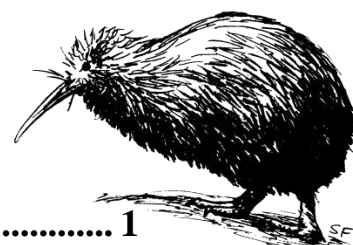


The background of the entire page is a photograph of a mountainous landscape. In the foreground, a large, ancient-looking tree with thick, gnarled branches and moss-covered bark dominates the right side. The tree's trunk is dark and textured, with some lighter patches where the bark is peeling or dead. The branches spread out, some reaching towards the top of the frame. In the background, a vast, rolling mountain range stretches across the horizon, covered in dense, lush green forest. The sky is a pale, clear blue, suggesting a bright, sunny day. The overall scene is one of natural beauty and wilderness.

**The
Wainuiomata
Project**

**A proposal to fence the Wainuiomata
Catchment and restore the biodiversity
of the Remutaka Range**

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About the author

James Lynch QSM is the founder and current Vice-Patron of Zealandia. His work in conservation has been significant in the rise of community conservation in NZ over the last 30 years. He has 35-years of experience in designing large scale management systems and training programmes for national scale organisations, including DOC. He has two WCC civic awards and a Queens Service Medal for services to conservation. He is currently a board member of Sanctuaries of New Zealand Incorporated (SONZI) and is an authority on fenced eco-sanctuaries.

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Part One: The Concept

The Wainuiomata Project is a proposal to fence the Wainuiomata catchment and restore the catchment and surrounding ranges, resulting in major biodiversity, social and economic benefits.

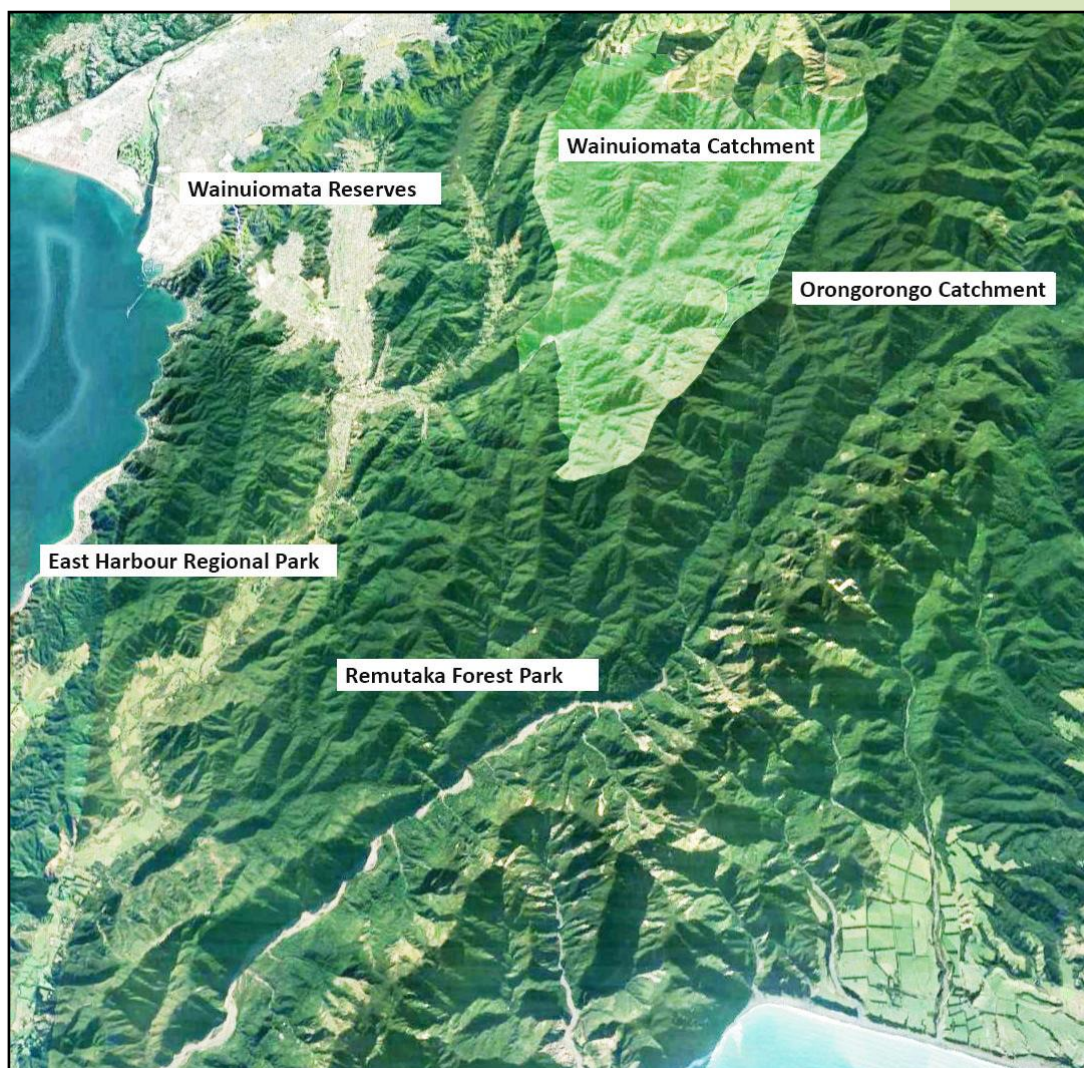
It is potentially the biggest leap forward for biodiversity since community conservation emerged as a force with the fencing of Zealandia in 1999. Zealandia has a 500 year vision because that is how long it will take for its shrub and pine dominated forest to regrow to maturity. Wainuiomata is a 50-year vision because the primordial forest is fully intact. Zealandia is 225 hectares. Wainuiomata, at 3,350 hectares, is fifteen times larger. Zealandia is adjacent to the 4,000 hectare Wellington town belt, much of which is still grass and gorse. Wainuiomata is adjacent to 40,000 hectares of primary forest, much of it in the same condition as in the Wainuiomata catchment.

Like Zealandia, Wainuiomata can be a major contributor to the ‘new economy’ which focuses on long term economic sustainability, communities and caring for nature and our planet.

This part explains the long term (50 year) vision, the outcomes, and the broad strategy. It also covers ‘why’ it must be done and the benefits which will accrue.

