

**INDIGENOUS PLANTING TO PROVIDE  
ENHANCED ECOLOGICAL HABITAT ASSOCIATED  
WITH EROSION PROTECTION ON THE  
MARGINS OF THE ROTORUA LAKES**

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WITH EROSION PROTECTION ON THE  
MARGINS OF THE ROTORUA LAKES**

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**Project Team:**

William Shaw – Report author

**Prepared for:**

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P.O. Box 364

Whakatāne

# CONTENTS

1.	INTRODUCTION	1
2.	METHODS	1
3.	ECOLOGICAL CONTEXT	2
3.1	Broader context	2
3.2	Lake level regimes	2
3.2.1	Overviews for 11 lakes	2
3.2.2	Lake level summaries	5
4.	SITE CHARACTER AND PLANTING	5
4.1	General	5
4.2	Terrestrial planting	5
4.3	In-lake planting	6
5.	SPECIES POTENTIALLY SUITABLE FOR PLANTING	6
6.	PLANT SOURCING	8
	ACKNOWLEDGMENTS	8
	REFERENCES	8
	APPENDICES	
1.	Photographs of lake margin planting and other vegetation	9
2.	Species potentially suitable for planting on lake margins	15

**Reviewed and approved for release by:**



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W.B. Shaw  
Director/Lead Principal Ecologist  
Wildland Consultants Ltd

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## 1. INTRODUCTION

Bay of Plenty Regional Council (BOPRC) require advice on indigenous planting to provide enhanced ecological habitat associated with constructed erosion protection walls on the margins of Lake Rotorua.

Ian Kusabs provided BOPRC with the following definition of a *habitat* wall:

“a ‘habitat wall’ is a wall designed to provide cover habitat for koura and native fishes and may include suitable rock, rip rap, gabion baskets and timber structures (i.e. framing) or any combination of these materials. In addition, planting of native flora alongside the wall should also be considered in achieving this purpose.”

BOPRC now require advice on species selections, plant spacing, and overall cover, which they would like to include in consent conditions. Advice is also required on:

- Planting on the land side of erosion protection or habitat walls.
- What native plants are suitable for land stability and visual effects and specific detail on plant spacing and cover area.
- Approaches that could be applied at multiple locations around the lakes (unknown at this stage) which BOPRC will likely use for resource consents for other erosion protection/habitat walls in the Rotorua Lakes.
- The effect of the degree of exposure of lake margins to lake margins.

The types of erosion protection structures are likely to be rock or rock-filled gabion baskets, rather than wooden retaining walls but some sites could be a combination of these.

The ultimate aim of planting on the landward side of erosion protection structures will be to improve land stability and natural character.

The ultimate aim of planting on the lake side of erosion protection structures will be to enhance habitat for indigenous species such as kōura (*Paranephrops planifrons*).

This report provides an overview of indigenous species that are potentially suitable for planting on lake margins.

## 2. METHODS

Relevant existing information was collated and reviewed. Experience with lakeshore ecology and management was drawn on, particularly relating to vegetation management in relation to lake levels, water depth, shoreline exposure, and shoreline character.

A site visit was undertaken to a section of highly-modified lakeshore at Ngongotahā that is subject to an application for a resource consent for an erosion protection structure.

### 3. ECOLOGICAL CONTEXT

#### 3.1 Broader context

Prior to undertaking physical works or planting on lakeshores it is useful, probably even essential, to have an understanding of the ecological context you are working in and also the lake level regime for the relevant lake(s). Any potential planting on lake margins needs to take account of current and potential future lake levels. Planting of inappropriate species on sites that will be inundated, potentially for weeks or months, is a waste of resources (Figure 1 in Appendix 1).

Brief overviews are provided below of 11 Rotorua lakes, including lake levels and vegetation cover on shorelines. All these lakes are in the lowland bioclimatic zone within the Rotorua Lakes Ecological District. Refer to Beadel and Shaw (1991) for a general account of vegetation on the lakeshores.

#### 3.2 Lake level regimes

##### 3.2.1 Overviews for 11 lakes

###### Lake Rotorua

Levels are controlled by the Ōhau Channel control structure at the inlet into the channel. Lake levels rise rapidly following heavy rain but then also return to ‘normal’ levels relatively rapidly, within days or weeks.

