Mahika kai in our backyard – *Nurturing our people and our environment*

Te taiao is highly valued and is intact so that kai & other cultural resources are available to our whānau in the future and that they can enjoy the environment living in a holistic way

E nohoana tatou kei raro
Ko Hikaroroa to maunga
Ko Waikouaiti te awa
Ko Araiteuru te tai
Ko Moana nui a Kiwa te moana

Contents

1. Introduction

The objective of this work is to implement a Mahika Kai strategy. The initial task has been to gather together the information on biodiversity restoration work that is progressing in the Kati Huirapa ki Puketeraki rohe, both with and without direct runaka involvement focusing on the immediate coastal area of the Puketeraki rohe. The initial geographic focus of this project is on our current runaka engagement and capacity. The larger whenua tupuna was utilised during seasonal inland migrations to the lake district for gathering mahika kai, with permanent inland settlements existing from time to time. While the larger area falls within the wider Kati Huirapa ki Puketeraki rohe this project begins at a scale that is currently practicable.

The aim of this work is to inform and support the Te Taiao section 1.3 of the Strategic Plan which aims to;

- Develop a clear environmental vision and strategy to prioritise what we want to achieve environmentally and how we intend to achieve it,
- Maintain/ form strategic partnerships & relationships to leverage off to enable us to be more effective,
- Allocate funding for priority projects.
- Share traditional knowledge of te taiao,
- Support takatatiaki & kaitiaki access training opportunities & engaging with support networks,
- Communicate vision for te taiao to whānau and the wider community,
- Work to ensure the voice of the rūnaka is heard where it needs to be heard.

I have developed an overview of the environmental work that is currently happening in our rohe and how we are contributing to that work. It describes the current partners with whom we are working. The format of the project shares mahika kai knowledge and research of coastal Otago between the Waihemo mouth and the Flagstaff (Figures 1 and 2). The presentation of this project is as a working document. I hope that as it grows it will allow whanau to gain an oversight to the extent that they feel empowered to actively engage in some of this work or find new projects which haven't yet been conceived. An overview of work that we and others have done allows us to assess of where new opportunities could exist. This experience and relationships and the knowledge that it fosters provides strategic alliances that provide leverage between projects.

Mahika kai refers to the natural indigenous world that Maori understood and utilised. Mauri connected all mahika kai, a river was not a some of its parts but was an entity. Physical mauri were placed to seek to recognise and create something tangible within which to focus the spiritual dimension of life and appease its unpredictability. The atua and the tipua, one day a river replete with patiki, kanakana, tuna and inanga, the next a raging torrent. Mahika kai was built by the accumulated experience or matauraka of our tupuna. Experientially we have lost much of this as we have lost the forests, the lands and the fisheries. Subsumed by European laws and practices of landuse based on agriculture, monoculture, introduced species and now global agribusiness. The tension between mahika kai and preservationist conservation still exists, but many more now understand the desirability of having a world where there the life of our indigenous species is not so marginal that they must be regarded as remnant curiosity, or sacred in their rarity. Though sadly rarity is largely the current situation.

1.1 Pataka matauraka

Biodiversity work in the coastal Otago area is being undertaken by a range of organisations, governmental, local territorial, educational and community. Many of these have a relationship with the runaka, in some cases through one or more members of the runaka serving representative roles. When the runaka is approached for representation on local government or community projects with an environmental take, the request goes to the Komiti Kaupapa Taiao (KKT) for determining who might best carry the runaka kaupapa for that role. This project begins assembling that information in a single database which could be appended to the web based interface, allowing members to understand the conservation landscape and whom they might approach if they are interested in taking an active interest. We need to be facilitating the tuakana/teina roles and organisational transparency contributes to that.

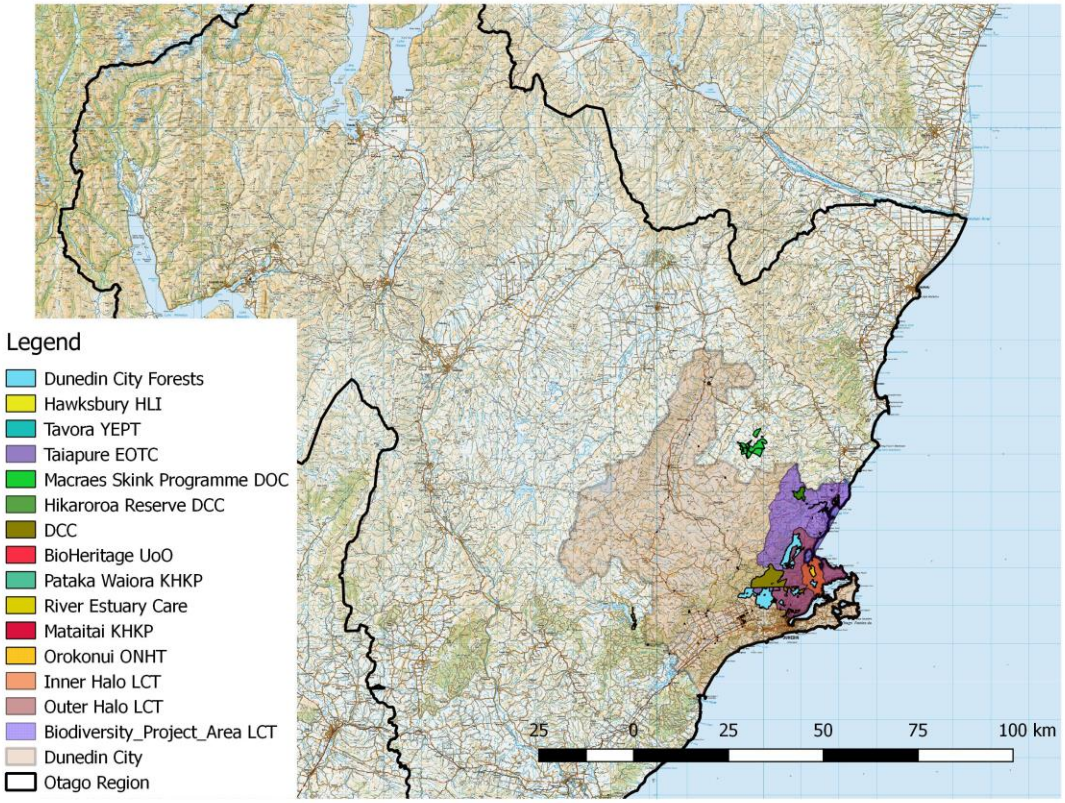

Figure 1. The larger Otago rohe showing local government territorial regional boundaries and range of project areas.

1.2 The Waikouaiti River, the beating heart

The Waikouaiti River has always been central to the life of the haapuu. The interface between the marine and freshwater worlds is rich in fish, shellfish and waterfowl. It is a transitional environment for migratory species whose life history utilises both food sources. The rich alluvial plains created by the river and proximity of the surrounding hills have supported a diversity of forest types and birdlife. Renewed focus on the degraded state of our freshwater environments and predator beleaguered forest ecosystems has meant contestable funding has been available for restoration projects. The river and its bounty of life has provided an obvious focus for this effort as has our dependence on the dwindling catch from the sea. This requires we understand our current landscape and the needs of our mahika kai species more fully. There has been considerable work contributing to this that can inform how we develop our own projects and how we contribute to others.

