

Smacks Creek Riverbank Reserve

Ecological restoration guidelines

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Christchurch
City Council



Approvals Panel			
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Introduction

Background

Development of the surrounding residential subdivision resulted in the land adjacent to Smacks Creek being set aside for ‘esplanade reserve’ purposes. The Resource Management Act (1991) defines the purpose of esplanade reserves as areas that:

- Contribute to the protection of conservation values,
- Enable public access to or along a river, and
- Enable public recreation where that use is compatible with conservation values

Legislation and policy relevant to the management of this reserve is contained in documents such as the Christchurch District Plan, the Long Term Plan, the Resource Management Act, the Reserves Act, the Wildlife Act, the Waterways and Wetlands Asset Management Strategy, and Christchurch Biodiversity Strategy. Smacks Creek is also a Site of Ecological Significance (SES) in the District Plan.

Smacks Creek Riverbank Reserve (Figure 1) is just over one hectare in area, and is accessible from Hussey and Gardiners Roads (Figure 1). The reserve borders residential properties to the south, and Redwood Aquatics to the north, and Smacks Creek – a tributary of the Pūharakekenui-Styx River – flows along the southern edge of the reserve. Because of this connection with the Pūharakekenui-Styx River, any planning and development of the Smacks Creek Riverbank Reserve must also support Christchurch City Council (Council)’s adopted ‘Styx Vision 2000 – 2040’ planning document.



Figure 1: Smacks Creek Riverbank Reserve

Ecological context

Our waterways and wetlands support a broad array of indigenous flora and fauna. They also play important roles in enhancing water quality, flood mitigation, carbon sequestration and also have high cultural and mahinga kai values. Most natural habitats – including waterways and wetlands within the Ōtautahi-Christchurch district – have either disappeared completely or have been severely degraded as a result of human-induced modifications to the land for (e.g.) agriculture, urban development, transport and industrial activities. Almost 90% of the pre-European extent of freshwater wetlands have been lost across Aotearoa-New Zealand¹, and here in the Low Plains Ecological District, less than 1% of the original indigenous vegetation remains today. It is therefore important that Sites of Ecological Significance like the Smacks Creek Riverbank Reserve are managed and protected². Habitat restoration is a way to remediate this and reinstate ecosystem function.

Smacks Creek is a Site of Ecological Significance owing to it supporting the At Risk – Declining longfin eel (*Anguilla dieffenbachii*) and the area also containing a degraded remnant fen wetland. Although degraded, the wetlands in Smacks Creek Riverbank Reserve are nevertheless significant because they represent some of all that remain of the original biodiversity of the low Canterbury Plains ecological district. Reports from 2003³ and 2018⁴ show that Smacks Creek has reasonable freshwater invertebrate diversity given its urban setting. The 2018 report states that, overall, the Pūharakekenui-Styx River catchment has higher abundance and diversity of pollution-sensitive invertebrates⁵ than the Ōtākaro-Avon, Ōpāwaho-Heathcote and Huritini-Halswell Rivers. The water quality of Smacks Creek has been tested each year since 2007 and scored ‘good’ for the last two years. However the water quality in 2021 was lower than 2020, when it was in the top five sites for water quality in the city.⁶

The forest area in the reserve provides habitat for native bush birds such as shining cuckoo (*Chrysococcyx lucidus*), grey warbler (*Gerygone igata*), fantail (*Rhipidura fuliginosa*) and silvereye (*Zosterops lateralis*), although optimal habitat is limited by its relatively small size and close proximity of houses and human disturbance. Restoring an area of wetland beside Gardiners Road could provide nesting habitat for waterfowl and wetland birds.

Although comparatively small, Smacks Creek Riverbank Reserve also has ecological value associated with its connectivity or proximity with to other nearby natural areas (Figure 2):

- Smacks Creek is a headwater tributary of the Pūharakekenui-Styx River, and therefore has a role to play in protecting the freshwater values of a wider river ecosystem.
- Another restored section of Smacks Creek - Smacks Creek Esplanade Reserve – is approximately 200 m south-west and is accessible from Wilkinsons Road. This reserve contains significant riparian restoration plantings that are being impacted by pest plants and garden-origin/ornamental plants, however we plan to carry out a full waterway restoration project through this section in 2024.

¹ Dymond JR, Sabetizade M, Newsome PF, Harmsworth GR & Ausseil A-G 2021. Revised extent of wetlands in New Zealand. *New Zealand Journal of Ecology* 45: 1-8.

² <https://districtplan.ccc.govt.nz/pages/plan/book.aspx?exhibit=DistrictPlan>

³ Taylor M & McMurtie S 2003. Ecological values of Smacks Creek, and assessment of enhancement options. Final Report. Aquatic Ecology Limited.

⁴ Styx River Catchment Aquatic Ecology 2018. Instream Consulting Limited:

<https://ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2018-reports/5-Yearly-Styx-River-Invertebrates-and-fish-2018-and-Annual-Styx-Mill-Invertebrates.pdf>

⁵ Specifically, the Ephemeroptera (mayfly), Plecoptera (stonefly) and Trichoptera (caddisfly) taxa.

⁶ Christchurch City Surface Water Quality Annual Report 2021:

<https://www.ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2022-reports/Appendix-F-Surface-Water-Quality-Annual-Report-2021.pdf>

- The private property immediately to the east at 51 Hussey Road supports approximately one hectare of semi-mature (>30 year old) native forest and several ponds. Although dominated by native trees, some species are not local to the Canterbury area, and those that are may not be eco-sourced. Nevertheless, the planting is a significant ecological feature of the local landscape that is likely to support a number of native bush birds and other forest and wetland fauna. The Styx Living Laboratory Trust and the Council Biodiversity Team are currently working with the property owners to assist them to extend their native forest plantings and protect the forest in perpetuity.
- Willowbank Wildlife Reserve is located immediately to the southeast and is also a dominant ecological feature in the local area. Willowbank contains extensive native forest and wetland plantings, and contains an approximately 400 m length of Smacks Creek
- The nearby Styx Mill Conservation Reserve (>60 ha) is managed by the Council’s Regional Parks team for its significant ecological values. These include significant remnant wetlands, water bird habitat and more than 15 hectares of planted native forest within a partially completed pest proof fence. Styx Mill Conservation Reserve also has an extensive trapping network.