Natural pre-human vegetation on lakeshores would have predominantly been indigenous forest, with tree canopies overhanging soft shorelines. Pōhutukawa (*Metrosideros excelsa*) would have been commonly present on shorelines, as still evident on Mokoia Island and between the Ōhau Channel and Hamurana, intermixed with a diverse range of other indigenous woody species.

Wetlands previously occurred extensively on low-lying land on lake margins, at Ngongotahā, Ngāpuna, between Ngāpuna and Hinemoa Point, and between Hinemoa Point and Mourea. Many of these wetlands have been drained.

Swamp forest, dominated by kahikatea (*Dacrycarpus dacrydioides*) would have been present behind beach berms, such as the ecologically-significant remnant at Te Ngae.

Wetlands would have had a varied cover of species such as raupō (*Typha orientalis*), jointed rush (*Machaerina articulata*), and harakeke (*Phormium tenax*).

Apart from steep terrain on the northeastern side of Lake Rotorua and on Mokoia Island, most indigenous forest has been removed. Most wetlands have been drained or are in a seriously degraded state, with remnant or restored wetlands at Ngongotahā, Ngāpuna to Hinemoa Point, and Hinemoa Point at Mourea. Many remnant wetlands now have a cover of exotic species such as willows (*Salix* spp.).

### Lake Rotoiti

Levels are controlled by the control structure at the Kaituna outlet and are managed within a very narrow range. Lake levels rise rapidly following heavy rain but then also return to ‘normal’ levels relatively rapidly, within days or weeks.

Natural pre-human vegetation on lakeshores would have been predominantly indigenous forest. Soft shorelines were probably covered with tawa (*Beilschmiedia tawa*)-dominant forest with podocarps common. There are extensive areas of marginal cliffs, east of Te Wētā Bay and on the northeastern side of the lake. Pōhutukawa, northern rātā (*Metrosideros robusta*), and hybrids of pōhutukawa and northern rātā were common on cliffs, along with kāmahi (*Weinmannia racemosa*) and a range of other woody species. Pōhutukawa-rātā hybrids are present also present locally on the southern side of the lake. Sheltered embayments have marginal wetlands with stands of raupō and kuta (*Eleocharis sphacelata*).

Wetlands are present on the northern side of the lake, and two have small stands of maire tawake (swamp maire; *Syzygium maire*).

### Lake Rotoehu

Levels are controlled by natural inputs and subsurface drainage, so lake levels can vary by metres. Similar to Lake Rotoiti but without the steep cliffs. Formerly covered with indigenous forest to the lake margins except where there are wetlands. A larger wetland, the Waitangi wetland complex, is present in the southeastern corner of the lake.

The lake has many shallow embayments and margins where raupō is common or locally dominant.

### Lake Rotomā

Levels are controlled by natural inputs and subsurface drainage, so lake levels can vary by metres.

Natural shoreline vegetation was originally similar to Lake Rotoehu. Indigenous forest is present on margins on the northern, western, and eastern margins. A road and residential development is present on the southern margin. There are large wetlands on the southeastern margins (Te Matahī Lagoon) and on the eastern shoreline (Te Onewhero and Whakarewa Lagoons). These latter lagoons are adjacent to the only farms in the catchment and help to buffer the lake from the effects of farming in the catchment.

### Lake Ōkātina

Levels are controlled by natural inputs and subsurface drainage, and can vary by metres. A cover of indigenous forest is still present on the lake margins around most of the lake, albeit modified by previous fires and also by introduced browsing pest animals.

### Lake Tarawera

Levels are controlled by natural inputs and drainage via the Tarawera River, and levels vary within a relatively narrow band. Most of the lake margin still has a cover of indigenous forest, albeit modified by previous fires and also by introduced browsing pest animals. Pōhutukawa and pōhutukawa-rātā hybrids are locally common. The only area without a complete cover of indigenous forest is adjacent to the residential housing along Spencer Road, along the western shoreline.