Part two deals with the ‘how’ it can be done.

Figure 1. The catchment and surrounding natural areas.



1.1. Background

This plan puts forward the concept of a fenced, LTA, iwi and community led, eco-sanctuary in the 3,350-hectare Wainuiomata catchment. It is proposed in response to the Government's request for local authority-led infrastructure projects as part of the economic stimulus post Covid-19.

New Zealand was once the land of forests and birds but has lost 70% of its original forests and 52 indigenous bird species. Many of our most vulnerable species are only able to survive on offshore islands or in fenced eco-sanctuaries.

Since Zealandia established the fenced eco-sanctuary model in 1999, fifteen-fenced sanctuaries have emerged protecting 9,000 hectares of valuable lowland ecosystems. They are run by local authorities, community trusts or private individuals. All of these have been able to successfully eradicate pests and establish populations of the most threatened species. This is now a proven model, although DOC have chosen to concentrate on offshore islands and intensively managed mainland areas as their choice of operating model.

Predator Free NZ was launched in 2015 with the intention of clearing all of NZ of selected pests by 2050. However, it is becoming clear that our toolbox is still a very long way from being capable of achieving this goal. In the meantime, the nation is desperately short of large, pest free areas on the mainland with mature high-quality lowland habitat. Currently, only Maungatautari (3,400 hectares) in the Waikato fills this role. Accordingly, a large predator free site in the southern North Island would be a prime national asset.



Since the establishment of Zealandia eco-sanctuary in Wellington in 1999, all the technologies and management practices needed to develop and maintain a large fenced eco-sanctuary have been devised and tested thoroughly. We now know exactly what we can and cannot do and the risks and costs are well known, if still challenging. It has been established that well-conceived and managed eco-sanctuaries have significant social and economic benefits for local communities in addition to the obvious biodiversity benefits.

Part of the Wainuiomata water collection area has been managed as a biodiversity 'mainland island' since 2005 with mixed results. There have been many suggestions over the years (including from the author) that this valley is of such high biodiversity value that it should be predator-fenced and managed as a secure eco-sanctuary, in addition to its water supply function. It represents one of the very few large, intact, lowland podocarp/rata/broadleaf forests in the southern North Island, it is in a strategic position to benefit the adjacent Remutaka Range and East Harbour Regional Park and is close to a major population centre.

Wellington has been a leader in this emerging and fast-growing community conservation sector. A project of this nature would cement this leadership and pioneer new ground in large landscape scale conservation management.

Wellington City has Zealandia. The time is right for the region and the nation to have Wainuiomata.

1.2. Imagine

It is 2050 and you are entering the Wainuiomata catchment east of the Hutt Valley. It is a tall, mature, podocarp-rata forest of 3,350 hectares in size (fifteen times larger than Zealandia in Wellington City). The headwaters of the Wainuiomata river, this catchment has never been logged and has been kept intact through its function as a bulk water supply facility for Wellington. It is surrounded entirely by a robust 30-kilometre pest proof fence. All pests have long been removed and are excluded from the valley.

As you walk through this forest you are immediately struck by the noise and the busyness; large clusters of bellbirds call continuously in a rotating chorus, noisy tui chime and flutter through the branches, flocks of whitehead trill in a continuous stream, kakariki chatter and flash green through the tree tops in noisy groups, flocks of rowdy kaka wheel overhead.

At almost every turn in the track a pair of robins hop down to investigate, families of saddleback leap from branch to branch through the shrubbery, flighty hihi chirp and flutter about, and the 'whoosh' of pigeon wings is everywhere. From the higher branches the long liquid chime of the kokako floats across the forest, lifting above the constant bird song.

As you walk along (and depending on the season) you will be struck by the show of flowers, the crimson aerial swathe of the tall rata and the yellow and red blush of the mistletoe. Closer investigation reveals the massed flowers and fruit of fuchsia, five-finger and hinau. Closer still and you will see the quick movements of lizards and large insects. The undergrowth is dense and varied, with strong signs of growth and rude health, as is the tops of the tall trees which carry a huge load of epiphytes – mini-ecosystems in the air. Where the occasional big tree has fallen, a thicket of seedlings jostles to take its place.

If you are there at dawn you will hear the rising cacophony of chimes and chatter that signal the dawn chorus and, in the evening, the equally impressive dusk chorus rings through the forest as it settles down. As the day birds quieten, the ruru start, followed shortly by the shrill calls of kiwi echoing through the dense forest from every swale and valley. In the breeding season, kakapo boom from the central ridges.

If you walk out to the river you will see the pairs of blue duck which space themselves out carefully along the banks, and the kingfisher and shags that glide up and down the river. Takahe forage in the grassy areas. This is a living and vibrant place with the obvious stamp of ancient New Zealand.

Further out in the Remutaka range, the forest is thriving and the birdlife booming. Close to the sanctuary even the most threatened and vulnerable of birds are in healthy numbers – protected by a comprehensive on-the-ground management system which effectively keeps threats at bay. Further out the abundance is still evident and increasing, benefiting from broad-scale management and the wide-ranging 'halo' effect from Wainuiomata.

The area is also a place for people. Volunteers help the professional staff with all manner of essential tasks. Tours of visitors and school children set off from the visitor centre, led by experienced guides. Trampers set off to do the world famous 'Remutaka great walk'. The area is generating a huge amount of people involvement and economic activity which is greatly benefiting the surrounding Wainuiomata and Hutt Valley communities.

Could this scene really happen? Indeed, it can. We now have the ways and means to make it happen.



