);
- Arum lily (*Zantedeschia aethiopica*);
- Ginger (*Hedychium spp.*); and
- Nasturtium (*Tropaeolum majus*).

The forest has also become a dumping ground for organic waste from the adjacent golf course and inorganic waste from unknown sources.

Lava rock forests have been reduced to less than 0.5% of their pre-European extent. Although this section of forest has been heavily degraded, it presents a good opportunity to enhance and preserve one of the rarest ecosystems in Auckland. Enhancement work in this area would also complement works proposed in the Chamberlain Park Master Plan (Jasmax 2015) to naturalise and restore areas of Meola Creek adjacent to Chamberlain Park.

3.5 Mt Albert Grammar School (MAGS) farm

The MAGS farm is an 8.1ha working farm located off Alberton Avenue, approximately 455m southwest of the Roy Clements Treeway (refer to Appendix A). The farm was established in 1932 and currently

educates 160 students (Years 10-13) annually in agricultural and horticultural sciences. It also provides short guided tours for other community groups.

MAGS recently signed a new lease agreement with the owners of the land, Auckland Savings Bank (ASB), for a term of 99 years and in 2017, MAGS was given permission to further develop farm facilities. This includes creating world class teaching facilities, as well as developing the land to improve environmental performance.

The farm includes a spring-fed tributary headwaters and approximately 280m of an unnamed tributary stream which feeds into Meola Creek via a culvert under MAGS school. The spring and approximately 150m of this stream are currently unfenced; as such, the margins are heavily impacted by stock access. The lower reach of the tributary is currently fenced, with some stock access and attempts to undertake restoration planting in this area have been largely unsuccessful.

Restoration of instream habitat quality and riparian margins, and exclusion of stock from the riparian margins are included in the ASB MAGS Development Plan (unpublished); however, funding for this work has yet to be realised. Fencing and planting of the upper portions of the tributary stream would improve instream habitat quality, as well as result in positive outcomes for Meola Creek by reducing the amount of point source contaminants (i.e. sedimentation, increased nutrients) from entering the stream at this location. Excluding stock and planting of the lower reaches is also proposed under the Development Plan.

3.6 Te Kura Kaupapa Maori O Nga Maungarongo

Te Kura Kaupapa Maori O Nga Maungarongo (Te Kura Kaupapa) is located at 140 Haverstock Road; approximately 350m southwest of the Roy Clements Treeway (refer to Appendix A). The school was established in 1987 and provides its students with total immersion of Te Reo Māori and teaches Māori values, philosophies, principles and practices. The school was originally located at Auckland College of Education and moved to its current location in 1998.

A small tributary stream is located approximately 30m north of the main buildings in mown grass area which is not used for grazing. The stream is approximately 60m long and discharges to the Meola Creek. The margins of the stream are currently unplanted and consist mainly of pasture. Planting of the margins of the tributary stream would improve instream habitat quality, as well as result in positive outcomes for Meola Creek by filtering overland runoff into the stream.

4.0 Waititiko – Meola Creek Enhancement Plan

4.1 Overview

This Waititiko – Meola Creek Enhancement Plan describes the enhancement activities which have been proposed within Roy Clements Treeway, the Norwood Reserve lava forest, the MAGS farm and Te Kura Kaupapa (refer Section 3.0) to mitigate the loss of vegetation and ecological values within the Roy Clements Treeway as a result of CI project works at the Lyon Avenue construction site. This plan has been developed in consultation with local community stakeholders (refer Section 2.3) to incorporate shared objectives concerning enhancement of Meola Creek.

The enhancement activities put forward in this plan are designed to be implemented by a qualified contractor, with support from community-based groups and initiatives, and are subject to approval of the owners of each site. The activities proposed in this plan aim to integrate Auckland Council and local board policies and with other planned works in the area.

These works include those described in:

- The Chamberlain Park Master Plan (Jasmax 2015);
- The ASB MAGS Development Plan;
- Auckland Council management strategies for the Roy Clements Treeway; and
- Relevant CI Open Space Restoration Plans.

Due to the unique challenges involved in enhancing lava rock forests, site-specific landscape plans will be required to further describe the arrangement of enhancement activities in the Norwood Reserve lava rock forest. Landscape plans may also be required for the MAGS farm and Te Kura Kaupapa sites; these are to be prepared by the appointed contractor.

4.2 Purpose

The purpose of this Waititiko – Meola Creek Enhancement Plan is to enhance the ecological values of the Meola Creek and adjoining riparian habitat. This will be achieved through:

- The removal of five large tree privets in the Roy Clements Treeway (as per Te Ngahere quote number QU-0187; refer to Appendix B);
- Enhancement planting within an area of lava rock forest adjacent to Norwood Reserve. This includes initial weed management, site preparation, planting and four years of maintenance;
- Removal of inorganic waste dumped within the Norwood lava rock forest;
- Animal pest control in the area of Norwood lava rock forest as required over a period of four years;
- Fencing of the spring and upper reach of the Meola Creek tributary located on the MAGS farm property;
- Restoration planting of the riparian margins surrounding the spring and upper reach the MAGS farm tributary. This includes initial weed management, site preparation, planting and four years of maintenance; and
- Restoration planting of the riparian margins surrounding the Te Kura Kaupapa tributary stream. This includes initial weed management, site preparation, planting and four years of maintenance.

4.3 Community engagement

It is intended that the objectives proposed in this plan are implemented by suitably qualified and experienced contractors in order to avoid reliance on the community volunteers. However, Watercare acknowledges the contribution the community has made to the well-being of Meola Creek thus far and recognises the opportunity this plan presents to improve community ownership and spirit.

Although the activities included in the enhancement schedules for each site (refer to Sections 6.6, 7.4 and 8.3) are to be implemented by a contractor, the involvement of community groups, such as STEPS, is crucial to the success of enhancement activities. It is intended that community members will be involved as much as possible and will include a number of community working days (i.e. planting days, weeding) where practicable. This will enable community members to feel a sense of ownership regarding the enhancement of Meola Creek and allow for a smooth transition into community-led initiatives once the steps in this plan have been implemented.