Figure 2: Nearby or adjacent natural areas to Smacks Creek Riverbank Reserve.

The 2004 development plan

A development proposal for Smacks Creek Riverbank Reserve (Figure 1) was consulted on in 2004, and was approved for implementation that same year⁷. Note that in this document, the reserve is called “Smacks Creek Esplanade Reserve”.

The objectives of the development plan included:

- That the wilderness nature of the area be maintained to act as a contrast to the adjacent urban areas.
- That the ecological values associated with Smacks Creek and the reserve continue to be protected and enhanced.
- That any built structures complement and enhance the wilderness nature of the reserve through appropriate location and design.
- That by working with the natural processes of decay and regeneration ongoing maintenance costs are kept to a minimum.
- To provide opportunities for people to gain, and appreciate, a ‘wilderness experience’.



Figure 3: Landscape development plan for Smacks Creek Riverbank Reserve from the development proposal (2004).

⁷Smacks Creek [Riverbank] Reserve. Community planning for the Future. August 2004:
<https://www.thestyx.org.nz/sites/default/files/research/smacks20creek20brochure.pdf>

Progress to-date

Currently only reactive maintenance occurs within the reserve. Contractors mow the lawns and grass berms (shown in red in Figure 4), and prune vegetation off the tracks but do not maintain the natural areas (shown in blue in Figure 4). Recently, staff from the Styx Living Laboratory Trust have been carrying out woody weed control within the forest and fen wetland areas of the reserve.

What's next?

The purpose of this report is to provide guidelines for the Council's Urban Parks team who are responsible for the maintenance of the reserve. It also provides guidance for the wider community for the ongoing protection, restoration and management of natural assets for biodiversity and for environmental education.



Figure 4: Map showing management areas – the blue are the 'natural areas' and the red are 'turf'. Obtained from the Community Parks Maintenance Contract Map.

We propose that the two reserve frontages and vegetation growing along the paths will continue to be managed in a tidy state and also to allow unimpeded access through the reserve. The rest of the reserve will be maintained as a natural area, and will not necessarily be maintained on a regular schedule, with restoration planting and weed removal being the main tasks. Our aim is for the reserve is for it to be relatively self-sustaining, whereby natural processes dominate and ongoing maintenance costs remain low. We will work with the Styx Living Laboratory Trust to invite and encourage the reserve's neighbours and the local community to participate in restoration efforts, and perhaps to form a community reserve-care group for activities such as weed control, planting, and pest animal control.

In the immediate future, we plan to restore an area of degraded natural wetland at the Gardiners Road frontage. This is likely to involve restoring original landforms, installing new reserve entrance signage, new boundary fencing, and establishing eco-sourced wetland plantings dominated by pukio sedges (*Carex secta*) and mingimingi (*Coprosma propinqua*).

Habitat Restoration

The aim of restoring Smacks Creek Riverbank Reserve is to establish an authentic patch of riverine forest and associated habitat that can be enjoyed by the community and will be largely self-sustaining in the medium to long-term. The reserves ecological authenticity will be further enhanced by establishing only locally appropriate and eco-sourced plants (Refer Appendix 1), and the ongoing management of the range of threats that are impacting on indigenous biodiversity values.

Restoration Zoning

For the purpose of this plan, we have separated the reserve into seven distinct restoration zones that require specific actions for habitat restoration. These zones are shown in Figure 5 (below), and include:

- The freshwater aquatic environment
- Riparian margins along the true left bank (TLB) and true right banks (TRB) of Smacks Creek
- Native forest
- A constructed pond at the eastern end of the reserve
- The *Carex secta* wetland at the Gardiners Road entrance
- The fen wetland
- Reserve entrance areas (currently grass berms and lawns)



Figure 5: Restoration zoning within Smacks Creek Riverbank Reserve.

Freshwater aquatic

Generally, the freshwater aquatic environment of Smacks Creek is managed and maintained by Council's Three Waters operational team, who have a focus on maintaining waterway conveyance along with the other five values of waterway asset management (landscape, ecology, recreation, culture and heritage). Note that instream habitat restoration work will not be led by Parks, and the recommendations included here will need further investigation in partnership with Council's freshwater ecologists.

Actions

Monitor pollution: Monitor waterway for discharges of sediment and/or other contaminants and report to Environment Canterbury (ECan) 24-hour pollution hotline (0800 765 588), or via the Snap Send Solve app: Report an environmental incident | Environment Canterbury (ecan.govt.nz).

Maintain waterway shade: Continue to provide continuous tree and shrub canopy over the stream channel to keep water temperatures low. Work with Councils Land Drainage Operations Team to find solutions to managing and maintaining pukio sedge (*Carex secta*) in such a way that older plants provide shade and overhangs for fish refuge and are not excessively cut back by contractors.

Maintain cobbles: Monitor for sediment build-up across cobble areas, and where this occurs investigate methods to remove and dispose of sediment. Note that any sediment removal will likely need to be coordinated with appropriate long-term management of upstream sediment sources.

Instream habitat diversity: Work with Council's freshwater ecologists to investigate the benefits and/or need for fine-scale instream habitat features such as submerged large woody debris, boulders, pools, eddies or overhangs.

Fish passage: Ensure there are no barriers for fish passage along the creek.

Fauna monitoring: There are opportunities for more biodiversity monitoring in the creek, especially after the actions in the document have been completed, to assess the effect of habitat quality on native fauna. Water samples can be collected to identify species through analyzing Environmental DNA (eDNA)⁸. There has been an assessment of eDNA in Smacks Creek which showed the presence of Queensland limpet, which is a biosecurity concern. Further freshwater invertebrate and fish monitoring should also be conducted in the future, following on from the previous surveys⁹, to assess any change in biodiversity.

Any sightings of red-eared slider turtles (*Trachemys scripta elegans*) (which are known to be in the constructed pond) in Smacks Creek shall be reported to Council's freshwater ecologists.