### Lake Rerewhakaaitu

Levels are controlled by natural inputs and subsurface drainage, so levels can vary markedly. Subject to lake levels, the immediate margin can be mostly open beaches adjacent to secondary indigenous regeneration. Shallow embayments and margins contain stands of raupō.

### Lake Rotomahana

Levels are generally controlled by natural inputs and subsurface drainage, although there is an overflow pipe to carry higher levels to Lake Tarawera. Lake levels can vary markedly.

Lake margins are primarily covered with secondary indigenous forest and scrub. On the eastern side there is a substantial area of farmland and on the western side there is an extensive area of exotic plantation forest. Geothermal activity is common on the western margin. Emergent wetland vegetation present in shallow embayments.

### Lake Rotokākahi/Green Lake

Levels are controlled by natural inputs and levels vary within a relatively narrow band. The lake drains to Lake Tarawera via the Wairoa Stream. With the exception of farmland in the southwestern corner, the entire catchment has a cover of secondary indigenous or exotic forest.

### Tikitapu/Blue Lake

Levels are controlled by natural inputs and subsurface drainage so lake levels can vary considerably, with consequent effects on lakeshore vegetation. Most of the catchment has a cover of indigenous or exotic forest. The exceptions are the grassed reserve at the northern end, the Blue Lake Holiday Park, and sealed roads.

### Lake Ōkāreka

Levels are controlled by natural inputs and outflows via a surface channel to Lake Tarawera. Levels have varied markedly, with consequent effects on lakeshore vegetation. Lakeshore margins include residential housing, farming, wetlands, and secondary indigenous forest.



### 3.2.2 Lake level summaries

As discussed in Section 3.2.1 above, levels in the various lakes are controlled by different mechanisms and, in some lakes, levels can vary markedly. Varying lake levels will obviously have a major influence on lakeshore vegetation, including any plantings. As noted above, when planning and undertaking planting it is important to understand lake level regimes. The 11 lakes addressed above are listed below within four lake level regime categories.

#### Lakes Controlled Within Relatively Narrow Ranges by Constructed Structures

- Rotorua.
- Rotoiti.

#### Lakes With Wide Natural Ranges Controlled by Subsurface Drainage

- Rotoehu.
- Rotomā.
- Ōkātina.
- Tikitapu.
- Rerewhakaaitu.

#### Lakes With Relatively Narrow Ranges Controlled by a Natural Surface Outflows

- Tarawera.
- Rotokākahi.

#### Lakes with Wide Ranges Controlled by Modified Surface Outflows

- Ōkāreka.
- Rotomahana.

## 4. SITE CHARACTER AND PLANTING

### 4.1 General

Each potential planting site will have a different character so it is important to identify why indigenous planting is to be undertaken and what is to be achieved. Reasons could include:

- Enhancement of visual and landscape amenity.
- Enhancement of terrestrial habitat.
- Shading of aquatic habitat.
- Restoration of in-lake aquatic habitat.

### 4.2 Terrestrial planting

Lakeshore structures, such as gabion walls, often have a shallow cover of soil so cannot be planted with tree species. Low-growing species, such as *Carex* spp. and vines

(e.g. *Muehlenbeckia* spp.) can also be planted directly on top of such structures. *Muehlenbeckia* vines can be planted immediately adjacent, to scramble over them and hang down to water level. A range of other species can be planted adjacent to structures, including trees, shrubs, sedges, grasses, and harakeke/flax. As noted above, it is important to identify the aim of the planting.

For well-drained or reasonably well-drained sites, pōhutukawa is one species which should be used commonly for lakeshore planting, along with northern rātā and pōhutukawa-rātā hybrids. It should be noted that pōhutukawa and rātā will develop into large spreading trees, providing considerable shade on lakeshores. Their root systems can also 'bind' or provide buffering on soft and hard lakeshores. Species such as harakeke (flax, *Phormium tenax*) can be planted on terrestrial sites and also in shallow water (see the section below). There are many varieties of harakeke and it is necessary to consider the stature of harakeke at maturity as some variations are very tall robust plants. Local hapū will often also have preferred varieties (c.f. Shaw *et al.* 1991).