Community groups and other stakeholders will remain informed throughout the process, either by means of direct communication with key representatives, pre-start or progress meetings and handover meetings once the plan has been implemented. Input from community members will also be considered during preparation of more detailed implementation plans once contractors are engaged.

5.0 Roy Clements Treeway Tree Privet Control

Five large tree privets were identified in the northwestern portion of the Roy Clements Treeway by a representative of Auckland Council's Parks, Sports and Recreation department (refer to Appendix B). Due to the size of the trees and regular use of the treeway by members of the public, the trees cannot be controlled by means of drill and fill methodology. As such, they will be controlled by a qualified arborist as described in quote QU-0187 in Appendix B.

Due to the large size of the trees and overall value of lava rock habitat in the treeway, control measures should consider the following guidelines where practicable:

- All tree removal works are to be undertaken outside the bird breeding season (September to February) to avoid disruption to nesting birds;
- Outer limbs shall be removed first, followed by inner limbs and the main trunk;
- Removal of tree limbs and stumps should be done in such a manner that reduces damage to the surrounding foliage;
- The base of the trunk should be cut as close to the ground as possible and painted with an herbicide paste to prevent the plant from resprouting. Due the characteristics of the treeway and lava rock groundcover, the stumps should remain in place to avoid disruption to the groundcover;
- Where practicable, some debris may stay on site to decompose and contribute nutrients and habitat within the treeway. Excess debris will need to be removed and disposed of off-site at a waste transfer station; and
- The remaining stumps should be periodically inspected for resprouting and treated accordingly.

Further control of the additional privet infestation identified in the quote QU-0187 (refer to Appendix B), the large crack willows located on the western boundary and Phoenix palm (*Phoenix canariensis*) located in the north of the treeway will be considered pending further discussions between Watercare and community stakeholders.

6.0 Norwood Reserve Lava Rock Forest Restoration

The following section describes the enhancement activities proposed for a section of lava rock forest located adjacent to Norwood Reserve in Mt Albert. The activities described will largely be undertaken by a qualified contractor; however, some activities may be implemented by Watercare in collaboration with STEPS and other members of the community as part of CI team building exercises and other community initiatives.

The enhancement activities have been proposed to kick-start restoration efforts in the lava rock forest between Norwood and Rawalpindi reserves and will focus on lower slopes of the forest habitat (avoiding level areas under the pine trees (*Radiata spp.*)). It is intended that restoration of the remaining area (approximately 0.7ha) will be initiated through council or community-based projects. As such, it is proposed the enhancement activities will be implemented over an area of approximately 1ha of the rock forest (refer to example in Figure 2).

Signage will be put in place to educate local community members about the enhancement initiatives taking place. Once the activities proposed under this plan have been implemented, it is anticipated that community groups, such as STEPS, will take ownership of the project and continue after care management.

Figure 2 Indicative area (1ha) proposed for implementation of enhancement activities in the Norwood Reserve lava rock forest under the Waititiko – Meola Creek Enhancement Plan



(Source: Auckland Council GeoMaps)

6.1 Waste removal

There are a number of organic and inorganic waste piles located along the northern edge of the lava rock forest. These should be identified and removed prior to the commencement of weed controls and planting.

If prior approval is obtained from golf course management and application is practical, some organic debris may be mulched on site and used to maintain out of play areas on Chamberlain Park Golf Course; or used during planting (refer to Section 9.4). Otherwise all debris removed should be appropriately disposed of at an off-site waste transfer station. Inorganic waste should be disposed of offsite at offsite recycling or waste transfer stations as appropriate.

Removal of organic and inorganic debris should be done in such a manner that reduces damage to the arrangement of basalt rock and surrounding native foliage. Although the dumping of inorganic waste is historic and sources are unknown, discussions should be held with golf course management to prevent the continued dumping of organic waste into the lava rock forest and find agreeable management solutions.

6.2 Weed management

Native regeneration within the lava rock forest is currently inhibited by dense weed growth in the understorey and canopy. The first stage of enhancement activities will include initial controls of existing weed infestations. These will be completed over a first round and follow-up applications in the initial planting phase (refer to Table 1 in Section 6.6).

Controls will include:

- Manual and/or chemical control of ground cover weeds and small shrubs; and
- Chemical control of large canopy weeds.

Refer to Section 9.1 and Appendix C for more detail general and weed specific controls.

Much of the canopy in the lava rock forest is currently comprised of invasive weed species (i.e. privet and willow); complete removal of these plants would create a hostile environment for existing native understorey plants and expose the forest floor to erosion. As such, it is proposed that control of canopy tree privet and crack willow will occur gradually over a three year period. Either by means of drill and fill or cut and paste chemical application; refer to Section 9.1.2.

Because there are no paths through the lava rock forest and it is generally not frequented by the public, drill and fill application is considered the best option for control of canopy weeds in this area. This method will cause the least damage to surrounding native vegetation and lava rock habitat, and will reduce the potential for Meola Creek to be exposed to herbicide runoff. Retention of standing trees will retain habitat and shade elements while planted trees are establishing and provide bird perches to encourage natural regeneration. As the trees decompose naturally they will contribute coarse woody debris and nutrient inputs into the forest system.

Larger trees which are considered to pose a risk to neighbouring properties or human safety will need to be removed by a qualified arborist.

Due to the expanse of weedy canopy cover, drill and fill application will be undertaken gradually over a three year period. Commencing in year one of the enhancement schedule (the initial planting phase) and continue through years two and three (in the maintenance period); refer to Table 1 in Section 6.6.