⁸ <https://www.epa.govt.nz/community-involvement/open-waters-aotearoa/what-is-edna/>

⁹ Styx River Catchment Aquatic Ecology 2018. Instream Consulting Limited:
<https://ccc.govt.nz/assets/Documents/Environment/Water/Monitoring-Reports/2018-reports/5-Yearly-Styx-River-Invertebrates-and-fish-2018-and-Annual-Styx-Mill-Invertebrates.pdf>

Riparian margin



Figure 6: Areas along riverbanks that require infill planting.

The established plantings along Smacks Creek provide an important buffer between the waterway and the surrounding land uses. As an eco-tone (a transitional area between two different plant communities that blend together), the riparian margin provides an essential habitat for a diverse range of both aquatic and terrestrial indigenous flora and fauna. Well managed waterway margins are the last lines of defence for keeping sediment and other contaminants out of waterways. Sediment is a major driver of waterway degradation throughout Aotearoa, as it smothers aquatic life and cobbles, and fills voids between the cobbles that are important for aquatic fauna. Therefore, maintaining a well vegetated riparian margin will not only provide habitat and shade the waterway, but it will also keep the streambank intact through root reinforcement, and help filter out sediment contained in surface flows during heavy rainfall.

Council contractors are tasked to maintain one metre back from the edge of the stream by Council's Three Waters team. These maintenance operations are typically carried out with weed eaters/line trimmers, however vegetation clearance is sometimes over-zealous resulting in damage to planted and naturally occurring native plants and resultant loss of riparian buffering, habitat and waterway shade.

Actions

Maintain vegetative cover: Work with Council's Three Waters operations team (and contractors) to ensure continuous native vegetation cover along the riparian margin of the creek is protected and maintained throughout the length of the reserve.

Infill planting: Where areas within the riparian strip have been cleared (E.g. Figure 6, top), these areas shall be in-filled with large grade riparian plants that will be quick to establish and fill any voids. This will not only bolster habitat, but will also reduce maintenance effort by eliminating open grassy areas.

Weed removal: Maintenance shall include removal of weeds that are likely smother native plantings. These will be predominantly woody weeds such as grey willow, blackberry, old man's beard and ivy, but may also include convulvulus – especially on young or low growing plantings.

Communication: Council staff will communicate the planting approach with private property owners abutting the true right bank of Smacks Creek as these planting areas will adjoin adjoins their backyards and outdoor living areas. Good communication/dialogue will be important in order to retain community support for this project.

Forest

Semi-mature native forest plantings cover most of the reserve area and line both sides of the main walkway running through the reserve. This was planted shortly after the adoption of the landscape development plan in the mid-2000s.

Actions

Facilitate natural process of decay and regeneration: Retain features like tree stumps, hollows and woody debris, as these are important as habitat, for forest regeneration, soil building and even aesthetics.

Eradicate weeds: The ongoing eradication of exotic woody species from the reserve area is important, and indeed many woody weeds have already been controlled by Council contractors and the Styx Living Laboratory Trust. It is important that work continues in order to halt further spread, reinvasion, and to maintain a high degree of natural character. Any herbaceous weeds shall also be controlled to levels where they do not compromise biodiversity or amenity values. Particular weed species of concern are discussed later in this document.

Introduce understorey plantings: The existing plantings have already matured to a stage where under-planting of some of the more frost, sun, and wind sensitive species will be possible. These types of plants, along with native vines and scramblers that require other plants for support, should be incorporated as secondary plantings wherever possible in order to help establish an authentic and fully functioning plant community and ecosystem. These types of plants will require additional care and maintenance over and above what the semi-mature plantings will be receiving and needs to be factored into maintenance work and/or contracts.

Vegetation maintenance along path: More regular maintenance of the track edges is intended to be carried to ensure people can easily move along the path unimpeded by overhanging branches or vines - including blackberry (e.g. see Figure 7). Any pruning shall be carried out in such a way that a high degree of natural character is maintained and does not look artificially pruned or hedged. Branches will only need to be pruned to just above head height, above which a canopy will be allowed to form across the path. Note that as the forest continues to mature, less of this type of maintenance is likely to be needed.

Remove Access to Redwood Aquatics: A short section of track that branches off the main track historically provided access from Redwood Aquatics (Figure 8). Following discussion with Redwood Aquatics, it has been determined that this gate and track is no longer needed. Therefore the gate shall be secured and the section of path removed and planted as native forest. The area with a seat that overlooks the pond will remain, although the path that connects it to the main path will be narrowed by extending the planting. This will reinforce the main pathway.



Figure 7: Overhanging branches and blackberry along paths and boardwalks.



Figure 8: Redundant track and gate to Redwood Aquatics to be removed and planted as native forest



Figure 9: Cleared areas along path to be planted with native forest edge or understorey species

Infill planting: In a number of locations along the main track where plantings have either failed or have been cleared by contractors, these areas will be re-planted with native forest understorey species to remove unsightly gaps and reduce ongoing maintenance costs.

Constructed pond

A pond (Figure 10) near the maintenance gate to Redwood Aquatics, was created by previous owners prior to the area becoming a public reserve. The previous owners also stocked the pond with goldfish and carp, and Council staff have sighted a red-eared slider turtle in the pond recently (2023) also. There are a number of key actions – outlined below – that can be taken to improve the quality of the pond and manage it as a valuable wetland habitat. After these actions are completed, monitoring of the pond's condition will be important to assess its ecological value. At this stage, there will not be any modification to the physical profile of the pond itself, as this may affect the water level in Smacks Creek and/or introduce invasive species in to the creek. The pond is also defined as a wetland under the National Policy Statement (NPS) on Freshwater.

Actions

Removal of weeds: The removal of deciduous exotic trees should improve the condition of the pond, by reducing leaf fall. Other pest plants within and around the pond shall also be removed.

Establish riparian planting: Appropriate eco-sourced native plants will be established to replace any pest plants around the perimeter of the pond.

Aquatic pest control: A survey for exotic/invasive fauna in the pond will be carried out including taking water samples to detect eDNA, and removing any undesirable species that are found. Monitoring regularly will be important for directing the future restoration of the pond. Pest animals are discussed later in this document.

Develop viewing area: Enhance the space around the existing seating area to create a space for quiet contemplation with good views to the restored pond area.



Figure 10: Constructed pond to be restored

Carex wetland

An area of approximately 470 m² of significant indigenous wetland vegetation at the Gardiners Road reserve frontage has been removed and sewn as lawn (Figure 11, top). We intend to restore this important area of wetland as a matter of priority.