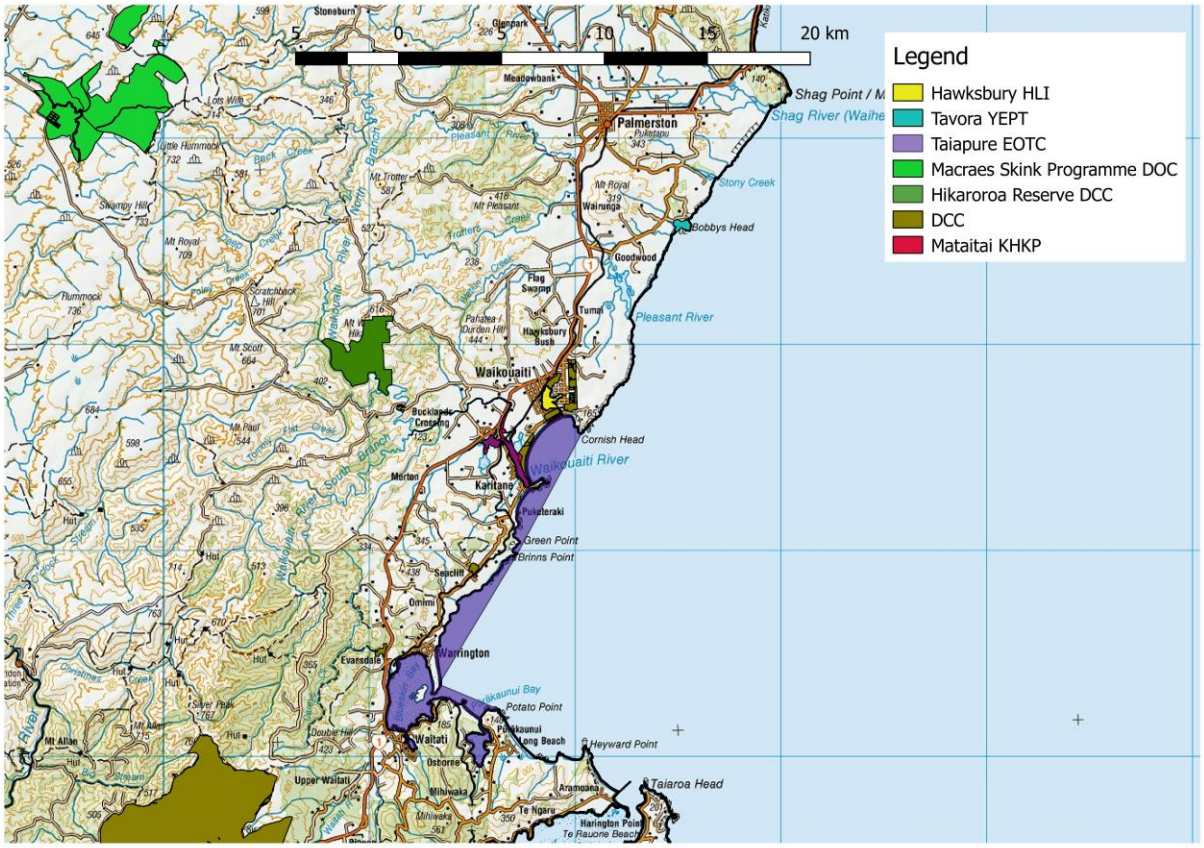

Figure 2. The coastal aspect of the Kati Huirapa ki Puketeraki rohe. The coloured blocks describe several of the projects located around Karitane.

The government's shift from the Department of Conservation delivering the bulk of species protection and restoration, to community engagement in delivering conservation provides opportunities for us to allocate funds to implement conservation ourselves. There are now several large funding streams (WaiOra Fund, MfE and BioHeritage) resourcing projects on the Waikouaiti River. Overlapping with these are the management processes, Mataitai and Taiapure. The riverine projects are still in their early stages so it is timely to create processes for storing and sharing information and ensuring that these projects are synergistic and deliver the greatest benefit to the river through participation. This means collaboration and building on processes that enable participation. The runaka aims to facilitate its members to exercise their kaitiakitaka. Sources of funding available to the runaka are in most cases aimed at engaging haapuu to manage their interests in nga taonga tuku iho, and funding objectives seek to provide that haapuu are resourced to do so. Since funding is aimed at building Maori engagement and capacity, it makes sense that we aim to ensure that Maori deliver on this work. We need to be growing our own capabilities for delivering real biodiversity

outcomes, while we are resourced to do so. The intergenerational life of the marae in the community makes Kati Huirapa a natural institution for accumulating the matauraka of coastal the Otago landscape which means organising our information to sustain our ability to contribute. It makes sense to build our experiential and intellectual capital but also recognising where this currently already exists.

'Beyond Orokonui' planned and being implemented by the Landscape Connections Trust, aims to extend the benefits of Orokonui Sanctuary to the wider area from north Dunedin to Waikouaiti (Figure 3). Through Predator Free Dunedin, this is likely to eventually include the city, thereby creating pest management contiguous from Otago Peninsula to Karitane. These large-scale trapping programmes will have huge benefits to our native species, their local distribution and abundance. It has the potential to be the most significant contributor to the well-being of our mahika kai yet initiated. The planning, inventory and methodologies are available as reports referenced and summarised here to make it accessible. An overview of this programme is important to understanding the unique habitats on our doorstep and the challenges they are facing, but also how we can organise ourselves to co-operatively act at a landscape scale. And it does take co-operation and common goals to provide the consistent effort required to shift ecological scale problems.

The overlap and synergies of these projects is becoming increasingly complex. Alongside the Waikouaiti River restoration plantings that have been progressed by the River Estuary Care Group. They have funded three comprehensive reports (Lloyd 2004, Onley 2005 and Patrick 2008) included here, on the vegetation, birds and invertebrates of the estuarine reach of the river. New work has begun throughout the Waikouaiti River catchment initiated by the runaka. The University and TRoNT have been involved via the Taiapure and Te Pataka o Waiora and Wairua projects.

The ORC and DOC have statutory responsibilities and seek engagement. DOC via its stretch goals strategy is wanting to build on existing 'ki uta ki tai' projects. This may or may not be the best way for them to contribute to developing freshwater conservation in the rohe. Kati Huirapa have a pivotal position in determining where DOC can best add value. Virtually no freshwater conservation work is occurring in the Waihemo/Shag catchment, also high in freshwater values and cultural association. For haapuu members seeking to engage with their kaitiaki responsibilities data, information and work plan sharing is needed to ensure that these programmes achieve optimal outcomes.

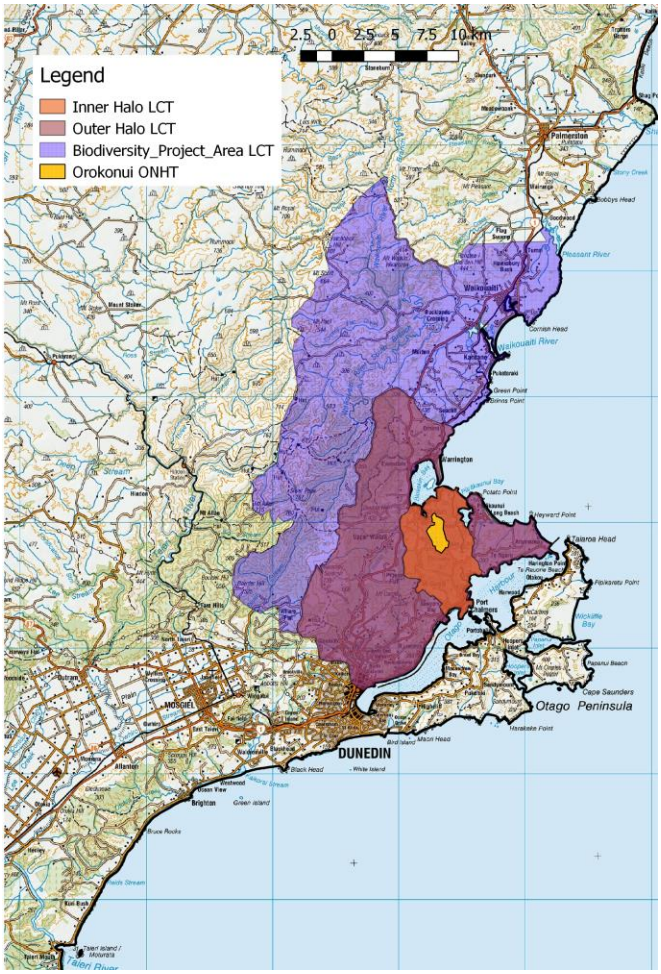

Figure 3. Orokonui Sanctuary at the heart of 'Beyond Orokonui' and the inner and outer halos, terms used to describe the tiered approach to predator control, planned and being implemented by the Landscape Connections Trust.