6.3 Enhancement planting

The species selected for the enhancement of lava rock forest should complement historical and existing plant communities within the forest. As such a number of plant species have been recommended based on the site's existing native species composition and recommendations made by GreensceneNZ Limited (Reynolds 2018). The species selected should include a mixture of native shrub and tree species which were once common in lava rock forests and can prosper under sheltered conditions

These may include, but are not limited to:

- Titoki (*Alectryon excelsus*).
- Kōwharawhara (*Astelia solandri*).
- Karaka (*Corynocarpus laevigatus*).
- Kohekohe (*Dysoxylum spectabile*).
- Hangehange (*Geniostoma ligustrifolium*).
- Puka (*Griselinia lucida*).
- Coastal karamu (*Coprosma macrocarpa subsp. minor*).
- Mangeao (*Litsea calicaris*).
- Mahoe (*Melicytus ramiflorus*).
- Mapou (*Myrsine australis*).
- Kawakawa (*Piper excelsum*).
- Horoeka (*Pseudopanax crassifolia*).
- Houpara (*Pseudopanax lessonii*).
- Puriri (*Vitex lucens*).

Planting within the lava rock forest will consist of infilling planting underneath canopy gaps created by onsite weed controls executed under this plan (refer to Sections 6.2 and 9.1). This will increase diversity in the lava rock forest and provide foraging resources for native fauna. To increase the survivability of the plants, planting will occur at 2.5m spacings (1600 plants/ha) and implemented over two planting seasons in years one and three (refer to Section 6.6), whereby half the allocated plants (800) will be planted in each round. This will complement the gradual control of canopy weed species (refer to Section 6.2) and increase structural diversity in the stand over time.

A 5m planting exclusion zone should be maintained around Meola Creek to allow future stream naturalisation works to occur under the Chamberlain Park Master Plan (Jasmax 2015) without impacting planted vegetation. Actions to ensure stream shading is maintained should be considered in detailed plans prepared by the contractor.

In the interest of public safety, construction of a walkway or public walkway is not included in this plan; however, planting should occur in such a manner that will allow the development of pathways in the future without causing damage to planted specimens. This may include avoiding areas where natural pathways already exist.

Refer to Sections 9.2 – 9.4 for more details regarding site preparation and planting methodologies.

6.4 Post-planting maintenance

Following initial planting, the plants should be inspected monthly during the first 12 months to enable any maintenance requirements to be identified and acted upon accordingly (refer to Section 9.5). This will be followed by a four year maintenance period in which blanking (refer to Section 9.5), replacement planting, general control of understorey weeds and gradual control of canopy weeds will occur.

Refer to Table 1 in Section 6.6 and Sections 9.5 and 10.0 for more detail.

6.5 Animal pest control

A four year animal pest control programme will be implemented in the Norwood Reserve lava rock forest to complement enhancement plantings and improve the survivability of planted seedlings. Controls will focus on resident rat, mouse and possum populations, and will employ manual trapping control methods (i.e. Timms possum and Snap-E rat traps). The programme will be designed and implemented by a qualified contractor in such a manner that pest numbers will be reduced within the lava rock forest. Presence/absence surveys should be undertaken prior to implementation to identify target pest species and establish a baseline. This could be achieved using tracking cards and/or spotlighting over a single night.

The first year of implementation will commence in year two of the site's enhancement schedule (refer to Table 1 in Section 6.6). Following completion of the first year, the effectiveness of the control will be assessed using the same methodologies used to establish baseline data. If results indicate that full-scale application is no longer warranted, the programme may be scaled back over the following three years of the programme.

Following completion of the four year pest control programme, Watercare will purchase the required equipment with the intention that the programme will be continued by local community groups, such as STEPS.

6.6 Enhancement schedule

Enhancement of the Norwood Reserve lava rock forest will follow a five year enhancement schedule. This will include:

- An initial planting phase in year one in which understorey weeds will be managed and partial control of canopy weed growth will occur. This will be followed by site preparation and the first round of understorey infill enhancement planting; and
- A four year maintenance period in which any lost plants are replaced and the second round of understorey infill enhancement planting will occur. As well as ongoing weed management, including gradual control of canopy weeds.

A summary of the enhancement schedule is provided in Table 1.

Table 1 Indicative four year enhancement schedule outlining key milestones for implementation of the Waititiko – Meola Creek Enhancement Plan in the Norwood Reserve lava rock forest

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	
2020 - 2021	Initial planting			First round of weed control – understory & selective canopy				Follow up weed control – understory & selective canopy						
		Pre-implementation site inspection							Order plants (½)	Site preparation		Understorey infill planting – Round 1 **		
2021 - 2022	Maintenance period (4 years)	General weed control					Selective canopy weed control				General weed control			
		Blanking						Check & order replacement plants (as req.)			Site prep.	Replacement planting (as req.) **		
Application of full-scale animal pest controls														
2022 - 2023	Maintenance period (4 years)	General weed control					Selective canopy weed control				General weed control			
								Order plants (½)	Site preparation		Understorey infill planting – Round 2 **			
Animal pest controls (as required)														
2023 - 2024	Maintenance period (4 years)	Blanking & general weed control						General weed control				General weed control		
		Animal pest controls (as required)												
2024 - 2025	Maintenance period (4 years)	General weed control						General weed control				General weed control		
		Animal pest controls (as required)												

** Due to the harsh nature of lava rockforest habitat, planting efforts should be focused in May to increase the odds of plant survival.

7.0 MAGS Farm Stream Restoration

The following section describes the restoration activities proposed for the tributary stream located on the MAGS farm. These activities will be undertaken as part of the activities proposed under the ASB MAGS Development, but will be funded and coordinated by Watercare.

The activities described will largely be undertaken by a qualified contractor; however, some activities may be implemented by Watercare in collaboration with MAGS and supported by school-based initiatives. Further discussions should be held with MAGS to ensure restoration works align with the objectives of the ASB MAGS Development Plan and timing is coordinated with existing proposed instream habitat restoration.