Figure 11: Images showing the current state of the previous wetland. The top image was taken from the footpath parallel to Gardiners Road and shows the flat lawn area. The bottom image is taken from the boardwalk within the reserve, looking towards the lawn area.

this wetland area. However, we propose that this walkway will not be established as it will detract from the restored wetland's value as habitat for wildlife, including wildlife disturbance.

Improved maintenance: Parks operations staff shall ensure this wetland area is maintained to a tidy standard, and in particular shall be kept clear of woody weeds such as willow, alder and blackberry.

Actions

Re-establish *Carex secta* wetland: Current fill material in lawn area shall be removed to reinstate original profiles, and any contaminated soils (if any) disposed of appropriately. The area (approximately 470 m²) will be planted with eco-sourced plant species that are appropriate for this habitat type (refer Appendix 2).

Replace tree canopy along Gardiners Road: Appropriate eco-sourced native trees are to be planted to compensate for the removal of 500 m² of park tree canopy. City Arborist shall work with Council ecologists to determine the number of trees required to compensate for this loss based on appropriate tree species.

Screen boundary with adjacent property: Harakeke (*Phormium tenax*) and mingimingi (*Coprosma propinqua*) to be planted, and a fence erected, at the legal property boundary between Smacks Creek Riverbank Reserve and the private property. This is important to maintain the natural/wilderness character of the reserve and its visitor experience.

Removal of other additions: Council staff shall work with adjacent property owners to remove *Griselinia* hedge, any exotic specimen trees and private drainage infrastructure.

Note: The development proposal of 2004 for this reserve shows the main path branching off through

Remnant fen wetland

Towards the eastern end of the reserve, a remnant fen wetland (a wetland type that is typified by low nutrient levels and a unique suite of native plant species) has continued to degrade under increasing pressure and competition from exotic woody weeds – principally grey willow. However, it may be that some of the original fen plants are still managing to persist, and Council contractors and the Styx Living Laboratory Trust have recently carried out extensive woody weed control within the fen area in an attempt to halt its decline.

Actions

Weed control: Continue to control woody weeds as they occur with the objective of complete eradication.

Botanical Survey: Re-survey site to determine presence of any remnant fen vegetation. In doing so, evaluate the feasibility of continuing to manage the area as a true fen, or whether it is better to allow it to revert to a freshwater wetland.

Ex-situ conservation: Where rare or uncommon fen species are found to still occur but are deemed irretrievable, evaluate the feasibility of rescuing and growing plant specimens ex-situ at the Christchurch Botanic Gardens, or alternatively translocate to another less threatened fen wetland site.

Species reintroductions: Where it is thought that the fen wetland can be preserved and enhanced, identify candidate plant species and assess feasibility of reintroducing locally extirpated (no longer occurring) species to the fen wetland area.

Long-term monitoring: Establish vegetation monitoring protocols to track the state of the fen over time and to inform timely management interventions.

Leave to regenerate: Once the weeds are removed, the area can be left and monitored to see what naturally regenerates.

Reserve entrance areas

The areas at each entrance of the reserve (Figure 12) require enhancement to ensure they are tidy, align with the objective to achieve the aspirations of the approved landscape development plan, reduce maintenance costs, reduce mowing-related CO2 emissions, and create a more ‘wilderness feel’ to the reserve.

The Hussey Road entrance is currently maintained lawn, with a swale along the western side. The grass requires scheduled mowing to upkeep amenity standards.

The Gardiners Road entrance is currently untidy. There has been weed control in this area, but there is still rank grass, crack willow, grey willow and dead blackberry. There is also narrow strip of rural roadside berm lawn alongside Gardiners Rd.

Actions

Removal of weeds: Weeds shall be removed to prepare for native plantings.

Plant eco-sourced native plant species: The 2004 development plan shows a formal cabbage tree (*Cordyline australis*) planting at both entrances to the reserve (Refer Figure 3). However we know that cabbage tree leaves can become a nuisance when they litter the ground, and can cause the public to complain, especially when next to a path and residential property. To reduce maintenance costs, native shrub and ground cover planting shall be established at the Hussey Road entrance, and native ground cover plants will replace the grass berms at the Gardiners Road entrance. This will eliminate the need for regular mowing, and establish the reserve as a fully grass-free park.



Figure 12: Areas requiring maintenance and infill planting around the two entrances to the reserve: Hussey Road (top) and Gardiners Road (bottom three images).

Threats to our biodiversity

Pest plants

The Council has a legal obligation to protect and maintain indigenous biodiversity under the Resource Management Act (1991). A number of documents have been developed to assist Council in meeting those obligations. Regarding pest plant management, the Canterbury Regional Pest Management Plan (RPMP) is the regulatory document for pest management across the region. The Council has a legal obligation to meet the rules set out in this plan, and additionally works with ECan to help achieve objectives in the plan when rules are not set.

There are some pest plants classified in the RPMP that have been found in Smacks Creek Riverbank Reserve (Table 1). These, and any other plants listed in the RPMP, shall be controlled and reported back to the Parks Biodiversity Team for reporting on to ECan.

Table 1: Pest plants listed in the Canterbury Regional Pest Management Plan that have been found in Smacks Creek Riverbank Reserve.

Botanical Name	Common Name	Classification	Strategy
<i>Betula pendula</i>	Silver birch	Organism of interest	Eradicate
<i>Rubus fruticosus</i> agg.	Blackberry (wild aggregates)	Organism of interest	Manage
<i>Ulex europaeus</i>	Gorse	Pest	Eradicate

In addition to the species outlined in the RPMP, there are a number of other pest plant species that can threaten Council owned and managed land and should be a priority for control. The ones that have been found in Smacks Creek Riverbank Reserve are listed in Table 2.

Table 2: Pest plants not listed in the Canterbury Regional Pest Management Plan that have been found in Smacks Creek Riverbank Reserve.