1.3. Outcomes and Strategy

The concept is to **establish a pest fenced eco-sanctuary in the Wainuiomata water catchment and develop its social and economic potential over time.**

Outcomes to be achieved would be:

- Restore the original (minus extinctions) ecosystems and species of the Wainuiomata catchment (3,350 hectares) (**biodiversity**)
- Improve the condition and function of the Remutaka range and East Harbour ecosystems (**Biodiversity**)
- Engage the community to participate in its management and to learn about their natural heritage (**social**)
- Add significantly to the economic activity of the local communities and region by way of employment and business activity (**economic**)

These outcomes would be achieved by following this long-term strategy:

Activities	Time Frame
1. Establish a trust to manage the ecosanctuary and halo.	Complete within six months of obtaining go-ahead.
2. Pest-proof fence the Wainuiomata catchment.	Complete within 18 months of securing funding and permissions.
3. Eradicate all pests from the enclosed area.	Complete within one year, after fence completed.
4. Restore missing species to the enclosed area.	Begin immediately after eradication and complete within twenty-five years.
5. Establish a 'buffer zone' managed area around the sanctuary to take advantage of the 'halo' effect from the fenced area.	Begin two years after eradication and continuous after that
6. Establish (with partners) a continuous management regime across the whole Remutaka Forest Park.	Begin three years after eradication and continuous after that.
7. Develop a visitor and education programme.	Begin membership and volunteer programmes after trust formed. Begin visitor and education programmes after eradication. Expand over time to reach optimum after twenty years.
8. Establish long term business and funding streams.	Secure base five-year funding within one year. Secure other funding and add businesses over time to reach financial stability within twenty years.

The concept envisages a 30-year development programme managed by a multi-partner trust which can establish and grow the programme for centuries. It calls for innovative governance structures to establish a dynamic iwi/public/private partnership governance and management model which can tap into a wide range of funding sources.

The Wainuiomata sanctuary would be run alongside the water supply facility and would aim to extract maximum possible value for the region from this amazing area.

The costs and risks are manageable, both immediately and over time, and the project represents excellent value for money. The concept is feasible with current technology and will only become more achievable and cheaper as technology improves.

It represents an interim strategy until technology breakthroughs allow us to pursue 'pest free' goals across even larger areas in thirty years' time.



1.4. The Need and the Benefits

This concept has wide ranging and profound benefits which address many critical needs. It represents outstanding value for money.

Biodiversity needs and benefits

- The nation lacks predator free lowland mainland sites of good habitat quality.

This project would increase the predator free mainland area by 30%. It is the same size as Little Barrier island and the same size as Kapiti and Codfish Islands combined. It is the finest unmodified ecosystem of its type in the southern North Island.

- Current fenced sites are too small or are unsuitable for many critically endangered species such as Kakapo and Kokako.

This site could accommodate up to 1,500 kokako and close to the current world's population of kakapo (215), plus large viable populations of all other extant threatened forest species representative of the area, such as rowi kiwi, saddleback, hihi, kaka and kakariki.

- The Remutaka range and East harbour are deficient in many species common or present elsewhere in the North Island, (e.g. kaka, kakariki, robin, kokako, kiwi, whio, weka).

The catchment will be the nursery for restoring missing species to the entire Remutaka range and East Harbour ecosystems over time through the 'halo effect'.

- The next challenge in conservation is landscape scale ecosystem restoration.

Wellington has become a world leader in the conservation of urban biodiversity; this project will propel Wellington to the forefront of cutting-edge, landscape-scale conservation in high-value, remote backcountry habitats.

Cultural benefits

- Taranaki Whānui ki te Upoko o te Ika /Port Nicholson Block Settlement Trust are the mana whenua for the area.

This project would provide a vehicle for Taranaki Whānui to exercise their mana over the catchment, be integrally involved in the project from the start, restore culturally important species and practices and improve the wellbeing and welfare of their people and community.

Social benefits

- Ordinary people are anxious to get involved in grassroots conservation projects and make a difference to overcome 'eco-anxiety'.

This project would involve the people of Wainuiomata and the Hutt Valley (and beyond), through membership and volunteering, in a world class project that would make a genuine national difference.

- People are keen to learn about their natural heritage.

This site could provide a real-life example for children and adults to see what a mature original lowland ecosystem looked like. Something which Zealandia and Kapiti Island won't provide for hundreds of years. It will be a much different experience to Zealandia and Kapiti.

- There is a need for people to get back in touch with nature and experience their natural heritage.

This project will enhance the well-being and mental health of ordinary people and provide rich recreational and leisure opportunities.