The restoration activities have been proposed to kick-start stream restoration works which are currently proposed as part of the redevelopment of the MAGS farm (refer to Section (3.5)). The activities proposed in this plan are focused on restoration of the upper reaches of the stream (approximately 150m in length), including the headwater spring (refer Figure 3). It is intended that restoration of the lower reach will be funded and implemented by MAGS and its sponsors.

Once the activities proposed under this plan have been implemented, it is anticipated that MAGS will take ownership of the project and continue after care management.

Figure 3 Indicative MAGS farm restoration area (~1,770m²), as proposed under the Waititiko – Meola Creek Enhancement Plan



(Source: Auckland Council GeoMaps)

7.1 Fencing

The spring and upper reaches of the tributary stream are currently unfenced and subject to stock impacts. In order to exclude stock from the stream channel and restoration plantings, stock proof fencing will be erected around the spring and upper reaches (the lower reach is already fenced, allowing stock exclusion when required).

MAGS has proposed to undertake stream works to reinstate the stream channel and enhance instream habitat as part of the ASB MAGS Development Plan (refer to Section 3.5). Installation of the fence should be undertaken following completion of these works and prior to restoration planting of the riparian margins.

The fence will be in the form of 8-wire and batten or post and rail fencing to permanently exclude both sheep and cattle from the stream margins. The fence will also be set back from the stream edge such that a 5m margin can allow planting on both sides of the stream (an area of approximately 1,770m²).

7.2 Riparian planting

Riparian planting will be undertaken within the fenced area (refer to Section 7.1) to buffer the spring and upstream reaches of the tributary stream. Planning should allow for a 5m margin on both sides of the stream, which equates to an estimated area of 1,770m².

The following plant species list has been compiled based on site conditions and recommendations made by GreensceneNZ Limited (Reynolds 2018) and Auckland Council's streamside planting guide (Auckland Council 2001). The species selected include a mixture of native sedges, shrubs and small tree pioneer species which are well-suited to riparian zone conditions. These plants will be planted at spacings that will stabilise soils and encourage canopy closure. The spacings will vary depending on plant type and location on the riparian margin:

Sedge and flax species will be planted at 0.5m to 1m spacings and may include:

- Ruatahi (*Carex lessoniana*).
- Pukio (*Carex virgata*).
- Purei (*Carex secta*).
- Harakeke (*Phormium tenax*).
- Giant umbrella sedge (*Cyperus ustulatus*).

Shrubs and small tree species will be planted at 1.5m spacings and may include:

- Ti kouka (*Cordyline australis*).
- Manuka (*Leptospermum scoparium*).
- Mahoe (*Melicytus ramiflorus*).
- Mingimingi (*Coprosma propinqua*).
- Karamu (*Coprosma robusta*).
- Coastal kowhai (*Sophora chathamica*).

Refer to Sections 9.2 – 9.4 for more details regarding site preparation and planting methodologies. Landscape design plans would help visualise the restoration planting around the tributary stream and would provide more detail regarding accurate plant spacing and sizing. MAGS have produced a concept design in the development plan; however, detailed landscape drawings may be required prior to tendering process.

7.3 Post-planting maintenance

Following initial planting, the plants should be inspected monthly during the first 12 months to enable any maintenance requirements to be identified and acted upon accordingly (refer to Section 9.5). This will be followed by a four year maintenance period in which blanking (refer to Section 9.5), replacement planting, general control of weeds will occur.

Refer to Table 2 in Section 7.4 and Sections 9.5 and 10.0 for more detail.

7.4 Enhancement schedule

Restoration of the upper reaches of the tributary stream in the MAGS farm will follow a five year enhancement schedule. This will include:

- An initial planting phase in year one in which weed incursions are managed, followed by site prep and planting of pioneer species; and
- A four year maintenance period in which any lost plants are replaced and weeds are managed through ongoing controls.

A summary of the enhancement schedule is provided in Table 2.

Table 2 Indicative five year enhancement schedule outlining key milestones for implementation of the Waititiko – Meola Creek Enhancement Plan at MAGS farm

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
2020 - 2021	Initial planting			First round of weed control				Follow up weed control					
		Pre-implementation site inspection							Order plants	Site preparation		Riparian planting – Pioneer species	
2021- 2022	Maintenance period (4 years)		General weed control				General weed control				General weed control		
		Blanking						Check & order replacement plants (as req.)			Site prep.	Replacement planting (as req.)	
		General weed control					General weed control				General weed control		
		General weed control					General weed control				General weed control		
2022 - 2023		General weed control					General weed control				General weed control		
2023 - 2024		General weed control					General weed control				General weed control		
2024 - 2025		General weed control					General weed control				General weed control		