Botanical Name	Common Name	Strategy
<i>Alnus</i> spp.	Alder	Eradicate
<i>Calystegia silvatica</i>	Great bindweed	Manage
<i>Pittosporum ralphii</i>	Karo	Eradicate
<i>Prunus</i> spp.	Cherry	Eradicate
<i>Salix cinerea</i>	Grey willow	Eradicate
<i>Salix fragilis</i>	Crack willow	Manage
<i>Sambucus nigra</i>	Elder	Manage

Given the relatively small size of the Smacks Creek Riverbank Reserve, most species listed in Tables 1 and 2 should be easy to eradicate from this reserve in the short-term. Other species are likely to be controlled to levels where they do not significantly adversely affect biodiversity values, and prevented from spreading to new parts of the reserve. Any reinvasion or new pest plant incursions shall be dealt with in a timely manner.

Appropriate herbicides should be used i.e. fatty acids normally used in urban parks cannot be used in this reserve due to the creek and wetlands. Glyphosate may be the most suitable option. Advice on the best control methods for different species of pest plants can be found on the Weedbusters website:

<https://www.weedbusters.org.nz/weed-information/weed-list/>

All pest plant locations and control work shall be recorded in the Council's GIS portal for pest plant management¹⁰.

¹⁰ GIS portal: <https://gis.ccc.govt.nz/portal/apps/sites/#/citizen/app/634ff87beade46d9a375d4c630808cba>

Pest animals

There are both aquatic and terrestrial pest animals to consider in this reserve. Queensland limpet DNA was found in an eDNA survey sample taken from Smacks Creek within this reserve. This will need to be investigated further for any biosecurity risk. On top of this, there could still be goldfish and/or carp present in the pond, and there is at least one red-eared slider turtle using the pond. Red-eared slider turtles are an invasive species worldwide, and are classified as pests under RPMPs in regions of the North Island and in Tasman-Nelson. The aquatic centre has a pond with this turtle species present, and Willowbank Wildlife Reserve also has them. These turtles also are released into the wild by people who owned them as pets. Turtles and goldfish have also been sighted in the ponds at 51 Hussey Road by the owners of the property. Further eDNA sampling in this pond and visual monitoring is required to assess what is in the pond, and anything undesirable should be removed and dealt with appropriately.

There are likely to be a variety of mammalian predators present in the reserve, such as brushtail possum, Norway rat, ship rat, mouse, cat (domestic and feral), hedgehog, stoat, weasel and ferret. However, if predator control was set up, there would likely be continual invasion of mammalian predators, due to the small size of the reserve and surrounding residential and commercial properties. Any control operation would have to be intensive to create an impact to benefit native wildlife within the reserve. The most suitable first step would be to set up a monitoring line of tracking tunnels to assess what pest species are present and their relative abundance, and encourage surrounding neighbours to trap in their private backyards. The Styx Living Laboratory Trust is setting up a trap library, so suitable traps could be loaned to neighbours for their own private properties. If there is community interest in trapping in the reserve in the future, then this can be considered.

Trapping projects in urban parks, such as Smacks Creek Riverbank Reserve, are subject to approval. Most projects are conducted by volunteers, and only in parks that meet the criteria¹¹. Approval for possum control would be unlikely due to the close proximity of the reserve to residential properties, and cat control would not be permitted for the same reason. If it was decided that trapping would occur, volunteers participating in the project must complete Council's community trapping workshop and associated courses. There would need to be liaison with Council staff, such as a Community Partnerships Ranger. Trapping could be used as an educational opportunity and would align with the objective to create a wilderness experience.

¹¹ Council's community trapping informational brochure: <https://ccc.govt.nz/assets/Documents/Parks-Gardens/Volunteering/Get-involved-trapping-in-parks-A5-brochure-WEB.pdf>

Interpretation

Currently there are no interpretation or informational signs within the reserve. There is an obvious need for signs at each entry point to indicate the entrances and increase interest in public use of the reserve. The Hussey Road entrance is particularly inconspicuous, with the only existing signs being used to indicate a bus stop along the road and the shared bike and walking track (Figure 10). The drafting of these entrance signs is currently sitting with the Parks Unit's Visitor Experience Team to be completed pending funding.



Figure 10: Entrance to the reserve from Hussey Road, with the driveway to Redwood Aquatics on the far right.

Interpretative signage could also enhance the experience of visitors to the reserve, providing information about (e.g.) the importance of wetland and river habitat, the role of habitat restoration, or information about the wider Pūharakekenui-Styx River catchment reserve network. The Styx Living Laboratory Trust has recently commissioned and installed eight interpretation signs at key locations throughout the catchment, each detailing an aspect of the natural environment specific to each site. These interpretation panels (e.g. see Figure 11) are designed so that they can be rotated periodically to provide a changing visitor experience. Panels proposed for Smacks Creek Riverbank Reserve should adhere to the same design styles and messaging to achieve a consistent approach to interpretation across the catchment's reserves.