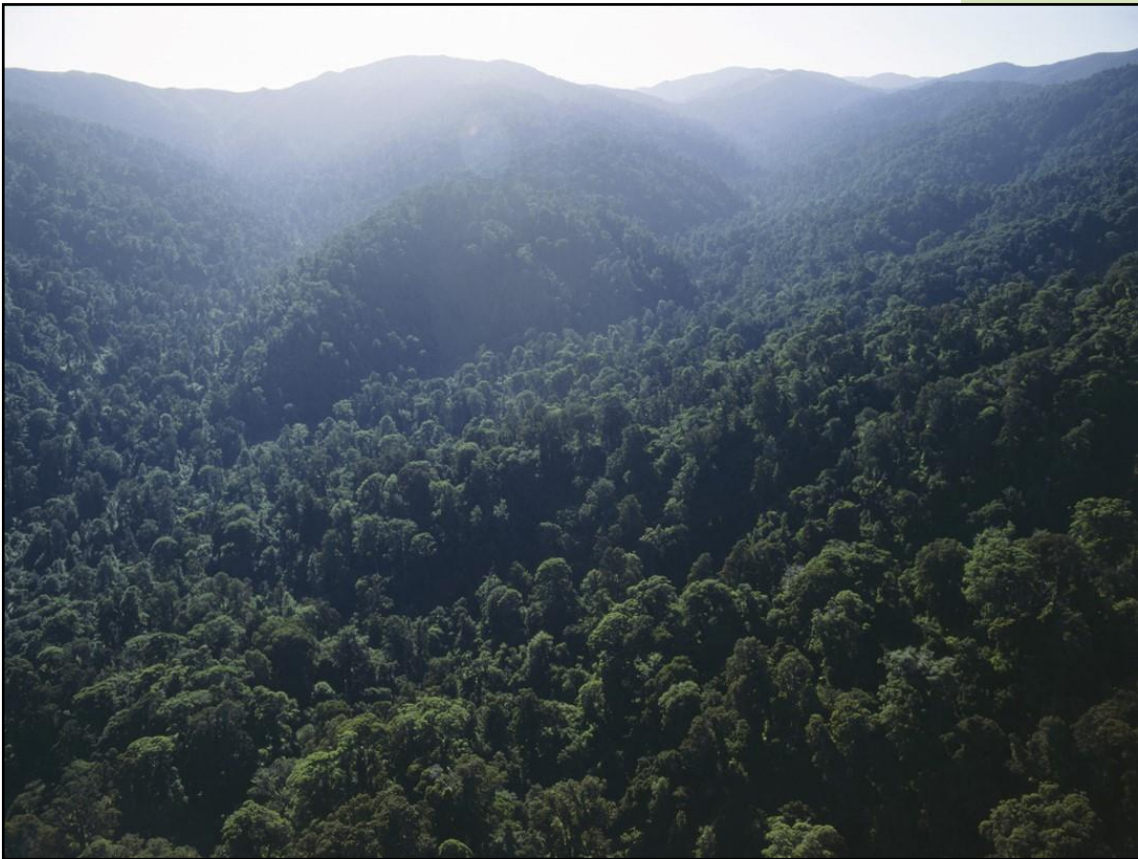
Economic benefits

- The Hutt Valley and Wainuiomata lack world class enterprises which can ‘put them on the map’ and create jobs and economic activity.

This project could in time create economic value in the order of \$25 to \$30 million pa through local spending on conservation activities, biodiversity research, creation of new jobs and business opportunities.

- There are few models for restoring biodiversity in a meaningful and sustainable way while adding social and economic value.

This site could become an international mecca for people to learn how to integrate biodiversity goals with social and economic goals.





Part Two: The Feasibility

The following section details the technical feasibility and methodology for the concept. It explains how it can be done and how much it will cost.

The overall conclusion is that the scheme is feasible, both in the short and long term and the risks are manageable.

Note: Some elements are well known, but others will require additional information and feasibility testing. Where this is the case, these aspects are identified for further work.

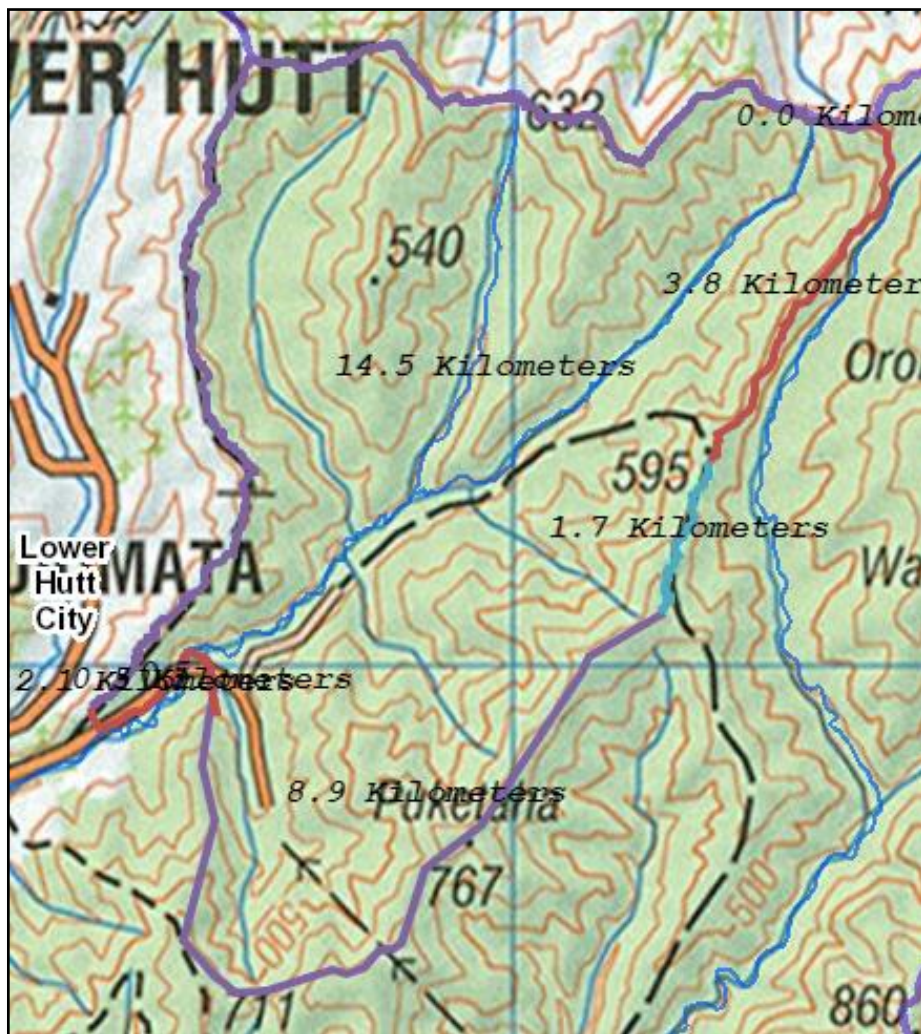


Figure 2. The Wainuiomata water catchment with proposed fence boundary marked.

2.1. The Site

Site Description

The Wainuiomata water catchment is the headwaters of the Wainuiomata river. The entrance is located off Moore's Valley Road on Whitcher Grove, two kilometres east of Wainuiomata township. It is part of Hutt City Council and is owned and administered by the Greater Wellington Regional Council as a bulk water collection facility.

The upper valley is 3,350 hectares and comprises the east and west branches of the Wainuiomata river and Skull Gully Stream, creating three large valleys in the upper reaches divided by two internal ridges: Drummond Ridge and Long Ridge. A western and northern ridge separates the valley from Moore's valley in the west and Whiteman's Valley to the North. There are habitat corridors in Moore's valley and around Wainuiomata township that link the area to the East Harbour Regional Park. There is a major (14.7 kilometre) ridge to the east which separates the valley from the Orongorongo river headwaters and catchment and is part of the wider Wainuiomata Water Collection area (total approx. 8,000 hectares). The water collection area adjoins the 23,000-hectare DOC managed Remutaka Forest Park.

The ridge system forms a roughly triangular shape which is exceptionally efficient for fencing. The terrain is medium to steep country and the climate is wet temperate with 3-4,000 millimetres of rainfall per annum. It is sheltered from most winds and snow is rare and of medium depth on the ridgelines.

The vegetation is mature, unlogged, lowland podocarp-broadleaf forest of exceptional quality and the valley has a significant natural wetland. It is rated by DOC as a site of national significance. It has been assessed by ecologist Ian Flux as highly suitable for kokako habitat and is regarded as one of the best examples of its type. It is being assessed by DOC for its suitability for kakapo.