2. Methods and Outputs

2.1 Mahika kai project outcomes

This project includes two QGIS mapping projects 'MK Mapping' and MK data. The first of these brings summary information from the reports and science papers, biological data relevant to mahika kai species, generated from the projects (Appendix 1). The second data accessed from governmental and online sources (Appendix 2). The literature provided does not provide a full and absolute account of all the material generated, but represents a substantial body of work, that I have been able to access, both online and by approaching partners and organisations involved. It is hoped that this provides a working document for managing information as projects progress. If and how that will occur would require discussion and resourcing.

Key outputs:

- Web view interface of projects and associated reports,
- QGIS database of 'MK data',
- Excel database of material collated, partner organisations, runaka representatives
- Project Report
- Database of 56 PDF reports

The mapping work is presented through a web viewer interface backed by a collated excel database. The interface will provide several levels of password protected access. The presentation is compatible with the cultural mapping programme. The web viewer was developed with TRoNT support (Adrian Patchett) and is provided from a TRoNT server. The web viewer interface allows for presentation of corrections by web users (corrected by an administrator) and additional information to be added as time work programmes progress. A map template is provided, with legend and layer information to enable viewers to save and print map views and layers of interest to them. A spiral bound hard copy of key areas and extents will provide an overview of the material. The interface will be available to all runaka members but with varying levels of access to sensitive material.

The establishment of the East Otago Taiapure has generated a large body of research that does not exist in a single repository, but is scattered throughout masters and doctoral theses and scientific reports. Dan Prichard seeing the need to provide access to

this body of work collated a useful bibliography of these current to 2010. This work is publicly accessed through https://www.pritchard.co/research/localknowledge/. There is now another seven years of work which could be added to this. I have sought and received some of this, it is included in the 'MK Projects' mapping database, but there is material outstanding.

A project developed as part of the South-East Marine Protection Forum, is the SeaSketch Project, developed by DOC. This is a web-based interface mapping; Marine Protection Areas for consultation, boundaries, management plans and regulations, biodiversity, historical (including archeoligical sites), marine features, recreational activities and fishing.
http://www.seasketch.org/#projecthomepage/5331eff529d8f11a2ed3dd04/layers

Another DOC project is the restoring estuaries project. Currently this is mapping agencies and communities are working together to enhance estuaries. The River Estuary Care project is listed for the Waikouaiti.
http://www.doc.govt.nz/nature/habitats/estuaries/restoring-estuaries-map/

2.2 Mahika kai categories

Each reference is given a broad mahika kai categorisation. The map then can be queried so a searcher can find information for mahika kai categories. The categories are given in Table 1. More work could be done on adding species and determining local names for species.

Table 1. Mahika kai categories and examples of species within each group.

Mahika kai group	Examples: species to be built on
Forest birds	e.g. kaka, kereru, tui, toutouwai, miromiro, rironiro, piwakawaka, pipwharauroa, ruru, karearea, kahu, matata
Freshwater fish	e.g. patiki, kokopu, inaka, matamata, tuna, toitoi, kanakana
Waterfowl	e.g. pateke, putakitaki, swan, kuruwhengi, papango
Estuarine fish	e.g. patiki, kokopu, inaka, matamata, tuna, toitoi, porohe, makawhiti
Marine fish	e.g. blue cod, elephant fish, barracoutta, groper, red cod,
Marine invertebrates	e.g. koura, paua, tuaki, tuatua, pipi, bubu
Marine mammals	e.g. tupoupou, tohora
Seabirds	e.g. toroa, titi,
Shellfish	e.g. tuaki, paua, tuatua, pipi, bubu
Wetland plants	e.g. raupo, wiwi, wawa, harakeke

Wading birds	e.g. reef heron, kuaka, torea, poaka
Forest trees	e.g. totara, kowhai, kotukutuku, akeake, tikouka, manuka, kanuka, mahoe, kaikawaka,
Freshwater invertebrates	e.g. koura, kakahi
Dune plants	e.g. pikao

2.3 Mapping Projects

Two mapping projects are presented, both can be made available through the web interface (yet to be decided it only the reference material and project areas will be, it may be possible to coalesce the two). The maps were constructed in QGIS (QGIS Development Team, 2009. QGIS Geographic Information System. Open Source Geospatial Foundation. URL http://qgis.osgeo.org).

2.4 References and Project Map

To date (10/3/2017) there are 61 reports and scientific papers presented (Appendix 1). The material is presented as a summary of the information provided not just a reference. A summary of each of the study objectives, key findings and recommendation are given. This allows for the key information to be disseminated This is meant to provide an over view of the mahika kai findings and to guide the reader towards acquiring more detailed information in the full report. A digital copy of 57 of the reports is held by the office, 5 are in hardcopy, 34 reports are available online. Links are not provided as an internet search can be done with the information provided, though links could be added if it were considered desirable. The information fields were limited to 350 words.

I have gathered material researched from the rohe which supports understanding mahika kai species and their habitat. Of the 61 reference materials 29 are published reports, four unpublished reports, 13 science papers, six plans, eight theses and 1 conference proceedings. Although the maitaitai, taiapure, and Waiora project are runaka initiatives the runaka has not been the lead author in the reports (Table 1). Some of the material is important ecosystem information but does not fit mahika kai categories, and example of this is Brian Patricks 2008 Insects of the Waikouaiti River Report. The mapping shapefiles describing project areas have been obtained or created. Some research does not fit any defined project, some University theses and the ORC water resource reports fit this category. Dunedin City Council (DCC) reports are referenced under the DCC reserves shapefile, except for Mt Watkins/Hikaroroa, which

has significance to Kati Huirapa ki Puketeraki. The DCC Significant Natural Area assessments and Orokonui Sanctuary Reference will be appended to the shapefiles but not summarised. It is not possible to summarise the details of the SNAs. The full copies of the 27 reports are however provided as part of the accompanying database of material. Orokonui Sanctuary has generated a range of studies and now has the Knowledge Solutions Group, as a subcommittee, managing its research objectives. The Orokonui Sanctuary Reference that will accompany the project area is the full information obtained and gives the scope of the research at Orokonui. Anybody wanting more detailed information will need to approach the key researchers.

The Waitaki District Council has identified in its Plan, areas of significant nature conservation value and geopreservation sites. These areas of significant indigenous vegetation and habitat of indigenous fauna are listed and appended to the Waitaki wards Palmerston, Waihemo and Nenthorn. I did not attempt to summarise the plethora of DOC reports or information that is obtainable for protected areas. That would be a significant undertaking and is available dispersed through the DOC website and Conservation Management Strategy. I have included the Macraes Skink Programme since it is a species-specific project for local endemics that has had considerable management effort over the last 20 years. Freshwater reports were hard to allocate to project areas, but are extremely important for mahika kai, so for some I have provided polylines from Freshwater Ecology New Zealand or FENZ (Leithwick et al. 2010) to designate their presence. There is also a wealth of grey literature, resulting from resource consenting environmental impact assessments (EIAs). Several are included here but largely that is another job. And although generic work that is species specific but not locale specific is no doubt useful, the focus here is on the work occurring locally.