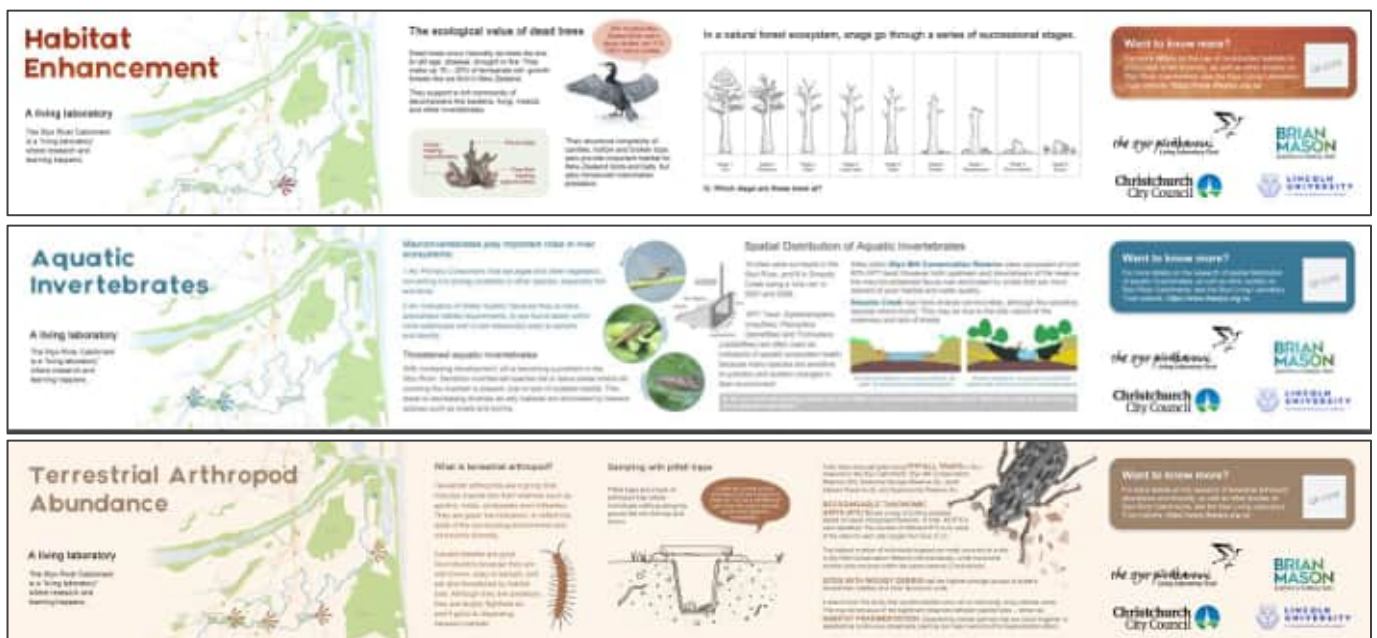


Figure 11: Examples of interpretation panels recently installed throughout the Pūharakekenui-Styx River catchment by the Styx Living Laboratory Trust.

Implementation plan

The following table provides an indicative costed implementation plan that outlines the basic ecosystem restoration tasks required to maintain the ecological integrity of Smacks Creek Riverbank Reserve. These scheduled items are mostly intended to be funded from Council's Parks Unit budgets except where indicated (e.g. Council's Three Waters budgets, private landowners or the Styx Living Laboratory Trust). Sums provided have been rounded to the nearest \$500, including a 15% contingency, and implementation will rely on budget availability.

Ecosystem restoration

Description	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Produce information leaflet to be distributed to neighbouring residents.	\$500					\$500
Relocate private fencing hedging and exotic specimen trees Gardiners Rd frontage, and excavate to reinstate original wetland profiles. <i>(Propose that Council re-coups part of these costs from adjacent landowner).</i>	\$11,500					\$11,500
Install 80 m (e.g.) post and cable fencing on Gardiners Road frontage.	\$4000					\$4000
Entrance planting at Gardiners Rd (955 plants).	\$11,500					\$11,500
Woody weed control. <i>(Propose that Styx Living Laboratory Trust contribute this item).</i>	\$2500	\$2500	\$1500	\$1000	\$500	\$8000
Install instream habitat features such as large woody debris (tōtara stumps) overhangs and boulders. <i>(Propose that these costs are covered from Council's Three Waters budgets).</i>		\$10,000				\$10,000
Infill planting of riparian margin (300 plants) <i>(Propose that these costs are covered from Council's Three Waters budgets).</i>		\$4500				\$4500
Infill planting beside the track (300 plants)		\$4500				\$4500
Entrance Planting at Hussey Road (880 plants).			\$11,500			\$11,500
Understory planting beneath existing forest (300 plants).				\$4500		\$4500
Eradication of aquatic pest species in pond (includes eDNA survey).		\$2000	\$5000			\$7000
Planting around pond (525 plants).				\$8500		\$8500
Re-locate existing seat and develop viewing area overlooking restored pond area.					\$4000	\$4000
Remove section of track to Redwood Aquatics and infill with planting (80 plants).					\$4000	\$4000
24 Month establishment.	\$4000	\$3500	\$3500	\$4500	\$3500	\$19,000

TOTAL	\$34,000	\$27,000	\$21,500	\$18,500	\$12,000	\$113,000
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Miscellaneous

Other items not directly associated with - but supporting - habitat restoration are listed below.

Description	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Reserve entrance signage (x 2)	\$3500					\$3500
Support for community planting and maintenance days.	\$250	\$250	\$250	\$250	\$250	\$1250
Pest animal monitoring using tracking tunnels	\$250	\$150	\$150	\$150	\$150	\$850
Pest animal backyard trapping		\$5000	\$250	\$250	\$250	\$5750
Design & install interpretation signage (x 2)			\$2000	\$4000		\$6000
TOTAL	\$4000	\$5400	\$2650	\$4650	\$650	\$17,350

Appendix one: Plant species list

Sourced from Lucas Associates' Ōtautahi Christchurch Indigenous Ecosystems guide: [https://www.lucas-associates.co.nz/christchurch-banks-peninsula/christchurch-ecosystems/Set 3_Plains Plant List AA \(lucas-associates.co.nz\)](https://www.lucas-associates.co.nz/christchurch-banks-peninsula/christchurch-ecosystems/Set 3_Plains Plant List AA (lucas-associates.co.nz))



KAHIKATEA – kereru – manatu, lush, older plains ecosystem

Food for native birds:

F = Fruit
S = Bird Seed
N = Nectar
B = Bush/Flower
I = Insects
For Seeds: L = fruit

Plant Tolerances

■ = tolerant or needs

□ = intolerant

½ = tolerant of some

* = to establish, protect from frost
† = toxic for toddlers

Staging

1 = 1st structural

2 = 2nd year

3 = only after canopy closure

PLANT LISTS Selected from vegetation natural to these wet Taitapu soils.