Site suitability for fencing

The author has seen no other site in New Zealand which is better suited for fencing as a biodiversity reserve. Its attributes are as follows

- It is a **valley network**. Valleys have proven to be the best geographic configuration for fencing. Valleys have defendable ridgelines and one water outlet and birds tend to stay in the valley or migrate downstream. They are warmer, damper and more sheltered than mountains and flat areas and often have a higher carrying capacity.
- It is of sufficient **size** (3,350 hectares) to carry genetically viable populations (generally regarded as 500 plus individuals) of almost all extant NI forest bird species. This size is similar to Little Barrier Island. It is a size which is still manageable as evidenced by Maungatautari.
- It has the most **efficient boundary** possible for fencing - a broad, blunt triangle with near straight-line accessible ridgelines. The efficiency is demonstrated by the fact that the provisional boundary is 30.8 kilometres, compared to the Maungatautari boundary fence of 47 kilometres, yet they will enclose the same area. The difference is the irregular edges and outliers of the Maungatautari boundary.
- It has an existing road and deer fence on sixteen kilometres of the west boundary, so the roading job is partly done. There appears to be a practical route for the remaining fourteen kilometres on the east ridge.
- Its **single water outlet** is already secured by the water operation. (Maungatautari has 54 water egress points).

- It is perfectly located on the upper end of a **significant habitat zone**. 40,000 hectares of the Wainuiomata catchment and town reserves, the East Harbour Regional Parks and Remutaka Forest Park.
- It is located close to a **major population centre** which improves the social and economic prospects, and aids in obtaining funding.

Tenure

The catchment is vested in the Greater Wellington Regional Council as part of the 8,000-hectare Wainuiomata/Orongorongo water collection area.

It is not envisaged that this would change but the reserve provisions may need to be altered to permit other uses and mandate a separate Governance arrangement.

Water supply function

The valley currently supplies about 10% of Greater Wellingtons water and the catchment is noted for the quality of its water. Discussion will need to be had with Wellington Water as to whether the purpose envisaged here is partly or fully compatible with the water supply function.

The valley is already managed as a biodiversity site based on a poisoning regime and guided tours are permitted. Eradicating all pests from the valley would improve the water quality as possums, deer and mustelids carry tuberculosis and less poison would be applied.

The authors understanding is that the biodiversity management purpose would be compatible, but some compromise may be needed if a major visitor programme emerged (not likely within five years at least).

While the catchment is valuable for its water supply, adding the biodiversity, social and economic values to it will make it one of the most important multi-purpose properties in the nation and extract maximum value from a currently single use resource.



Figure 3. A 3D image of the Wainuiomata water catchment (looking north) with proposed fence boundary and streams marked. The entrance is bottom left.

2.2. Governance and Management

The future governance structure for the venture is an important decision to make early. With time of the essence, the initial infrastructure claim would need to be lodged under the auspices of the GWRC or jointly with the Hutt City Council. However, the GWRC will need to decide what long term role it wishes to take in the additional development and decide what the best structure is to get the most out of the opportunity.

The options available are:

1. A responsibility of a GWRC Division.
2. A GWRC controlled charitable trust (CCO).
3. A joint venture trust between GWRC, Iwi, DOC, Hutt CC, community, and key funders.
4. A community charitable trust.

It is assumed that a private or public company would not be considered due to the strong element of public good, and this is too big an undertaking for a community group.

A GWRC/iwi controlled charitable trust is the preferred governance structure to get the enterprise started (the first five years when the focus is on the catchment). After that when the focus moves to include managing the wider Remutaka and developing the economic sphere, the joint venture trust becomes a preference.

Regardless of the structure chosen the assets created in the catchment (fences, facilities, buildings) and liabilities of the trust will devolve to the council in any instance of dissolution.

A charitable trust is the ideal structure to facilitate public good activities on both public and private land; it can receive both public and private funding; it allows all interested parties, including the public to be involved; it is flexible enough to cope with both national and local levels of activity; and it can have the longevity needed to pursue very long term goals. A GWRC/iwi-controlled trust would give the council confidence around the compatibility issues with the water supply but still have all the advantages stated above and can be migrated when appropriate to a trust with a wider brief and participation.

The role of the 'Wainuiomata Conservation Trust' will be to:

1. Develop and maintain the trust deed in association with GWRC.
2. Develop long term strategy and plans.
3. Raise the development funds need to undertake the venture.
4. Organise and invite partners to participate in the venture.
5. Facilitate membership of the trust and volunteering by the general public.
6. Maintain records and databases as appropriate to support the enterprise
7. Hire sufficient staff to achieve the desired work programmes
8. Develop and execute the required programmes of work. (Biodiversity, social, business)
9. Manage risks and develop contingencies.
10. Procure funding for the trust operations and capital works.
11. Monitor overall progress towards the goal and adjust as needed.
12. Report to stakeholders

1.



2.3. Fencing the Site

Is fencing the best option?

A 'mainland island' style poisoning and trapping programme has been running in the upper catchment over 1,200 hectares for about fourteen years. This programme has resulted in an increase in some predator-vulnerable birds but has not been sufficient to establish more sensitive species. A recent robin release appears to have failed. This is consistent with other open sites where similar programmes have been insufficient to establish the most sensitive threatened species. Only a very few species (kokako, kiwi, kaka), all of which still survive on the mainland, have been re-established through pest control programmes.

By contrast Zealandia, has established sixteen species in their fenced area since 2000, including extremely sensitive species such as little spotted kiwi, hihi, saddleback and tuatara. **The conclusion is that traditional pest control will not achieve the species outcomes expected with a fence and without those species outcomes, the social and economic goals cannot be fully realised.**

The fence line.

Key to success is the practicality of finding a cost effective and viable fence route. An existing road runs for 16.6 kilometres around the west and north boundary. This has a deer fence on it, the posts for which appear to be too light, and in a condition insufficient to support a retrofitted predator proof fence.