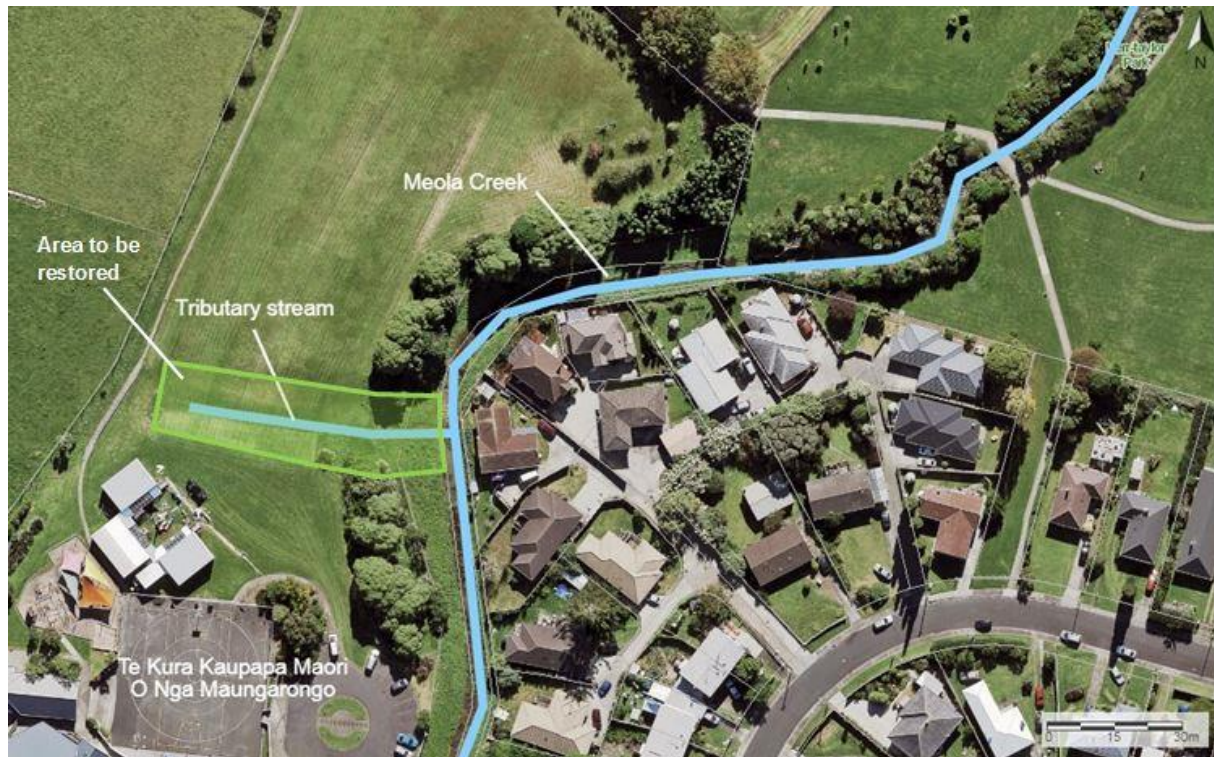
8.0 Te Kura Kaupapa stream restoration

The following section describes the restoration activities proposed for the tributary stream located on the Te Kura Kaupapa Maori O Nga Maungarongo property (refer to Figure 4).

The activities described will be funded by Watercare and implemented by Watercare in collaboration with Te Kura Kaupapa and STEPS, supported by qualified contractor. Further discussions should be held with Te Kura Kaupapa representatives prior to implementation.

Once the activities proposed under this plan have been implemented, it is anticipated that Te Kura Kaupapa will take ownership of the project and continue after care management.

Figure 4 Indicative Te Kura Kaupapa restoration area (~800m²), as proposed under the Waititiko – Meola Creek Enhancement Plan



(Source: Auckland Council GeoMaps)

8.1 Riparian planting

Riparian planting will be undertaken around the tributary stream (refer to Figure 4). Planning should allow for a 5-10m margin on both sides of the stream, which equates to an estimated area of up to 800m². Fencing will not be required as the surrounding grass area is not used for grazing.

The following plant species list has been compiled based on site conditions and Auckland Council's streamside planting guide (Auckland Council 2001). The species selected include a mixture of native sedges, shrubs and small tree pioneer species which are well-suited to riparian zone conditions. These plants will be planted at spacings that will stabilise soils and encourage canopy closure. The spacings will vary depending on plant type and location on the riparian margin:

Sedge and flax species will be planted at 0.5m to 1m spacings and may include:

- Ruatahi (*Carex lessoniana*).
- Pukio (*Carex virgata*).
- Purei (*Carex secta*).
- Harakeke (*Phormium tenax*).
- Giant umbrella sedge (*Cyperus ustulatus*).

Shrubs and small tree species will be planted at 1.5m spacings and may include:

- Ti kouka (*Cordyline australis*).
- Manuka (*Leptospermum scoparium*).
- Mahoe (*Meliclytus ramiflorus*).
- Mingimingi (*Coprosma propinqua*).
- Karamu (*Coprosma robusta*).
- Coastal kowhai (*Sophora chathamica*).

Refer to Sections 9.2 – 9.4 for more details regarding site preparation and planting methodologies. Landscape design plans would help visualise the restoration planting around the tributary stream and would provide more detail regarding accurate plant spacing and sizing. Detailed landscape drawings may be required prior to tendering process.

8.2 Post-planting maintenance

Following initial planting, the plants should be inspected monthly during the first 12 months to enable any maintenance requirements to be identified and acted upon accordingly (refer to Section 9.5). This will be followed by a four year maintenance period in which blanking (refer to Section 9.5), replacement planting, general control of weeds will occur.

Refer to Table 3 in Section 8.3 and Sections 9.5 and 10.0 for more detail.

8.3 Enhancement schedule

Restoration of the tributary stream on the Te Kura Kaupapa Maori O Nga Maungarongo property will follow a five year enhancement schedule. This will include:

- An initial planting phase in year one in which any weed incursions are managed, followed by site prep and planting of pioneer species; and
- A four year maintenance period in which any lost plants are replaced and weeds are managed through ongoing controls.

A summary of the enhancement schedule is provided in Table 3.

Table 3 Indicative five year enhancement schedule outlining key milestones for implementation of the Waititiko – Meola Creek Enhancement Plan on the Te Kura Kaupapa Maori O Nga Maungarongo property

		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
2020 - 2021	Initial planting			Weed control (as req.)				Follow up weed control					
		Pre-implementation site inspection							Order plants	Site preparation		Riparian planting – Pioneer species	
2021- 2022	Maintenance period (4 years)		General weed control				General weed control				General weed control		
		Blanking						Check & order replacement plants (as req.)			Site prep.	Replacement planting (as req.)	
2022 - 2023	Maintenance period (4 years)		General weed control				General weed control				General weed control		
2023 - 2024			General weed control				General weed control				General weed control		
2024 - 2025			General weed control				General weed control				General weed control		
			General weed control				General weed control				General weed control		

9.0 General Methodology

9.1 Weed control

The following provides a general description of proposed weed control to be used in this plan. Appendix C provides a summary of recommended weed controls for species which are considered likely to be present in the Norwood Reserve lava rock forest and MAGS farm sites.