		Tolerances				Stages
		Food	SUN	shade	WIND	
TALL (NOBLE) TREES (> 12 m)			1/2	1/2	1/2	
<i>Alectryon excelsus</i>	titoki	F,I	1/2	1/2	1/2	3*
<i>Cordyline australis</i>	ti kouka, cabbage tree	F,N,I	1/2	1/2	1/2	1
<i>Dacrycarpus dacrydioides</i>	kahikatea, white pine	F	1/2	1/2	1/2	2
<i>Elaeocarpus dentatus</i>	hinau	F,I	1/2	1/2	1/2	3*
<i>Elaeocarpus hookerianus</i>	pokaka	F,I	1/2	1/2	1/2	2
<i>Pittosporum eugenioides</i>	tarata, lemonwood	F,I	1/2	1/2	1/2	1
<i>Plagianthus regius</i>	manatu, lowland ribbonwood (deciduous)	I,B	1/2	1/2	1/2	1
<i>Podocarpus totara</i>	totara	F	1/2	1/2	1/2	2
<i>Prumnopitys ferruginea</i>	miro	F	1/2	1/2	1/2	3
<i>Prumnopitys taxifolia</i>	matai, black pine	F	1/2	1/2	1/2	2
<i>Pseudopanax crassifolius</i>	horoeaka, lancewood	F,B,N,I	1/2	1/2	1/2	2
<i>Sophora microphylla</i>	kowhai	N,B	1/2	1/2	1/2	2
SMALL TREES & TALL SHRUBS (> 5 m)			1/2	1/2	1/2	
<i>Aristotelia serrata</i>	makomako, wineberry (semi-decid)	F,I,B	1/2	1/2	1/2	2
<i>Carpodetus serratus</i>	putaputaweta, marbleleaf	F,I	1/2	1/2	1/2	2
<i>Coprosma areolata</i>	net-leaved coprosma	F,B	1/2	1/2	1/2	2*
<i>Coprosma linariifolia</i>	linear-leaved coprosma, yellow-wood	F	1/2	1/2	1/2	2
<i>Coprosma lucida</i>	shining karamu	F	1/2	1/2	1/2	2
<i>Coprosma robusta</i>	karamu	F	1/2	1/2	1/2	1
<i>Coprosma rotundifolia</i>	round-leaved coprosma	F,B	1/2	1/2	1/2	2*
<i>Fuchsia excorticata</i>	kotukutuku, tree fuchsia (decid)	F,N,B	1/2	1/2	1/2	3*
<i>Griselinia littoralis</i>	kapuka, broadleaf	F,I	1/2	1/2	1/2	2
<i>Hedycarya arborea</i>	porokaiwhiri, pigeonwood	F,I	1/2	1/2	1/2	3*
<i>Hoheria angustifolia</i>	houhere, narrow-leaved lacebark (semi-dec)	I	1/2	1/2	1/2	1
<i>Leptospermum scoparium</i>	manuka, tea tree	I	1/2	1/2	1/2	1
<i>Lophomyrtus obcordata</i>	rohutu, NZ myrtle	F,I	1/2	1/2	1/2	2
<i>Melictyus micranthus</i>	manakura, shrubby mahoe	F,I	1/2	1/2	1/2	3
<i>Melictyus ramiflorus</i>	mahoe, whiteywood	F,L,I	1/2	1/2	1/2	3*
<i>Myrsine australis</i>	mapau, red mapau	F,L,I	1/2	1/2	1/2	3*
<i>Neomyrtus pedunculata</i>	rohutu, NZ myrtle	F,I	1/2	1/2	1/2	3*
<i>Pennantia corymbosa</i>	kaikomako, ducksfeet	F,N,I	1/2	1/2	1/2	2
<i>Pittosporum tenuifolium</i>	kohuhu, black matipo/mapau, tawhari	F,I	1/2	1/2	1/2	1
<i>Pseudopanax arboreus</i>	fivefinger, whauwhaupaku	F,N,I	1/2	1/2	1/2	2
<i>Pseudowintera colorata</i>	horopito, peppertree	F,N,I	1/2	1/2	1/2	2
<i>Schefflera digitata</i>	patete, seven-finger	F,I,B	1/2	1/2	1/2	3*
<i>Streblus heterophyllus</i>	tūrepo, small-leaved milk tree	F,I	1/2	1/2	1/2	3*

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			Tolerances						
			Food	sun shade	wet dry	wind	Stages		
CLIMBERS & VINES									
<i>Clematis forsteri</i>	yellow clematis	I		½	½	½	½	3	
<i>Clematis paniculata</i>	puawananga, bush/white clematis	I		½	■	½	□	3*	
<i>Parsonsia capsularis</i>	kaiwhiria, NZ jasmine	I		■	■	½	½	■	3
<i>Parsonsia heterophylla</i>	kaiwhiria, NZ jasmine	I		■	■	½	■	■	3
<i>Passiflora tetrandra</i>	kohia, NZ passionvine	I		□	■	½	□	½	3*
<i>Ripogonum scandens</i>	kareao, supplejack	F,I		½	■	½	□	½	3*
<i>Rubus australis</i>	taramoa, bush lawyer	F,I		½	■	■	□	□	3
<i>Rubus cissoides</i>	not in Riccarton!	F,I		½	½	½	□	½	2
<i>Rubus schmidelioides</i>	taramoa, narrow-leaved lawyer	F,I		■	½	½	■	■	2
SHRUBS & SCRAMBLERS									
<i>Calystegia tuguriorum</i>	powhiwhi, NZ bindweed	I		■	½	□	½	■	2
<i>Coprosma rhamnoides</i>	red-fruited mikimiki	F,L		□	■	½	½	½	3*
<i>Coprosma propinqua</i>	mikimiki, mingimingi	F,L		■	½	■	■	■	1
<i>Coprosma rubra</i>	red-stemmed coprosma	F,L		■	½	½	½	■	1
<i>Hebe salicifolia</i>	koromiko	I		■	□	□	½	■	1
<i>Fuchsia perscandens</i>	climbing fuchsia	F,L,N,I		½	½	□	½	½	3*
<i>Melicope simplex</i>	poataniwha	F,I		½	■	½	½	■	3
<i>Metrosideros diffusa</i>	white/climbing rata	I		□	■	½	□	□	3*
<i>Myrsine divaricata</i>	weeping mapou	F,L,I		½	½	■	½	■	2
<i>Olearia bullata</i>	crinkly shrub daisy	S,I		■	½	■	½	■	
<i>Pseudopanax anomalus</i>	shrub pseudopanax	F,N		½	■	½	□	½	3
<i>Rubus squarrosus</i>	leafless lawyer	F,L,I		■	½	□	■	■	2
<i>Urtica ferox</i>	ongaonga, tree nettle	I		½	■	□	½	□	3*
PERCHING PLANTS & PARTIAL PARASITES									
<i>Asplenium flaccidum</i>	raukatauri, hanging spleenwort	B		½	■	□	□	□	3
<i>Ileostylus micranthus</i>	NZ mistletoe	F,N,B		■	□	□	□	■	3
<i>Korthalsella lindsayi</i>	dwarf mistletoe	I		■	□	□	□	■	3
<i>Pyrrosia elaeagnifolia</i>	leather-leaf fern			■	■	□	■	■	3
<i>Tupeia antarctica</i>	NZ mistletoe	F,I		■	□	□	□	■	3
GROUNDCOVER HERBS & 'GRASSES'									
<i>Acaena anserinifolia</i>	pipiri, bidibidi	S,I		■	½	□	½	■	3
<i>Anemanthele lessoniana</i>	hunangamoho, bamboo/wind grass	S		■	■	□	½	■	2
<i>Astelia fragrans</i>	kakaha, bush flax	F,I		■	■	½	½	■	2
<i>Astelia grandis</i>	kakaha, swamp flax	F,I		■	■	■	½	■	1
<i>Carex cockayneana</i>	forest sedge	S		■	■	½	½	■	3
<i>Carex forsteri</i>	forest sedge	S		■	■	½	½	■	3
<i>Carex lambertiana</i>	forest sedge	S,		■	■	½	½	■	3
<i>Carex secta</i>	pukio	S		■	□	■	□	■	1
<i>Carex solandri</i>	forest sedge	S		■	■	½	½	■	3
<i>Carex virgata</i>	swamp sedge	S		■	½	■	½	■	1
<i>Cortaderia richardii</i>	toetoe	S		■	□	■	■	■	1
<i>Cyperus ustulatus</i>	upoko-tangata, umbrella sedge	S		■	□	■	½	■	1
<i>Deschampsia caespitosa</i>	tufted hair grass	S		■	□	■	½	■	1
<i>Dianella nigra</i>	turutu, blue berry	F,I		■	■	□	■	■	2
<i>Echinodium hispidum</i>	moss			□	■	½	½	□	3
<i>Gahnia xanthocarpa</i>	giant gahnia	S		½	■	½	½	□	3
<i>Hypnum cupressiforme</i>	moss			½	■	½	■	■	3
<i>Juncus distegus</i>	wiwi, tussock rush	S		■	□	■	½	■	1