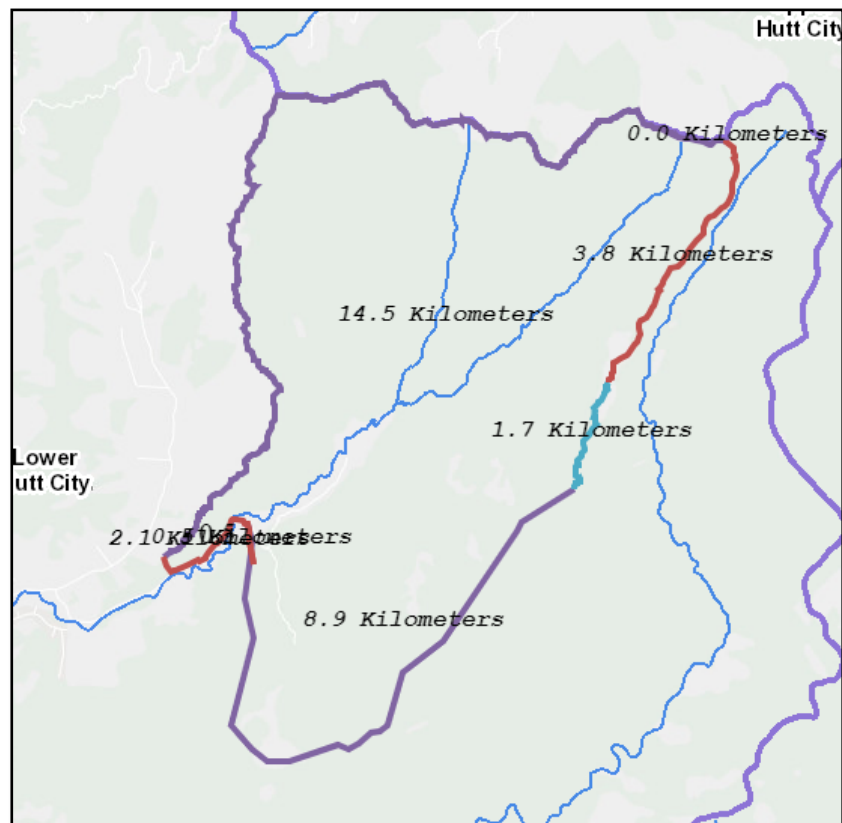


Figure 4. The proposed fence boundary.

A ridgeline runs from the north-east corner to the old dam and incorporates Georges creek: a distance of 14.4 kilometres. The ridge is not excessively steep but is covered entirely in primary silver beech forest. This ridge appears (at a distance and on maps) to be a practical route on which to build a ten-metre road bench and fence. A telecommunication station has its access road on a 1.7-

kilometre section of this ridge. This would make a total length of 31 kilometres of which under half is a new road through primary forest.

Clearing the route

The existing 16.1-kilometre road will need to be widened and graded to provide a ten-metre roadbed and the deer-fence removed. A new road will need to be driven the 14.9 kilometres down the east ridge. This will result in the clearance of about 12 hectares of primary silver beech forest.

Some of the existing road intrudes on private land and the new route may need additional permissions and agreements.

Fence design

Predator fencing has been available since 1999 and is now a well proven technology up to the scale of this project. Fencing has proven to be effective against all species over long time periods except for mice. It has proven to be practical to manage the fences and deal with occasional incursions but requires constant surveillance and a robust incursion response capability.

There are at least four options available for predator proof fences:

1. **The original Zealandia design** (1999). This has proven robust, long lasting and highly effective against all pest's bar mice. It is rarely used now as it employs higher cost material. All fences are a variant of this model.
2. **The Xcluder design** (2006). This is a lighter version of the Zealandia fence and is the most widely used as a proprietary company markets and builds it. It is less robust and needs more maintenance and seems to have a shorter life (20 years). One Xcluder fenced area is still mouse free after ten years.
3. **Cape Sanctuary design** (2008). This combines the robustness of the Zealandia design with more cost-effective materials. Its effectiveness is difficult to gauge because Cape Sanctuary is only partially predator-free with the ends open to the sea.
4. **Custom design**. It is probably an appropriate time to reassess all available designs and building materials and develop a modern version which incorporates the best of all designs. Such an option would take additional time but may save costs and get a more effective (mouse proof) and longer lasting model.

The conclusion is that fencing is now a proven (but challenging) technology where the risks and costs are well known and manageable.

Fencing costs

The most recent fence built was the 14.1-kilometre Brook-Waimarama Xcluder fence (2017). This is on a difficult steep site through primary forest and cost \$4.2 million (\$300 per lineal metre). A recent quote for an 8-kilometre fence on flat swampy ground near Ruapehu was for \$3.2 million (\$400 per lineal metre) but this appears high and is still to be negotiated. Note that these indicative costs include service gates, water course security and road bench. As the proposed fence line is partly constructed, a budget figure of \$350 PLM, with a contingency, seems safe. This would give an indicative cost for a 31-kilometre fence of **\$10,850,000**. A 15% contingency should be added to this figure for funding bid purposes.

Total estimated cost for the fence is \$12,500,000.

Consent issues

The fence will require a resource consent for earthmoving and for the clearance of approximately twelve hectares of primarily beech/kamahi/kanuka forest. There will be a proportionately very small amount of podocarp on Solomon's spur. The loss is compensated by the fact that there is very little podocarp/rata involved and the gains to the wider ecosystem are huge. The Brook-Waimarama sanctuary obtained consent to clear nine hectares of primary beech forest along the fence route so there is a precedent for this.

Actions needed to get the fence built.

The following actions need to be undertaken:

1. **Survey the route.** This needs to be done by a registered surveyor/engineer and experienced road builders and ecologists (which GWRC has on staff).
2. **Develop fence design and route specifications.** Through a registered engineer and biodiversity staff.
3. **Obtain quotes for prices.** Xcluder or local contractor. Settle on the contractor and price.
4. **Negotiate neighbour and private land issues.**
5. **Apply for the resource consent.** Allow six months (if fast tracked).
6. **Finalise funding.** This should be in a package which would include the eradication.
7. **Begin construction.** One year (minimum) after the first action begins.
8. **Complete construction.** Eighteen months after construction begins.

Total time to complete the fence – allow three years from now.