Various other species that are potentially suitable for terrestrial planting adjacent to lake margins and structures are listed in Appendix 1 and examples include ti kōuka, kānuka, toetoe, kōwhai, rewarewa, mapou, tōtara, kāmahi, and mānatu (lowland ribbonwood). Refer to Appendix 2 for photographs of lakeshore planting.

#### 4.3 In-lake planting

Rock-filled gabion baskets and other hard structures such as rocks or rock walls will only provide aquatic cover and habitat if permanently immersed in water.

Unless there is some form of protection from wave action, it is generally not appropriate to plant in-lake. If there is some type of buffering from wave action, and subject to water depth, then species such as raupō, kuta, jointed rush (*Machaerina articulata*), kuawa (*Schoenoplectus tabernaemontani*), and/or harakeke could be planted. Note that this type of planting requires the permanent presence of lake water, especially for raupō, kuta, jointed rush, and kuawa.

Raupō will establish to a water depth of about two metres. Kuta requires permanent water 0.5-1.0 metres deep, with a reasonably constant level. Harakeke (flax) is only suitable for shallow margins less than 0.3 metres deep or thereabouts.

Dense stands of raupō and kuta provide good cover for indigenous fish and kōura.

## 5. SPECIES POTENTIALLY SUITABLE FOR PLANTING

A list of species potentially suitable for planting on lake margins is provided in Appendix 2.

Guidance for the types of species potentially suitable for planting on different shoreline types is provided below:

#### Poorly-Drained (Damp, Even Swampy)

- Ti kōuka.
- Mānuka.
- Harakeke.
- Carex species.
- Maire tawake (swamp maire).
- Kahikatea.
- Pukatea.

#### Shallow Water

- Raupō.
- Kuta.
- Harakeke (shallow margins only).
- *Machaerina articulata*.
- *Schoenoplectus tabernaemontani*.

#### Moderately Well-Drained (but not Well-Drained)

- Pōhutukawa.
- Kānuka.
- Kohūhū.
- Mānuka.
- Tī kōuka.
- Kahikatea.
- Pukatea.

#### Well-Drained (i.e. Free-Draining)

- Pōhutukawa.
- Kānuka.
- Kohūhū,
- Rewarewa.
- Mapou.
- Kōwhai.
- Akeake (green form only).
- Karamū.
- Koromiko.
- Northern rātā.
- Titoki.
- Mānatu (lowland ribbonwood).

## 6. PLANT SOURCING

All indigenous plants planted on lakeshores in the District should be sourced locally, i.e. from the Rotorua Lakes Ecological District. When sourcing material from nurseries it is necessary to check that they have good records of where plant material was collected. This is important for all species but particularly for pōhutukawa and northern rātā, and pōhutukawa-rātā hybrids. Note that only the green local form of akeake should be used as 'red' akeake is a northern South Island cultivar.

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## REFERENCES

- Beadel S.M. and Shaw W.B. 1991: Lake shore vegetation. Pages 55-58 in Botany of Rotorua. Forest Research Institute, Rotorua. 132 pp.
- Shaw W.B., Schuster E., and Nicholls J.L. 1991: Traditional uses of wild plants. Pages 109-114 in Botany of Rotorua. Forest Research Institute, Rotorua. 132 pp.

PHOTOGRAPHS OF LAKE  
MARGIN PLANTING AND  
OTHER VEGETATION





Plate 1: Harakeke/flax planted on the shoreline at Lake Rotomā but submerged and killed by high lake levels in 2023.



Plate 2: Harakeke/flax, māhoe, and koromiko planted on the eastern shoreline of Lake Rotoiti.





Plate 3: Toetoe planted on the eastern shoreline of Lake Rotoiti.



Plate 4: Pōhutukawa planted on the eastern shoreline of Lake Rotoiti.





Plate 5: Harakeke/flax, karamū, koromiko, and māhoe planted on the eastern shoreline of Lake Rotoiti.



Plate 6: Harakeke/flax planted on the western shoreline of Lake Rotoiti.





Plate 7: Harakeke/flax in the background and *Carex geminata* and *C. secta* in the foreground, on the margin of the Ōhau Channel.