The 18 project areas defined are defined: the inner and outer halos, Landscape Connections Project, Orokonui Sanctuary, Hawksbury Lagoon Society Inc., River – Estuary Care, Macraes Skink Project, Mt Watkin/Hikaroroa Reserve, Dunedin City Forests, Yellow Eyed Penguin Trust Tavora Reserve, Orokonui Stream, Mataitai, He Pataka Waiora, BioHeritage, Waitaki District, Dunedin City Council, East Otago Taiapure, Otago Regional Council and 7 stream polylines. The examples of these presented here are Figures 1 & 2. Fifteen organisations have been the primary leading organisations involved in produacing the information presented here (Table 2).

Table 2. Leading organisations responsible for reports presented in this project.

Lead Organisation	Count
Department of Conservation	9
Dunedin City Council	8
Hawksbury Lagoon Society Incorporated	2
Landcare Research	1
Landscape Connections Trust	4
Ministry for Primary Industries	1
Oceana Gold Limited	1
Otago Regional Council	5
Port Otago Limited	1
East Otago Taiapure Management Committee	1
University of Otago	22
Waikouaiti Karitane - River Estuary Care Group	3
Waitaki District Council	1
University of Otago, TRoNT	1
University of Otago, TRoNT, Runaka	1

2.5 Project shapefile data

Data was obtained from several sources (Appendix 2). DOC staff kindly provided a range of data files and Dunedin City Forests their block boundaries. Much of the data and topographical maps (Topo250 and Topo50) were sourced through the open source site LINZ Data.

A shapefile layer is included that divides the coastal rohe into FENZ (Leithwick et al. 2010) into catchment orders. The Clutha River/Mata-Au 6 – 7th order and Taieri River 5th order catchments are presented at high order catchment scales. The coastal catchments are lower order catchments (1st 4th order). Catchment scales are a convenient, ki uta ki tai mode of viewing and analysing local habitat extents. They define the cumulative downstream effects through the riverine systems to the sea of landuse. Descriptives of various types of landuse/protection and restoration allow for percentages of a catchment area (planar) to be described. Improvements in areas under active management can then be compared and measured *ki uta ki tai* (mountains to the sea). Wildland Consultants has very fine detail vegetation and habitat data for the entire Landscape Connections Area, but we would need to pay for this.

An additional project I undertook was to map River-Estuary Care's restoration areas and create a database of site information, area fenced, fencing type, trees planted,

instream values, plant survivorship etc. Joel Vanderburg and I worked at mapping these areas first in the field and then on GoogleEarth. These files were given to River Estuary Care so they can maintain them in future.

2.6 Web-based interface

The migration of the QGIS data and references to web format was done at TRoNT by Andrian Patchett using Web AppBuilder for ArcGIS. This is available using http://arcg.is/2slp5e2 Password: MKBY Mah1nga. As yet the shapefile data without references have not been added. If this is considered useful at a local wananga, we will request that this is added. From initial discussions this is likely.

3. Recommendations

The comprehensive research that has taken place already provides a large contribution to the information needed for assessing where we can best work towards achieving improved outcomes for mahika kai species. The recommendations from these works are summarised in (Table 3) and I suggest ways we support or undertake these outcomes. This would be best achieved by a series of wanaka (Box 1) that involves expert presentations, then we work through prioritising options. Engaging some of the authors of key reports, presented in this project, in discussing their findings would encourage use of the mapping project and create a baseline understanding for runaka members of some key environmental issues identified in the rohe. This would inform mahika kai direction, planning and implementation.

In most cases work presented here focuses on restoration ecology. It will be up to Kati Huirapa ki Puketeraki to develop mahika kai focused plans. In some cases these may not represent natural ecosystems but represent native arboriculture or other food production systems based on native species. Encouraged in a wild state, this type of food production can provide economic resilience.

I also have identified some of the primary issues we should address to ensure good governance, administration and communication of runaka projects. These will ensure a comprehensive information base and provide for institutional memory. As follows;

- Maintain a current accurate database of runaka projects and information pertaining to them that can be accessed by members this should include; objectives, methods, work planning, results, reports and the annual work plans.
- Raw data currently being gathered in local projects and in runaka led projects should be added to a runaka database (e.g. Te Pataka Waiora fish, water quality and macro-invertebrate data, Bioheritiage data) as work progresses. It is important that the runaka has a repository for raw data and spatial data and reference material and this is kept current. This knowledge is funded to the hapu and should be owned by the hapu. Important that it is keep within the runaka process. That we do not just get reports but that we own the information and demonstrate the skills to manage it.
- Resourcing - Cost for overseeing the data and information capture process is a cost to each project. Ensure a process for reports being delivered to the runaka in a timely manner, ensure agencies understand the importance of providing this information. Groups such as the Ngai Tahu Committee at the University of Otago work with us on this.

- Ensure that information we produce goes to open source data collections, such as the New Zealand Freshwater Fish Database so that all new Zealanders can work towards protecting the environment. Currently part of electric fishing license.
- Create a process for delivering a local annual or biannual hui, for runaka work being undertaken in the catchment. This will provide overviews of what's working, what's not working and how we can do things better.
- Add funding rounds to the webpage so people can see opportunities for funding projects.
- Review and map the mahika kai information from tenure review, both from the cultural and natural resources reports.
- Inventory of runaka expertise in environmental mahi, encouraging and rewarding participation.
- Database KTKO biodiversity reports held from RMA processes; eg; fisheries reports done by consultants for developers.
- Reference and sort the River-Estuary Care library, River – Estuary Care have over the years collected information on local studies, that they have been happy to share with the runaka, that material should be systemised so it can be utilised by the runaka and local restoration community.
- Determine how we best work with TRoNT resourcing.

Box 1. Suggested wanaka subjects for developing haapu participation in mahika kai and restoration projects.

- Hold workshops on restoration skills, predator trapping, making traps (subsidized by runaka for home use), bird call identification, identifying plants for rongo etc,
- Deliver the final web-based project as undertaken by RJC and demonstrate its use, think about the recommendations presented through the project,
- Get people to work through the recommendations for restoration highlighted by that project and think about criteria for developing runaka focussed initiatives
- Talk about the species that we would like to see receive focus and the ways that we can contribute to current projects to achieve that or develop new ones,
- Looking at mahika kai species, what is still present, which are perceived as most important to us, which ones can we develop to use, which require longterm development, which can be developed in backyards and how to work with public and private landowners,

- Brainstorm a series of restoration mahika kai projects that will meet those criteria, and possibly be the theme of another workshop or wanaka,
- Look at our processes and decide how to manage and co-ordinate restorations, their governance, implementation, resourcing and information. The role and parameters of other organisations such as, DOC, TRoNT, Fish and Game and LCT in supporting our work. Look at the recommendations for this as listed in the first report to prioritise where we put administrative effort.

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4. Summary

This stage of mahika kai strategy is gathering of information on biodiversity restoration work that is already progressing in the Kati Huirapa ki Puketeraki rohe, both with and without direct runaka involvement in the Puketeraki rohe. This identifies our strategic partnerships & relationships, provides information in a way that enables our members to gain an oversight of the work that is currently occurring, the kind of information that that work is generating to progress. That project needs to be maintained and kept current if it is to be useful. It also generation questions and recommendations as to the way that the runaka resources, administers and provides for governance of biodiversity mahika kai work. We now need to prioritise what we want to achieve environmentally and how we intend to achieve it. We need to come together to do this because we need to come together to achieve it. This will be best progressed through progressing a series of educational and planning wananga.

Table 3. Highlighted recommendations for local restoration drawn from research findings.