Logging the east ridge

The east ridge will need to have many hundreds of silver beech trees logged and removed. There will be too many to simply leave on the ground. Silver beech is a valuable decorative timber which is in short supply and commands prices of up to \$400 a cubic metre. A logging contractor should be consulted to assess the value of these logs which can be hauled out during the road construction and sold to defray costs.

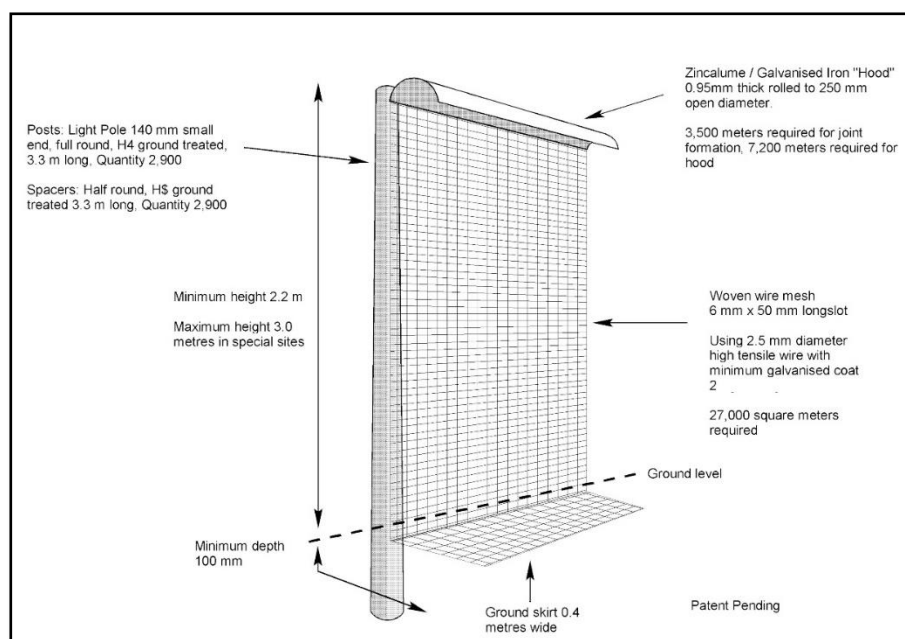


Figure 5. The Zealandia fence

2.4. Eradicating the Pests

Pests in the valley will be browsers: (goats, pigs, deer and possums): predators: (rats (2), mustelids (3), cats and hedgehogs) and competitors (mice, exotic birds, some invertebrates). Pest eradication from fenced areas is now an established process for which the costs and risks are well known and predictable. However, this is still a process that requires rigorous planning and execution and once done, a 'forever' surveillance and response system is required to stay in place to deal with the inevitable incursions.

The largest mainland site to be cleared of pests is Maungatautari near Cambridge (3,400 hectares). This site has had periodic incursions, but these have proved manageable. It should be noted that all fenced sanctuaries have experienced incursions, but the systems deployed to deal with these have proved generally effective and the incursions have not prevented the reintroduction and establishment of sensitive species. The predator-resistant peninsular fences near Auckland (Tawharanui and Shakespeare) experience numerous incursions every year but are still able to maintain populations of saddleback.

Mice

The exception is mice. Only one fenced sanctuary (Rotokare near Stratford-250 hectares) has been mouse free for any length of time. All others have tried and failed to eradicate mice. It should be assumed that we will not be able to get rid of mice from the catchment, and if it was achieved this may only be a temporary state. Mice can build up to large populations in summer in the absence of predators and where there are beech masts their numbers can be huge; then they collapse in winter. Wainuiomata is very wet and lacks beech forest so the numbers here are likely to be lower than elsewhere. Mice mainly consume fallen fruits, seeds and small invertebrates and therefore they are a competitor to birds rather than a predator. They may depress lizard recovery.

Method

The standard method for eradication is to put in place a monitoring track and line grid of 100 metre apart lines with stations at 50 metre intervals along each line across the whole catchment. Pre-trapping to reduce densities won't be necessary as pest numbers won't be high due to current management. Two aerial drops of brodifacoum at 8kg and 6kg per hectare is recommended. Follow up to shoot all remaining pigs, deer and goats and trapping and baiting for hedgehogs will take another three months. Intense monitoring along the grid will be maintained for six months until all clear. New technology in lures and detecting and removing lone animals from large clear areas is emerging from the ZIP research programme and will enable this to occur.

Eradication costs

GWRC has the internal capability to undertake a project of this nature with their biosecurity and pest control unit who should manage and oversee the project. However, it is a huge undertaking which should be completed in 12 months but could take up to 18 months to complete; depending on the seasonal timing in relation to the fence completion. The GWRC team would almost certainly need bolstering to undertake the project.

Following are some cost estimates based on experience to date (note these are indicative only and a full cost assessment would need to be done by the GWRC pest control division.

Activity	Units	Unit cost	Total
Management and planning	100 days	700 per day	70,000
Pest-off bait –Two drops at 14 kg per ha (total)	45 tonnes	\$4,000 per tonne	180,000
Helicopter – two drops	40 hours per drop	\$2,000 per hour	160,000
Tracking and monitoring equipment and traps	Tunnels, ink and chew cards. Victor rat traps. DOC 200	\$various	250,000
Field staff (track cutting, monitoring and operational support)	6 FTE X 12 months plus transport and equipment.	\$75,000 per FTE per annum	450,000
Consumables	various		15,000
Contingency		15%	175,000
		Total	1,300,000

Maintenance costs

Once the valley has been cleared then there are ongoing costs to maintain the track system and to monitor for and respond to incursions. This will require at least two FTE per annum with a half FTE per annum for responses when required plus equipment and consumables.

This comes to **\$250,000 per annum.**



2.5. Restoring the Site

With the pests removed the restoration phase can begin immediately. This will centre on reintroducing missing fauna and flora to the catchment.

Biological inventories of the site where extant fauna and flora are identified and located and missing representative taxa listed have already been completed.

Extant Species

Species present in the catchment have already increased due to past management and will recover their populations further without intervention until they reach carrying capacity. Forest fauna which are present include: NI brown kiwi, tui, bellbird, kereru, silvereye, grey warbler, fantail, morepork, shining cuckoo, long-tailed cuckoo, rifleman, whitehead, red and yellow crowned parakeet, falcon and tomtit. Pukeko, harrier, kingfisher, paradise duck, grey duck, scaup, grey teal and shags may be on the wetlands, ponds and rivers. Some of these (silvereye, grey warbler, fantail, tomtit) will reduce in numbers when the deeply endemic species become abundant. Within ten years they should all be abundant throughout the catchment and adjacent valleys and will be migrating beyond the catchment.