Appropriate site-specific approaches will be determined by a suitably qualified contractor in consultation with community stakeholders.

9.1.1 Manual control

Where practicable, it is recommended that manual control is the first method considered for the removal of smaller weed infestations within the lava rock forest and MAGS farm sites. Though labour intensive, this approach will reduce damage to non-target plant species and protect Meola Creek from potential herbicide inputs.

Manual controls will largely consist of hand pulling and removal of the entire weed and root systems for small-scale infestations and may require digging out larger growths with a grub or spade (if possible). The following methods have been recommended based on the general characteristics of the weed species present in both areas:

- **Weeds with bulbs or rhizomes** (i.e. agapanthus, arum lily) – These should be dug out using a large spade or grubber, digging down beside the roots and leveraging the root system up; ensuring all rhizomes or bulbs have been removed. Cut off any flower or seed heads first to prevent the spreading of seeds and disposed of appropriately off site (refer to Section 9.1.3).
- **Vines and creepers** (i.e. wandering Jew, jasmine) – Dense growth can be rolled up like a rug or raked into piles for removal. Hand-pull from around native trees and saplings. These species are generally prone to resprouting or may clone from fragments of plant matter, so should be disposed of appropriately off site (refer to Section 9.1.3).
- **Small shrubs** (i.e. Chinese privet, woolly nightshade) – where the growth is less dense, or plants are in their juvenile stages, they may be dug or pulled out individually. Trees too large to remove in this manner may be felled; however, resprouting is likely to occur; requiring regular follow up controls. Depending on the characteristics of the species under control, waste material may be managed onsite; however, species that can clone from plant fragments should be disposed of appropriately off site (refer to Section 9.1.3).

9.1.2 Chemical control

For larger infestations, such as the large privet and willow trees, and dense climbing asparagus mats in the lava rock forest, herbicide application will be required to ensure adequate control is achieved. Application of chemical controls should be undertaken in accordance with the manufacturer's instructions, as well as the conditions set out in Auckland Council's Auckland Regional Pest Management Strategy (Auckland Council 2007) and Weed Management Policy (Auckland Council 2013). This will reduce the risk of personal harm, accidental loss of native species, and contamination of the soil and Meola Creek.

Glyphosate is a broad spectrum herbicide that works by inhibiting a target plant's enzymes and spreading to the roots to kill the entire plant. Glyphosate binds strongly to soil and is not easily spread to waterways (USEPA 1993); as such, it is currently the preferred control method used by Auckland Council to control weeds, particularly in areas close streams. Other compounds approved for use around water include Triclopyr and metsulfuron-methyl. The appropriate compound for purpose will be determined by the contractor.

A general description of the appropriate chemical control techniques are provided below:

- **Spraying** – Spraying of foliage is commonly used to control weeds on riparian margins and will be best suited to resilient, low growing weeds (i.e. climbing asparagus, pampas). This method is less labour intensive, but can damage neighbouring plants if care is not taken. A shield should be placed around planted and regenerating natives to protect them from spray drift.

- **Cut and paste** – This is suited to variable plant sizes, from shrubs to larger trees, and involves cutting the plant stem or trunk as close as possible to the ground and applying herbicide to the cut surface. Application must be done within five minutes of stem removal to prevent a protective skin from forming on the cut surface, which would deem the control ineffective. This method is advantageous as it can destroy trees and climbing vines without damaging surrounding vegetation and also requires less herbicide than spraying. This method is appropriate for controlling the large tree privet in the Roy Clements Treeway and may also be used in the lava rock forest as it will open up the canopy for creating increased light conditions for planted trees to establish.
- **Drill and fill** – This method is best suited to larger shrubs or trees on the site (i.e. privet, willow) and involves drilling holes into the trunk at regular intervals (approximately 10cm). The holes are then filled with herbicide using a disused drenching pack or plastic squeeze bottle. This method is best suited for the control of larger canopy weeds in the lava rock forest where there is less risk to the public and infestations can be controlled without damaging native vegetation. It also allows standing trees to breakdown naturally, contributing nutrients to the forest and creating gradual light gaps to help planted trees grow. If there is a danger of falling tree limbs, these can be cut down once the tree is dead and added to the leaf litter to provide soil stabilisation and nutrient inputs.

These methods should be applied according to the specific characteristics of the infestations at each site; however, where possible, cut and paste or drill and fill options are considered the most appropriate to prevent the loss of non-target species, damage to surrounding native vegetation and spray drift or runoff into the Meola Creek.

To minimise the risk of re-infestation and further spread, species specific-controls should be undertaken by a suitably qualified person in early spring and late summer prior to seeding and should be integrated with any other work planned in the area by Auckland Council.

9.1.3 Disposal of plant material

Where practicable, all unwanted plant material should be dealt with on the property. This will remove the need for off-site disposal. Vegetation cut from species that are known not to resprout (i.e. cut tree privet branches) can be left on site to decompose naturally and enrich the soil. Alternatively, they can be mulched and used to buffer plantings and reduce soil exposure during the initial stages of planting. Seed heads should be removed from all plants and disposed of off-site at a waste transfer station to prevent further spread.

Some species, such as wandering Jew and willow, are easily spread from fragments of plant material. These species should be carefully bagged and appropriately disposed of at a transfer centre in order to prevent further spread and infestation.

9.2 Site preparation

As part of site preparations all pest plants should be controlled (as per Section 9.1) in the seasons prior to planting (i.e. spring and summer). When practicable, manual removal should be considered as the first option to avoid non-target mortality to native flora and fauna.

Manual clearance or spot sprays (approximately 1m in diameter) of weed species will likely be required to free up planting locations and reduce competition from weed species while the plants establish. Herbicides can be applied four to six weeks prior to planting, being careful not to overspray the area.

In other instances, freeing up the soil may be required to increase the efficiency of planting efforts and encourage root development. This can be done with a trenching space or crowbar. Additional planting mix (i.e. bark-based material, excluding volcanic substances, such as pumice) may be required during planting of the lava rock forest to bolster existing substrate. Ensure the planting site is moist, but not water saturated.