Mahika kai group/how these might be implemented included in column	**Recommendations**
Forest and Tussock	Fencing of significant habitats to exclude stock and increasing the extent of these habitats by planting. Legal protection of indigenous remnants to provide long-term security. In treeland vegetation, where there are large gaps between trees, planting of additional indigenous species to improve connectivity and achieve canopy closure. Kānuka-dominant forest provides important habitat for indigenous insectivorous birds such as pipirihika, piwakawaka, tititipounamu, and toutouwai. It tends to be an under-appreciated forest type for rural landholders, and its value for insectivorous birds should be advocated more strongly. Kānuka forest associations are successional vegetation types, and while currently widespread within the project are they will slowly become less extensive over time as successional development to broadleaved forest continues. Thus, **protection of young regenerating stands of kānuka** is important if this forest type is to be maintained within the project area in the long-term. If habitat improvement for miromiro is needed, then increasing the amount of forest bird habitat within a local area will improve the likelihood of it supporting miromiro. This increase in habitat extent does not need to be restricted to indigenous forest, and can include the establishment of exotic coniferous forest, which also provides habitat for most other indigenous forest birds within the project area. Exotic forest should not however replace high quality indigenous forest habitats such as kānuka forest, broadleaved forest, and podocarp/broadleaved forest. **Increase areas of kanuka forest, broadleaf forest and podocarp/broadleaf forest.**
	Continued monitoring over several seasons to ascertain whether 1080 operations have any long-term benefits for robins at Silver Peaks. Promotion of benefits of 1080 for robins.

Emily Gray to come to Karitane and discuss her findings. The community to put together a plan for providing bird habitat targeting a range of species.	**Hikaroroa –** one of the most ecologically important forest remnants remaining in North Otago and probably the largest and best remaining example of dry forest in coastal. **Exclusion of stock and refencing of some areas**. Need for **replanting of podocarps** will be considered where appropriate. **Pest plant and animals eradicated or controlled.** Creating buffer zones with adjoining landowners. Monitoring of Councils ecological management programme. A range of other pest animals are certainly present within the reserve. Ongoing monitoring is also required. Isolated **Scotch broom shrubs are a high priority for contro**l, particularly those that are present in grassland on the southeast slopes of Mt Watkin/Hikaroroa. **Sheep should be removed from the reserve**. The chief requirements for maintenance of threatened plant species at the site are **ongoing control of woody weeds and pest animals**. While matai and totara (and probably kahikatea and rimu also) are under-represented as canopy trees, natural regeneration of these species is occurring. In the absence of further disturbance, these will become increasingly apparent as emergent trees. Intervention by restoration planting could however be used as a strategic tool to help contain weed spread within the site.
	Exotic vegetation can be useful to native birds that are behaviourally adaptable and opportunistic and should be considered and **promoted for urban plantings**. Management incentives need to consider the varying needs and preferences of native birds as a group and those of all species individually, with a focus on enhancing habitat for struggling species as well as avian biodiversity as a whole.
	Maximize ecological health in; • Christmas creek/Three O' Clock Stream and up the upper Taieri River Gorge/Deep Stream – connection of Flagstaff – Mihiwaka Silver Peaks complex, to the Rock and Pillar Lammermoor complex; Connection of Flagstaff – Mihiwaka Silver peaks complex to the Maukaatua – Waipori complex via Christmas Creek and the lower Taieri Gorge. • Alluvial shrublands - Mid-high altitude inland forest. • Beach ecosystems – restoring dune form and function through restoration of native communities of active and mature sand dunes. • **Wetlands – keystone habitats for ecological health - find example to work on - Merton Arm?** • **Coastal forests – place of current and historic concentration of population and agricultural activity. Find example to work on – Coast Road?** • **Lowland fertile forests – a rare ecosystem on east coast South Island**. **Find example to work on – Estuary escarpments?**

Forest trees, forest birds, seabirds, waterfowl and weaving materials	**Exclude stock from coastal forest fragments by provision of fencing**. **Legal protection of coastal forest**. Restoration of coastal forest through **planting in strategic sites. Restoration of coastal indigenous forest on scarps above the Merton Arm of the Waikouaiti Estuary. Improve the condition of broadleaved treelands above Merton and Waikouaiti.** Incorporate planting of Threatened and At Risk plant species of coastal forest habitats. Improve the condition and extent of indigenous forest fragments throughout the Waikouaiti Coast and Hills rural character area, or start to restore indigenous forest from scratch. Pest control can also be considered in protected or enhanced coastal forests. If suitable coastal habitat (e.g. Heyward Point, Purehurehu Point, Mapoutahi, Huriawa) could be protected from mammalian predators by intensive trapping and/or pest exclusion fences, then breeding sites for 'Threatened' and 'At Risk' seabirds such as titi could potentially be restored. Acoustic attraction could result in self-colonisation, or colonies could potentially be started by translocating juvenile birds. Habitat enhancement through planting coastal shrubland and grassland could also be an objective within this project. Undertaking intensive pest control, educating people about the danger posed to penguins by dogs, enhancement of habitat, and provision of dog-proof artificial nest boxes, could be of significant benefit to the southern blue penguin breeding colonies on the coast from Mapoutahi to Potato Point. Penguin fencing can also be considered to keep penguins from moving onto roads. ***Lepidium juvencum*** **and** ***L. crassum*****, two Threatened coastal cress species, which have very small populations in the project area, would benefit from projects to propagate local individuals** and plant them in seabird breeding habitats so as to increase their population sizes. Protection of habitat could also be an objective of this project. Legal protection of the many areas of indigenous forest still present in the catchment. Legal protection would increase the durability of restoration or enhancement. · Excluding stock from existing forest areas by provision of fencing. There are significant benefits in retaining and enhancing what is already present compared to having to restore it from scratch. A strategic approach to fencing would be useful to firstly aim to capture the most important sites first, and secondly spread the fencing across a number of landholders to reduce the pressure on each. Riparian fencing and restoration a **longterm project to fence off and plant appropriate indigenous vegetation in the riparian margins of the Waikouaiti River and its major tributaries**, so as to maintain and enhance water quality so as to benefit aquatic values. The North Branch of the Waikouaiti River already has a substantial cover of indigenous forest and gorse scrub on its mid-catchment margins, which represents a head start on riparian habitat enhancement. Monitoring of river condition would need to be enhanced and continued to determine project success. Improving the North-South forest corridor. **Promoting indigenous planting, natural regeneration, or exotic afforestation in the gap between the Silverpeaks and the hills west of Merton** could potentially improve any dispersal limitations. Coordinated pest control surrounding Orokonui. Planting guidelines

	for coastal forests and riparian margins. Indicative costs for fencing and restoration. Engagement with community and volunteers. **A programme for seabird restoration and costs.**
	Full promoted and supported participation in the programme of spatial trapping for Inner Halo Area for the full range of trapping and poison methods for mammalian pests. Subsidising traps for runaka members, but traps remain property of runaka and trapping information is submitted to runaka or traps are returned.
Freshwater fish and waterfowl **Easy to do, no data. My suggestion, could be easily done in a few days. With help of city forests.**	**Hikaroroa and Silver Peaks -fish surveys and mapping of species presence**. There is no data for freshwater fish within NZFFD (2008) for Hikaroroa and very little for Silver Peaks. The two main streams on Hikaroroa reserve should be surveyed.
	Search for trout barriers on Sliver Peaks and establish extent of native only areas.
	Expansion of freshwater work into the Waitati and Waihemo catchments. Seek partners in these catchments to undertake and promote work.
Freshwater fish, estuarine fish, wading birds and waterfowl	Continue building awareness of Waikouaiti River water quality and building relationships within the community. Continue sampling at sites to add to the baseline information. Sampling once a month and standard operating procedures for monitoring should be developed. Develop cultural and ecological monitoring methods for the Waikouaiti Estuary. No suitable "pre-packaged" tools currently exist for estuarine environments. Any new tool should consider human use of the estuary as a primary indicator of estuary health. Encourage the development of appropriate research projects by reporting findings and sharing with other researchers. Investigate the Merton Tidal Arm and the possible nutrient source which was detected at Te Tauraka a Waka, a site which is likely influenced by this tributary. Consider the influence from other tidal arms on the water quality of the Waikouaiti Estuary. **Future environmental monitoring programmes should consider the influence of logging operations on the South Branch**. A site (or sites) should be added on the South Branch of the river and just above the confluence of the North Branch for future monitoring. This could aid in distinguishing catchment scale processes (which will be seen in both branches) and land use effects (which may be localised to one branch). **Develop a catchment re-vegetation and habitat restoration plan**. The overall strategy should be coordinated to maximise the long-term improvement of water quality and habitat. **Continue building information regarding the cultural and historical knowledge** of the sites.
	Localised Cd contamination within the lagoon and further work should focus on **isolating the input of Cd into Matainaka** Lagoon. By excluding the possibility that heavy metals are responsible for the degraded state of the