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		Tolerances					Stages
		Food	sun	shade	wet	dry	
<i>Juncus edgareae</i>	wiwi, tussock rush	S	■	□	■	■	1
<i>Juncus sarophorus</i>	wiwi, tussock rush	S	■	□	■	■	1
<i>Libertia ixioides</i>	mikoikoi, NZ iris	F,I	■	■	■	■	3
<i>Microlaena avenacea</i>	bush rice grass	S	□	■	■	■	3
<i>Nertera depressa</i>	nertera	F,I	■	■	■	■	3
<i>Parietaria debilis</i>	NZ pellitory	I	■	■	■	■	3
<i>Phormium tenax</i>	harakeke, NZ flax	N,L	■	■	■	■	1
<i>Pratia angulata</i>	panakekene, creeping pratia	F,I	■	■	■	■	1-3
<i>Ranunculus reflexus</i>	NZ buttercup	S,I	□	■	■	□	3
<i>Stellaria parviflora</i>	NZ stitchwort	S,I	□	■	■	□	3
<i>Thuidium sparsum</i>	moss		■	■	■	■	3
<i>Uncinia leptostachya</i>	matau, hooked sedge	S	■	■	■	■	3
<i>Uncinia uncinata</i>	watau/kamu, hooked sedge	S	■	■	■	■	3
<i>Urtica incisa</i>	dwarf nettle	I	■	■	■	□	3

GROUND & TREE FERNS

<i>Asplenium flabellifolium</i>	necklace fern	B	■	■	■	□	3*
<i>Asplenium gracillimum</i>	makau, graceful spleenwort	B	■	■	■	□	3*
<i>Asplenium terrestre</i>	ground spleenwort	B	■	■	■	□	3*
<i>Blechnum chambersii</i>	kiokio, a hard fern		□	■	■	□	3*
<i>Blechnum discolor</i>	piupiu, crown fern		□	■	■	□	3*
<i>Blechnum fluviatile</i>	kiwakiwa, creek fern		□	■	■	□	3*
<i>Blechnum novae-zelandiae/minus</i>	swamp kiokio		■	■	■	□	2
<i>Blechnum penna-marina</i>	kiokio, little hard fern		■	■	■	■	3
<i>Cyathea dealbata</i>	ponga, silver (tree) fern		■	■	■	□	3*
<i>Cyathea smithii</i>	katote, soft tree fern		■	■	■	□	3*
<i>Dicksonia fibrosa</i>	kuripaka, wheki ponga - tree fern		■	■	■	□	3*
<i>Dicksonia lanata</i>	tuokura, woolly tree fern		■	■	■	□	3*
<i>Dicksonia squarrosa</i>	wheki, rough tree fern		■	■	■	□	2
<i>Histiopteris incisa</i>	mata, water fern		■	■	■	□	3
<i>Hypolepis ambigua</i>	rough pig fern		■	■	■	■	3
<i>Hypolepis rufobarbata</i>	sticky pig fern		■	■	■	■	3
<i>Lastreopsis glabella</i>			□	■	■	□	3*
<i>Leptopteris hymenophylloides</i>	heruheru, crape fern		□	■	■	□	3*
<i>Pellaea rotundifolia</i>	tarawera, button fern		■	■	■	□	3
<i>Microsorium pustulatus</i>	maratata, hounds tongue fern		■	■	■	□	2
<i>Polystichum vestitum</i>	puniu, prickly shield fern		■	■	■	■	2
<i>Polystichum zelandica/richardii</i>	pikopiko/tutoke, shield fern		■	■	■	□	2
<i>Pneumatopteris pennigera</i>	pakau-roharoha, gully fern		□	■	■	□	3*

Note Use plants propagated from wild populations and ask for natural local species rather than cultivars.

1. Don't use the common North Island lacebarks (*Hoheria populnea* or *Hoheria sexstylosa*) as they hybridise with the natural local narrow-leaved lacebark (*Hoheria angustifolia*).

2. The common grown Golden Totara is a sterile hybrid and therefore does not produce berries, food for birds.



Underlayers: Clay & sand alternating on silt over greywacke river stones (2-100mm rounded) with some peat.

Appendix two: Gardiners Road frontage landscape concept plan