A slow release fertiliser should be applied to each planting hole at the time of planting as per the manufacturer's recommendations. This will improve the competitiveness of the plants against weed growth during the first twelve months following planting.

9.3 Plant Selection

The plant species recommended for enhancement planting at the lava rock forest, and MAGS farm and Te Kura Kaupapa streams (refer Sections 6.3, 7.2 and 8.1, respectively) have been selected based on the composition of current native species at each site and the environmental conditions present.

Plants should be eco-sourced from the Tamaki Ecological District where possible. Suppliers should be contacted as early as possible to ensure an ample supply of species is available.

9.4 Planting

In order to prevent erosion and re-invasion by weeds, enhancement planting should be undertaken as soon as practicable following initial weed controls. Planting should be completed during late autumn to early winter in May and June, and should only be undertaken when the weather is suitable (i.e. mild weather) and when the ground is moist and workable. All planting operations should be suspended during periods of severe frost, drought or waterlogging.

The plants will be set out to ensure species are planted in random arrangements (i.e. random species mixture and not planted in straight lines). The planting contractor should also be cognisant of species ecology and environmental requirements for survival at each site (i.e. shade/exposure tolerance, moisture requirements).

A thick layer of mulch should be placed around each plant, ensuring the mulch is clear of the plant stem. This will help conserve moisture and suppress weed growth. The mulch may be sourced from the organic golf course waste or tree privets felled on site. Or the desired effect can be obtained by using old straw or pre-cut squares of weed-mat.

9.5 Post-planting maintenance

Enhancement plantings should be inspected monthly over a period of 12 months. This will enable any maintenance requirements to be identified and acted upon accordingly.

Maintenance requirements may include:

- Dead or dangerous trees/tree limbs that may require removal;
- Weed release; or
- Replacement plantings.

The manual weed release of plants should be undertaken at least three times a year for the duration of the enhancement schedule (refer to Section 10.0). The effort required will be dependent on site conditions and plant growth.

Some plants may need to be replaced in the first month following planting if they fail to establish. This is called blanking and refers to the like-for-like species replacement of failed seedlings. The requirement for planting in subsequent years will be dependent on the overall establishment of initial plantings. If required, replacement planting will be done in the year following enhancement planting.

10.0 General Enhancement Schedule

The first year of the enhancement schedule (initial planting) will provide the foundations for restoration and ecological enhancement of the lava rock forest, and MAGS farm and Te Kura Kaupapa stream sites and will include weed removal, site preparation and planting.

Initial planting will be followed by a four year maintenance period. This will include blanking in the first month following the initial planting and replacement planting the following planting season (May-June), if required. Weed control will continue over a four year period following planting and will generally be focused on monitoring and control of site-specific weed incursions as per the strategies identified in Section 9.1.

The site-specific enhancement schedules for the Norwood Reserve lava rock forest, MAGS farm stream and Te Kura Kaupapa stream are provided in Sections 6.6 , 7.4 and 8.3, respectively.

Following the four year maintenance schedule, it is anticipated that future weed incursions (and pest management in the lava rock forest) will be managed by MAGS, Te Kura Kaupapa and Auckland Council in collaboration of local community groups, such as STEPS.

11.0 General Review of the Waititiko – Meola Creek Enhancement Plan

This Waititiko – Meola Creek Enhancement Plan should be considered as a living document. It may be updated throughout the course of its implementation and should reflect any changes to the methodology or site conditions which may affect implementation.

Auckland Council certification and approval are required before any changes to the Waititiko – Meola Creek Enhancement Plan can occur.

12.0 References

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13.0 Limitations

AECOM New Zealand Limited (AECOM) has prepared this plan in accordance with the usual care and thoroughness of the consulting profession for the use of Watercare Services Limited only and those third parties who have been authorised in writing to rely on this plan.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this plan.

Where this plan indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the plan. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared between 16 November and 10 December 2018 and is based on the conditions encountered and information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time.

This plan should be read in full. No responsibility is accepted for use of any part of this plan in any other context or for any other purpose or by third parties. This plan does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

To the extent permitted by law, AECOM expressly disclaims and excludes liability for any loss, damage, cost or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this plan. AECOM does not admit that any action, liability or claim may exist or be available to any third party.

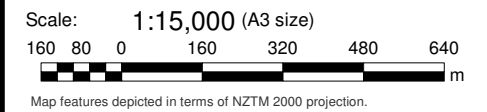
It is the responsibility of third parties to independently make inquiries or seek advice in relation to their particular requirements and proposed use of the sites.

Appendix A

Waitītiko – Meola Creek Enhancement Plan Site Overview



SPATIAL REFERENCE



Data Sources:
Cadastral Boundaries – LINZ NZ Cadastral Dataset 2018

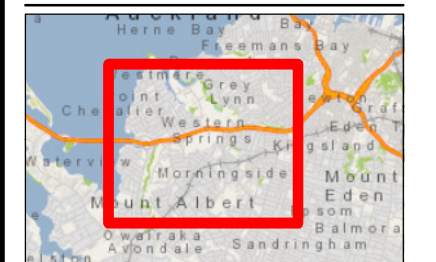
PROJECT MANAGEMENT

Approved	AC	Date	12/12/2018
Checked	AC	Date	12/12/2018
Designed	SS	Date	12/12/2018
Drawn	SS	Date	12/12/2018

ISSUE/REVISION

Rev	Date	Description
B	12/12/2018	FINAL

KEY PLAN



PROJECT NUMBER

60587863

SHEET TITLE

WAITĪTIKO – MEOLA CREEK
ENHANCEMENT PLAN CONTEXT

MAP NUMBER

FIGURE 1



© Copyright AECOM New Zealand Limited, 2015. This map is confidential and shall only be used for the purposes of this project. The signing of this title block confirms the design and drafting of this project have been prepared and checked in accordance with the AECOM Quality Assurance system certified to AS/NZS ISO 9001:2008.