	lagoon, attention must focus on **ameliorating the eutrophic state of Mataınaka**. It can also be concluded that **altering the hydrological regime of the lagoon** will pose very little risk in terms of resuspension of harmful metals to other areas of the lagoon and open coast.
Marine fish and seaweed	Yearly fish surveys to understand the longer temporal scales of reef fish changes in abundance. **Monitoring of reef fish populations should also be carried out to see if reduced bag limits for recreational fishermen, which were established in October of 2010, are successful in increasing fish stocks within the East Otago Taiāpure**. Future research upon epifaunal communities is needed to further characterize habitat preferences and associated biomasses. This could involve sampling throughout a year and replication of simulators at several sites within differing habitats. **With the threat of sedimentation and harvest of kelp forests, a useful future study could involve looking at the effects of increased sedimentation on Macrocystis pyrifera kelp forests.** Also, experiments could be done looking at the effects of harvest and the removal of kelp biomass from the system. This would lead to a better understanding of the accumulative effects upon macroalgal beds due to current and future threats and how to manage them. Another possible future study related to modification of kelp forests would look at the effects of kelp loss on epifaunal species and reef fish populations, observing the effects of decreased and modified areas of kelp forest to the productivity of the area.
Marine fish and shellfish	Awareness of the purposes and regulations of the taiāpure. Once repeated at 3-5 year intervals the surveys can access trends in stock levels and user profiles to guide the kaitiaki on sustainability and the need or otherwise to intervene with local regulations.
Seaweed	To obtain an optimal karengo yield whilst maintaining a sustainable harvest, hand pulling late in the season is recommended. These findings support and strengthen a harvest technique based on mātauranga Māori and provide information to actively manage and preserve highly valued wild karengo stocks.
	Undaria needs to be actively managed if is not to outcompete the native macroalgae and form monspecific stands.
Shellfish	Paua slow growing and maturing – taking anywhere between six and 10 years to reach minimum legal size. For communities wanting to act quickly species targeted for management or protection may suffer further unrecoverable declines while the regulations are being reviewed. Mātaitai bylaws in comparison must be processed within 40 days of their submission to the Minister for Primary Industries but though they can be implemented much faster, their use is contingent on the presence of a mātaitai reserve in the first instance. Consistent community-led monitoring should be required however to ensure that communities are actively engaged in management and are not overzealously closing off areas. **Repeat surveys should be undertaken within 3 - 5 years to assess the realised trajectory of the East Otago Taiāpure pāua fishery**. Future work to assess the impact of the proposed wading only

	fishery may consider a targeted method to assess the density of pāua over their entire depth distribution (e.g. shore-normal / down shore transects). These projects include an assessment of the movement of pāua between depth strata (over a range of timescales) and connectivity and larval transport between reef systems within the East Otago Taiāpure.
	The results from the present study identified that there are areas within the EOT capable of supporting juvenile paua yet due to limited recruitment were not occupied. **Reseeding of paua into these areas is ideal as they place no added pressure due to competition on wild stock limiting disruption to wild populations**. It has been shown that paua populations are on the scale of tens-hundreds of meters, yet they are managed on the scale of regions (100 km). For effective implementation of small scale management local information is required. Future work on sedimentation could measure the effect of juvenile H. iris competition with adult H. iris and the susceptibility to sedimentation for both life stages
	Based on these finding we recommend that the Ministry of Fisheries adopts a **precautionary approach to management of cockles in Papanui and Waitati inlets and investigates development of a rotational harvest scheme for discrete beds in each inlet**. The fact that we cannot know how fishing of this species affects the recruitment of juveniles is a major concern. **Rather than open harvesting within each inlet, individual beds should be managed and monitored separately, taking care not to reduce each bed below a desired density**. Considering the slow growth rate of clams in the Otago region, cycles of 5-6 years may be appropriate for this rotation.
	Harvesters may be able to reduce their influence on parasite infection levels in clam populations by **harvesting less intensively, and allowing more time between harvests for clam biomass to regenerate**.
Waterfowl and wading birds **A survey of all grazing leases for opportunities is recommended**	**Surveys of the estuary on a regular and consistent basis**. **Harassment by dogs is an annual problem for the Black Oystercatchers nesting at the end of the spit and for the colonies of Pied Stilts at the Ponds**. Ask people to keep their dogs on a lead, to drive, bike or ride with care. Suggest, that people keep below the high tide mark on the spit to avoid the Black Oystercatcher nests. Talk to farmers and see if they would be prepared to keep stock out of a paddock during the vulnerable few weeks of the breeding season. **Education**. **Erect notices containing information about the birds and a request for peoples' consideration, especially on the sandspit.** If the group feels that some restriction on duck shooting would be a good idea then extensive discussions with hunters, landowners and leasees and Otago Fish & Game would be necessary. Nesting success can be increased by **controlling predators** and there have been considerable

Part of a local community day could be to go look at spartina so community and whanau can recognise it and provide community input to mapping occurrence. A citizen science project would aim at online recording.	improvements in trapping techniques over the past twenty years, many developed by DoC in NZ. The group could perhaps consider setting up trap lines and the best place to start may well be around the main Pied Stilt nesting areas. **A couple of restoration areas owned or administered by DoC and the DCC which are worth investigating. The simplest and most accessible is the DOC land between the Merton Arm and the road to Karitane which now leased, grazed and cut for hay. Restoration of these 5 hectares would create a scenic block of bush on the approach to Karitane that would be big enough to attract nesting brown creepers, bellbirds and possibly pigeons**. Ideally it would be fenced to keep out stock and controlled for predators. An even more ambitious scheme involves crossing the estuary and tackling the DoC and DCC land adjacent to the spit. **This would provide a wider range of vegetation restoration options from native dune plants like pingao, through coastal salt tolerant shrubs to taller forest alongside the estuary. It could also be connected to the removal of stock and predator control around the saltmarsh, estuarine margins with perhaps the ultimate aim of liaising with landowners to extend the wetland to include the tidal flats and marsh towards the Waikouaiti waste water ponds.** A largescale project like this would provide habitat for a wider range of native birds, may attract forest species like tomtits and riflemen and with a predator control program provide safe nesting sites for stilts and penguins and may even allow the re-introduction of native species like fernbird. Table 2, Onley, for species suitable for revegetation.
Wetland plants, estuarine fish, waterfowl and wading birds **Rivercare keen to pursue this, work with them at identifying areas and begin planting and fencing.**	The vegetation type reduced to the largest extent is coastal forest. Saltmarsh vegetation remains largely intact, except for the areas that have been drained, but the top end of the zonation from saltmarsh to coastal forest has been severely truncated. The remnants of snow tussock vegetation are also worthy of attention. These are in danger of being eliminated and will require active management if they are to be maintained. **Spartina should continue to be treated as a serious weed and eradication should be the goal**. Known populations of Spartina mapped so that control can be followed up annually until no regrowth occurs. All areas of saltmarsh should be fenced to exclude stock, both cattle and sheep. **Terrace scarps adjacent to the Merton tidal arm offer the best scope for restoration of coastal forest**, as these are the areas where remnants of coastal forest currently exist, existing fences often exclude stock, restoration of coastal forest would help to control gorse and broom, the saltmarsh – forest gradient would be restore, these sites have constraints for other land uses. In the long term, it may also be possible to **restore podocarp forest to some areas of fertile river flat adjacent to the estuary**. These areas are often valued for farming, but some areas of river flat are managed by the DOC, which is likely to support restoration initiatives by the community. **Swamp vegetation is predominantly found on the Karitane side of the estuary and have suffered from grazing of**