Plate 8: *Carex secta* on the margin of the Ōhau Channel, providing excellent cover for fish and kōura.





Plate 9: Mamaku tree ferns on the eastern shoreline of Ōkawa Bay, Lake Rotoiti, providing good cover for small fish and kōura.

## SPECIES POTENTIALLY SUITABLE FOR PLANTING ON LAKE MARGINS

### Key

1. These species suitable to form the bulk of plantings.
2. These species are suitable to be used in low numbers.
3. Plant these species once shelter has been established, or in the shelter of remnant groves of indigenous trees or shrubs.

Species	Higher Ground	Lake Margin
<i>Alectryon excelsus</i> (titoki)	✓(2)	
<i>Aristolelia serrata</i> (makomako; wineberry)	✓(2)	
<i>Beilschmiedia tawa</i> (tawa)	✓(3)	
<i>Carex secta</i>		✓(1)
<i>Carex virgata</i>		✓(1)
<i>Carpodetus serratus</i> (putaputaweta)	✓(2)	
<i>Coprosma grandifolia</i> (kanono)	✓(3)	
<i>Coprosma propinqua</i>	✓(2)	
<i>Coprosma robusta</i> (karamu)	✓(1)	
<i>Cordyline australis</i> (ti kouka; cabbage tree)	✓(2)	✓(2)
<i>Coriaria arborea</i> (tutu)	✓(1)	
<i>Austroderia fulvida</i> (toetoe)	✓(2)	✓(1)
<i>Cyathea medullaris</i> (mamaku)	✓(3)	
<i>Dacrycarpus dacrydioides</i> (kahikatea)		✓(2)
<i>Dacrydium cupressinum</i> (rimu)	✓(2)	
<i>Dicksonia fibrosa</i> (wheki-ponga)	✓(3)	
<i>Elaeocarpus dentata</i> (hinau)	✓(3)	
<i>Ficina nodosa</i> (knobby club rush)	✓(2)	
<i>Fuchsia excorticata</i> (kotukutuku)	✓(2)	
<i>Gahnia setifolia</i>	✓(2)	
<i>Hebe stricta</i> (koromiko)	✓(1)	
<i>Ixerba brexioides</i> (tawari)	✓(3)	
<i>Kunzea robusta</i> (kānuka)	✓(1)	
<i>Knightia excelsa</i> (rewarewa)	✓(3)	
<i>Laurelia novae-zelandiae</i> (pukatea)	✓(3)	✓(2)
<i>Leptospermum scoparium</i> (mānuka)	✓(1)	✓(1)
<i>Litsea calicularis</i> (mangeao)	✓(3)	
<i>Meliccytus ramiflorus</i> (mahoe)	✓(2)	
<i>Metrosideros excelsa</i> (pōhutukawa)	✓(2)	✓(2)
<i>Metrosideros robusta</i> (northern rātā)	✓(2)	
<i>Myrsine australis</i> (mapou)	✓(2)	
<i>Nestegis cunninghamii</i>	✓(2)	
<i>Phormium tenax</i> (harakeke; flax)	✓(1)	✓(1)
<i>Phyllocladus trichomanoides</i> (tanekaha)	✓(2)	
<i>Pittosporum eugenioides</i> (tarata)	✓(1)	
<i>Pittosporum tenuifolium</i> (kohuhu)	✓(1)	
<i>Plagianthus regius</i> (lowland ribbonwood, mānatu)	✓(2)	
<i>Podocarpus totara</i> (tōtara)	✓(2)	
<i>Prumnopitys ferruginea</i> (miro)	✓(2)	
<i>Prumnopitys taxifolia</i> (matai)	✓(2)	
<i>Pseudopanax arboreus</i> (whauwhaupaku; fivefinger)	✓(2)	
<i>Pseudopanax crassifolius</i> (horoeaka; lancewood)	✓(2)	
<i>Schefflera digitata</i> (pate)	✓(3)	
<i>Sophora microphylla</i> (kōwhai)	✓(2)	
<i>Syzygium maire</i> (maire tawake; swamp maire)		✓(2)
<i>Weinmannia racemosa</i> (kamahi)	✓(3)	



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