Appendix B

Te Ngahere Quote



Te Ngahere

Native Forest Management

Ecological Restoration and Consultancy

QUOTE

Auckland Council, Huw.HillMale@aucklandcouncil.govt.nz

Date
05 Oct 2018

Quote Number
QU-0187

Reference

Expiry
05 Jan 2019

TE NGAHERE (2009) LIMITED
PO Box 71109
Rosebank Post Centre
Auckland 1348
Ph: 09 828 4035
M: 021 726 239
richardmairs@te-ngahere.co.nz

Roy Clements Treeway tree privet control 2018

Thank you for requesting a quote from Te Ngahere and Treesafe. This quote covers the control of large tree privet in areas as itemised below.

Drilling of these privets has not been considered due to their size and proximity to property boundaries and paths.

Another two large tree privet were identified within MU1. Although not by boundaries or paths, their size and spread is still considered a risk. It is recommended that these trees could be removed if budget is available or at a later date. It is likely that the cost to remove each tree would be similar to items 2 or 3.

No smaller tree privet were recorded within the rock forest areas. Therefore, the work outlined is solely arborist work.

Please contact me if you have any questions or require further information.

Regards,

Richard Mairs

Description	Quantity	Unit Price	GST	Amount NZD
1. Roy Clements Treeway MU1 By the rock wall: 3 x tree privet	1.00	1,650.00	15%	1,650.00
2. Roy Clements Treeway MU1 By informal path, near boundary with MU2: 1 x tree privet	1.00	1,815.00	15%	1,815.00
3. Roy Clements Treeway MU1 Below item 2, near boundary with MU2: 1 x tree privet	1.00	1,760.00	15%	1,760.00
			Subtotal	5,225.00
			Total GST 15%	783.75
			TOTAL NZD	6,008.75

Terms and conditions

1. Work will be invoiced at the end of the month following the completion of the work/line item and will be due on the 20th of the next month.
2. All debris will be left on site in pieces either within the bush area or at the edge of the grass by the rock wall.
3. Treesafe is not responsible for any lawn damage.
4. The stumps will be cut as close to ground level as the terrain safely allows.
5. Treesafe accepts no responsibility for any damage to the undergrowth, however the trees will be climbed and dismantled in a manner to reduce this.



Figure 1: Map of tree privets mentioned in this quote, Roy Clements Treeway.

Appendix C

Recommended Weed Control Methods

Appendix C Recommended Weed Control Methods

Weed	Control method	Timing	Comments
Agapanthus (<i>Agapanthus praecox</i>)	Dig out and dispose off site Knapsack – foliar spray	Year round October-March	Only if this can be done without posing a weed hygiene risk Not when flowering or seeding
Arum lily (<i>Zantedeschia aethiopica</i>)	Hand pull seedlings/ small plants Dig out and dispose off site Cut and spray stems of large plants	Year round October-March	Only if this can be done without posing a weed hygiene risk Spray immediately following cutting. Monitor for re-growth.
Bear's breeches (<i>Acanthus mollis</i>)	Dig out and dispose off site Cut and treat stump	Year round October-March	
Bindweed (<i>Calystegia spp.</i>)	Knapsack – foliar spray		
Blackberry (<i>Rubus fruticosus agg.</i>)	Knapsack – foliar spray	December-April	
Brush wattle (<i>Paraserianthes lophantha</i>)	Handpull seedlings/small plants Cut and treat stumps Drill and inject	Year round October – April	
Chinese privet (<i>Ligustrum sinense</i>)	Seedlings – hand pull Trees – drill and inject Saplings - cut and stump treat	November-April	
Climbing asparagus (<i>Asparagus scandens</i>)	Knapsack/hand sprayer	October-March	Foliar spray both climbing stems up to 1m high and scrambling plants in situ. Ensure no tree fern are sprayed.
Crack willow (<i>Salix fragilis</i>)	Drill and inject/frill and spray	November-February	Do not cut as every twig becomes another willow .
Garden nasturtium (<i>Tropaeolum majus</i>)	Knapsack – foliar spray	November-March	
Gorse (<i>Ulex europaeus</i>)	Knapsack foliar spray	October - March	
Ivy (<i>Hedera helix</i>)	Cut and treat stems/tubers	November-March	Leave foliage in host to die off
Japanese honeysuckle (<i>Lonicera japonica</i>)	Knapsack – foliar spray Cut and treat stems	Year round	Pull away from non-target species before spraying. Spray to run off. Ensure no epiphytic attachment. Do not pull cut vegetation from host plant
Montbretia (<i>Crocasmia x crocosmiiflora</i>)	Knapsack – foliar spray	October-February	
Moth plant (<i>Araujia hortorum</i>)	Cut and treat stump	October-March	Leave cut vegetation in host to die off. Remove seed pods if possible.

Weed	Control method	Timing	Comments
Phoenix palm (Phoenix canariensis);	Dig out seedlings and small plants Drill and inject Cut and paint stumps Knapsack – foliar spray (saplings)	Year round October-February	dispose of material at a refuse transfer station
Pine (<i>Pinus radiata</i>)	Felling Drill and inject	Year round	
Tree privet (<i>Ligustrum lucidum</i>)	Cut and treat stumps Drill and inject	November-March	
Wandering Jew (<i>Tradescantia fluminensis</i>);	Knapsack – foliar spray	November-March	Pull away from non-target species before spraying.
Wild ginger (<i>Hedychium spp.</i>)	Hand pull seedlings/small plants. Knapsack – foliar spray Cut and treat stems/tubers	October to February Spring to late autumn	Ensure no tuber left behind. Practice caution around waterways and native vegetation
Woolly nightshade (<i>Solanum mauritianum</i>)	Seedlings/small plants – hand pull Trees – drill and inject Saplings - cut and treat stump	Year round	