Plan for managing vehicle access developed	**sensitive species and pugging. These would benefit from exclusion of stock**. Enhancement of the swamp vegetation would primarily involve **addition of flax or native shrubs such as Coprosma propinqua**. Swampy wetlands behind saltmarsh have many ecological values and generally retain a native species composition. They would benefit from **removal of weeds such as blackberry and willows**.
	Additional investigation of nutrient enrichment and **vehicle access in the Waikouaiti and erosion in the Shag**. Vehicle access and damage on the north side of the Waikouaiti needs monitoring. Back waters of the Waikouaiti Estuary on the northern side need monitoring. Monitoring of rates of erosion along the main channels may be of benefit in the Shag.
Earlier cautions against this as polluted sediments enter coastal marine system. But may be inevitable. Some modelling required perhaps. **Partial and slow managed releasing of sediment may reduce local coastal impacts.**	Further sediment metal analysis for cadmium contamination, localised areas of the East and South Arms, is required. A sampling design which will **pinpoint the location that contaminants are entering Hawksbury Lagoon is needed**. This will require radial sampling around the contaminated sites, focusing on any inflow entering Hawksbury lagoon close to these areas. Remediation procedures are not recommended in this case as the contamination is fairly localised. If sediment was manually removed from these areas it would pose risks to less contaminated areas of the lagoon through the re-suspension of sediments and the liberation of metals from within it. Other contaminants that may be negatively influencing the sediment and water column of Hawksbury Lagoon could include, organophosphates, which are common pesticides and insecticides used in agriculture and horticulture. It is recommended that further research should focus on the anoxic state of the Hawksbury Lagoon sediments as well as the inputs of nutrients to the lagoon, which is the most likely cause of the current eutrophic state. **A sampling design should focus on quantifying the inputs of nutrients, namely nitrogen and phosphorus which are entering the lagoon at major inflow points**. It would be beneficial to also understand the hydrodynamics of the lagoon to model re-suspension of sediments at various water flows, this is essential information required if the hydrological regime of the lagoon is ever to be modified as the threat to coastal ecosystems would be great if sediments were flushed from the lagoon.
	The lagoon is formally under the jurisdiction of the Department of Conservation to be managed as a Wildlife Reserve. It appears that changes could be made to the water management regime without contravening the reserve rules in their Management Plan. To give any new water management proposals the best chance of being sustainable in the long-term, local manifestations of changes in the global climate and energy regimes already underway will need to be taken into account. Of pivotal practical significance to future water management is cumulative sea level rise due to climate change. The first step to developing a water plan is therefore for the community to make a

And be preferred to catastrophic change.	considered decision between two future pathways: • Retaining the current relatively isolated state of the lagoon from tidal influence. In this cas**e, enhancement of the lagoon would be largely limited to freshwater interventions such as, for example, increasing the volume of flushing reaching the lagoon from Post Office Creek, or artificially augmenting it with freshwater from the Waikouaiti River**. **Or opening up either a part or the entire lagoon to more tidal influence. In this case, there would be more regular and complete flushing of both the lagoon and the existing estuary with saline water**. Rather than a ponded water body, the re-established estuary would again appear as mud flats for much of the time (behaving in a manner more akin to Blueskin Bay). The **recommended option is to open the southern compartment of the lagoon to tidal flow, so allowing it to revert to estuary and retain the northern compartment as a lagoon by water level control**. Survey data shows that this option does not increase flooding risk to existing homes as floor levels are above peak tide and flood levels. Flooding of lawns could be prevented by the placement of low bunding at the lagoon edge, or spoil placed on the lower areas of some lawns up to about 250mm deep. Additional freshwater can feasibly be directed for flushing the remaining lagoon area. A range of technical options that would enable this have been identified and broadly assessed. **Once more information is available on the thickness and nutrient profile of the sediments across the lagoon, the value and feasibility of sediment removal as a means to reset the system to a lower nutrient status can be considered in more depth**. The **formation of islands** and the construction of a hide could be included as part of this process to enhance habitat, minimise excavation haulage and make more of the location as a wildlife attraction. **Enhanced flushing of the lagoon with fresh water will be most effective if the incoming water is lower in nutrient and sediment than is currently the case. It is recommended, therefore, that the community engages on how this might best be achieved.** Because all who live in the catchment contribute in some way to the nutrient and sediment entering the system, this process would ideally be genuinely catchment-inclusive. In this way, restoration of the estuary complex may become a catalyst and vehicle for improving local ecosystem services, a stronger community and a more pleasing local environment. An on-going community-based monitoring programme should be undertaken to provide a means to measure long-term patterns of the lagoon ecosystem status and populations for birds and fish present,
	Eleven management zones (A-K) have been identified based on existing land cover, land use, and location. The primary purpose of these zones is to identify specific management needs for particular areas. It is not envisaged at this stage that restoration would be undertaken on dunes and beach as, ideally, this should be undertaken as part of the restoration of the entire DCC-administered estate that extends south to the Waikouaiti River estuary. The restoration approach for each management zone is listed. It is recommended **that exotic trees are progressively**

	removed from areas targeted for restoration plantings. Stock should be excluded from the head of Hawksbury Inlet before planting is undertaken in this area, permanent 8-wire fencing is recommended, as this will exclude both cattle and sheep. The **weed control component of site preparation should be undertaken over the summer months in those areas designated for planting in the following autumn**. Possum control can be undertaken using a network of bait stations. Rabbits and hares are best controlled by spotlighting and shooting, but because the lagoon is located in a residential area, pindone poison baits are likely to be the preferred option. The species to be planted at the restoration site should occur naturally at other similar habitats in Waikouaiti Ecological District and they should be "eco-sourced". Plant schedules (Table 4) are dominated by hardy species such as flax and *Coprosma propinqua*. On hillslopes these species will provide shelter for slower-growing species such as totara and matai. **A high planting density of 10,000 plants/ha (1 m centres) is recommended to achieve canopy closure within 2-3 years of planting and reduce the opportunity for weed establishment. Large canopy trees such as Hall's totara and kahikatea are spaced at least 5 m apart amongst the smaller, faster growing species which are spaced 1 m apart. On lagoon margins, sedges and grasses should be planted at 0.5-0.75 m centres to rapidly cover the bank and reduce erosion from wave action.** Spring plantings can be affected by equinoctial or dry northwest winds and staking may be required to provide initial support for species that are susceptible to wind, with irrigation required for those species that are sensitive to water stress. **Planting of wetland sites (e.g. reservoir margins and drains) should be undertaken in November, when the stems of wetland plants are actively growing and will not rot. The plantings will need to be released from weed competition two or three times during the first year following planting, and 1-2 times in the following two or three years, until the indigenous plants have become established.** Restoration should focus on improving habitats for existing species. However, habitat may be able to be created or improved for other bird species, especially if combined with restoration at larger scales (e.g. Waikouaiti River Estuary, dune and beach restoration): • **Marsh crake prefer raupo swamps and saltmarsh habitats** • **Spotless crake prefer raupo swamps and reedbeds** • **South Island fernbird prefer wetlands with dense ground cover under a selection of shrubs and small trees like manuka** • **Australasian bittern prefer tall, dense raupo and reeds.** Indigenous plantings, especially aquatic plantings, will increase the diversity of invertebrates in the lagoon, but the only other way of increasing food supplies is through changing the hydrological regime of the lagoon. Regular tidal flushing would have the greatest effect on productivity, but this is an impractical scenario given the flooding threat

	to private property**. Fish habitats will also be improved through the restoration of aquatic plant communities.** A longterm objective could be to improve the quality of water entering the lagoon by establishing **riparian buffers alongside all contributing waterways.**
Skinks	Until such time as the exact causal agent/s of the decline of grand skink populations is/are determined **the wisest management is to maintain the indigenous tussock grassland cover over all areas where the conservation of grand skink populations is important**. If this interpretation of the problem is correct it probably means there is little that can be done to safeguard grand skink populations on private farmland where there are conflicts with development plans. It is just possible that the **retention of extensive tussock "corridors", with landowner cooperation, may aid dispersal of grand skinks between outcrops** but this remains to be proven.
Purerehua/katipo	Because many of the plants recommended for reintroduction still occur in the wider landscape (eg. Mt Watkin/ Hikaroroa) together with their specialist native insects, it is impossible to predict which of the insects will naturally disperse to the revegetated areas. **Some key insect species that should be reintroduced if possible are:** • **The noctuid moth *Graphania nullifera*, a specialist on speargrasses (but wait till there are suffi cient plants established, as it is a big moth with a big appetite!)** • **The day-flying orange geometrid moth *Dasyuris partheniata* (speargrass)** • **The day-flying orange underwing *Paranotoreas brephosata*** • **The orange geometrid *Asaphodes clarata*** Patrick (2002) found red katipo spiders to be locally common in the foredunes of the Karitane dunes, but none were discovered during this survey. **As it is an iconic invertebrate species in New Zealand, it would be a high priority to reintroduce it once suitable habitat (eg. Pikao) is established and a full survey has been conducted to check if it is still extant in this large dune system. The species is still common on Kaitorete Spit, south of Banks Peninsula, so this would be the most suitable source of spiderlings.**

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Appendix 2. Data provided with sources.

Information type	Information	Organisation (where data was obtained or is held)	Comments
Data Acquired	Known trout barrier	DOC	Coastal north Otago
	Fish records	NZFFD	Otago
	Non-migratory habitat fragments	DOC	G. depressiceps and G. anomolous for coastal
	Protected areas (DOC, DCC, LINZ)	LINZ	Otago
	Ecological management units	DOC	Coastal north Otago with rankings
	Ecological districts	DOC	Coastal north Otago
	Catchment orders	FENZ (DOC)	Otago
	Ngai Tahu forestry	TRoNT	South Island but none present in Puke rohe
	Waikouiti/Shag habitat descriptives	ORC	with report
	Orokonui Stream monitoring sites	DOC	point locations
	Swin Burn trout barrier and reports	DOC	point locations
	Swamp polygons topo	LINZ	
	DCC reserves	LINZ	SNA reports sourced and available as digital
	City Forests lands	City Forests	Blocks and block names
	Orokonui Bibliography	ONHT	
	Macraes Skink Programme	LINZ	
	Ngai Tahu Holding Forestry Assests	TRoNT	Forestry blocks Te Wai Pounamu
Material requested not received	DCC holdings other than reserves	DCC	e.g. town supply catchments
Project Areas	Landscape Connections Greater Biodiversity Project Area	Wildlands	
	Inner Halo	RJC mapped	
	Outer Halo	RJC mapped	
	Orokonui Sanctuary	RJC mapped	
	Hawksbury Lagoon Society Inc.	RJC mapped	
	Mataitai	TRoNT	
	East Otago Taiapure	TRoNT	
	BioHeritage	RJC mapped	
	Pataka Waiora	TRoNT (based on mataitai)	no data as yet

Information type	Information	Organisation (where data was obtained or is held)	Comments
	Rivercare restoration sites	Rivercare with RJC mapped	
	Tavora Yellow-eyed penguin reserve	RJC mapped	large paper archive to organise
Areas and maps	Otago area	Statistics NZ	
	Topo 250	LINZ	
	Topo 50	LINZ	
	Dunedin City Council area	Statistics NZ	
	Waitaki District Council area	Statistics NZ	
Data not requested but identified as useful	DOC grazing concessions, river grazing concessions.	DOC	
	Grey literature	Organisation where data was obtained	

Appendix 3. Register of Research in Orokonui Ecosanctuary - March 2017. Includes non-scientific research by community members.

Research title	Research Submitter	Completion
FLORA		
Vegetation baseline Surveys	Kelvin Lloyd Wildlands	From 2005 ongoing
Three-dimensional mapping of New Zealand's tallest tree **(Flora)**	Robert Van Pelt and Stephen Sillett – Humboldt State University	2013
Establishing permanent photopoint records as part of tertiary teaching **(Flora)**	Kath Dickinson Botany Dept University of Otago	2016
Marie's Block **vegetation** survey	Kelvin Lloyd Wildlands	2005
Fuchsia pollination survey	Sue Hensley Science Fellowship	2010
Rare plant translocation (Carex inopinata)	Kelvin Lloyd Wildlands	2011
AQUATIC		
Orokonui Creek Monitoring **(Aquatic)**	R Clucas DOC	2014
Trace Metal Speciation in NZ Freshwater Systems **(Aquatic)**	Birthe Kortner Dr Sylvia Sander Chemistry Dept University of Otago	2014

INVERTEBRATES		
Shedding Light on the Night: Nocturnal Biodiversity in the Otago Region **(Invertebrates)**	Dr Barbara Anderson Landcare Research	2016
Wild and introduced **bee** competition and seasonal resource utilization	Jay Iwasaki Botany/Zoology University of Otago	2014
Invertebrate Survey eucalypt cf non eucalypt	Kelvin Lloyd Wildlands	
REPTILES		
Lizard Monitoring	Bas Egeter Zoology Dept University of Otago	2016 ongoing
Thermal suitability of Orokonui for **tuatara** breeding	Dr Alison Cree Zoology Dept University of Otago	2007
Comparing the dispersal of **jewelled geckos** (Naultinus gemmeus) from hard-release and soft-release translocations	Carey Knox Jo Monks Mandy Tocher DOC	2013
Green **skink**	Carey Knox Herpetologist	From 2016 ongoing
Tuatara – integrating phsiology into conservation	Anne Besson Alison Cree Zoology Uni of Otago	2010

Otago **skinks** post release monitoring	Megan Bogisch Zoology Uni of Otago	
BIRDS		
5 Minute **Bird** Counts	Derek Onley Murray Efford	ongoing
Listeners in the Night **Kiwi** monitoring	Michael and Valerie Fay Community	2014
How Safe is My Cat (**Pests)**	Clare Cross Landscape Connections Trust	2016
Kiwi and Morepork monitoring using acoustic recording devices	Derek Onley Mary Thompson	2013
Predator recognition, predator impacts and habitat choice in NZ **robins**	Luke Easton Zoology Uni of Otago	2017
Translocation of SI **Saddleback**	Ian Jamieson Zoology Uni of Otago Elton Smith Orokonui Ecosanctuary	
Kaka surveys	Elton Smith Orokonui Ecosanctuary	annual
Reintroduction biology of SI **Saddleback**	Bryce Masuda Ian Jamieson	

	Zoology Uni of Otago	
Translocation of SI **Robin**	Ian Jamieson Zoology Uni of Otago	
FROGS		
Habitat selection and population dynamics of the rare native **frog** Leiopelma hochstetteri	Luke Easton Dr Phil Bishop Zoology Dept Uni of Otago	2014
PESTS		
Pest mammal surveys	Elton Smith Orokonui Ecosanctuary	quarterly
OTHER		
Volunteering in Ecological Restoration	Anne Schmurpfell University of Applied Sciences Eberswalde, Germany	2014
Ecosanctuary **feasibility** report	Ralph Allen Diane Campbell-Hunt	2004
Fenced Sanctuaries	Hilary Phipps Auckland University	2008
GIS mapping to support Conservation Planning	Claire Freeman	2011

	Geography University of Otago	
Marie's Block **ecological assessment**	Kelvin Lloyd Wildlands	2008