Lizards and invertebrates will depend on the eradication of mice and may take time (ten years) for them to re-emerge as they can be very cryptic in low numbers. Fish are unlikely to be affected.

Locally extinct species

Likely missing species which could be reintroduced over twenty years include: kakapo, rowi kiwi, little spotted kiwi, kokako, saddleback, hihi, kaka, robin, takahe, weka, brown teal, blue duck (on the rivers), grebe (on ponds), fernbird, bittern and banded rail (in swamps), tuatara, various lizards, Hamilton's frog, giant snails and giant weta. In time, NZ snipe could be considered for reintroduction.

The recovery of these species will be highly variable. Some, such as robin, kaka and kakariki, will establish and recover fast and spread throughout the valley and adjacent managed areas (within ten years of release). Others, such as kokako and kiwi, will recover more slowly but steadily and will eventually (within twenty years of release) occupy the whole catchment. Some very sensitive species, such as saddleback and hihi, may establish quickly but will only be in good numbers within the fenced zone. Some, such as fernbird, rail, bittern, takahe, tuatara, frogs and the ducks, will be habitat restricted. Slow breeders like tuatara and frogs will take many years to increase enough to occupy all their available habitat in the valley.

Plants

Extant plant species will recover quickly but it will take ten to twenty years before gains in flora can be measured and some understory species heavily impacted by browsers may take many decades to recover. Some species which are entirely missing or vital to the ecosystem (e.g. dactylanthus, mistletoe) can be planted quickly but it could be many years before they show significant recovery.

Re-establishing species

The effort required to re-establish missing species in a large fenced area varies enormously for one species to another. Some are easy to establish provided they are released in sufficient numbers, e.g. kiwi, weka, kakariki, robin, brown teal

Others need special care and monitoring to ensure they stay and thrive e.g. kaka, kokako, saddleback, hihi, blue duck. Most are difficult and expensive to procure in large enough numbers. A typical transfer can cost between \$50,000 and \$100,000.

Experience shows that generally only two or three major species transfers can be made each year and periodic consolidation and close monitoring of establishment and survival is required. Some species may require several releases to establish. Seasonal fluctuations are common, and birds can be very picky about their choice of habitat and will not always stay inside the fenced area. Tactics such as supplementary feeding and mass or slow release can be used to enhance the chances of success. Ground birds such as kiwi and weka will need to be relocated within the zone at times.

However, it could be reasonably expected that within thirty years nearly all missing fauna would have been re-established in the catchment, that many species will have dramatically recovered across the whole managed area and that the ecosystem will be peaking on its recovery trajectory. The scene described in 1.2 will be a reality.

Kakapo

There are 215 kakapo remaining, all are on offshore islands. There is a lack of rimu/podocarp rich islands of sufficient size to accommodate a steadily expanding kakapo population. The catchment is big enough to accommodate a population of about 150 kakapo (twice the number on Codfish Island). The catchment habitat is superior to, and more productive than Codfish and its climate is warmer. Wainuiomata could become the primary mainland site for kakapo recovery over the next twenty years. The DOC Kakapo Recovery Team is currently investigating the site for kakapo and regard it as very promising.



Kiwi

A decision will need to be made early about kiwi. There are NI brown kiwi in the catchment, reintroduced from the long running Remutaka kiwi project. The indigenous kiwi for the region are the rowi and little spotted kiwi who co-existed but became locally extinct before Europeans. The rowi is still critically endangered and its total national numbers are about 600. The catchment could in time potentially support a viable population of up to 1,000 rowi which would make it a nationally important site and a source of rowi for other projects.

Partnership with DOC

Given the catchment's potential for threatened species recovery and the proximity of DOC land, it is logical that DOC becomes a major partner in this venture. DOC has largely been a by-stander in the fenced sanctuary movement, but this project could be so valuable that they would be remiss not to become deeply involved. The logical contribution is for DOC to fund the conservation and recovery programme on a permanent basis. While there is currently no precedent for this to happen, it may be time for DOC to become more seriously involved in the fenced sanctuaries.

Resourcing

A recovery programme will typically require a conservation Manager and at least three to four full time staff. These can be supplemented with researchers, volunteers and students as required. Personnel costs will be as follows:

1. Conservation manager	100,000
2. Three FTE rangers at \$75 pa	225,000
3. Research, volunteer, student support	25,000
4. Equipment and overhead	75,000
5. Projects 3 x \$50K	<u>150,000</u>
Total per annum	\$575,000

2.6. Managing the 'Halo'

The Wainuiomata catchment occupies a strategic position at the head of two large natural areas: the Orongorongo/Remutaka range and the Wainuiomata and East Harbour valleys. This amounts to about 40,000 hectares of quality habitat. Some of these places are of near equal quality to Wainuiomata, particularly the Orongorongo water catchment, the Catchpool valley and Gollan's Valley. This area has been well researched as the DSIR research station worked on the Orongorongo River for about 25 years until the 1990's. The area could become a national test and research site for largescale biodiversity management.

The 'halo effect'

Zealandia in Wellington City has confirmed that certain species of bird will migrate out of a protected area and recolonise nearby habitat. In Wellington this has been largely tui, kaka, falcon and kakariki. Other birds struggle to make headway despite predator control, most likely due to the abundance of domestic and feral cats and rats which are in inordinately large numbers in cities, and the still re-generating city habitat. The Remutaka/Orongorongo zone doesn't have these 'city' problems with cats being in low numbers. It is assumed that if the forests in the Remutaka/East harbour area were systematically managed then the 'halo effect' from Wainuiomata would be much greater than Zealandia as the habitat is much better and the range of native species will be much greater.

Landscape management

There is considerable work being undertaken nationwide on how to deal with landscape scale pest management. Currently, very little is being done in the Wellington Region. This represents an opportunity to tie landscape scale management in with the fenced sanctuary concept to generate a synergistic and powerful strategy. Current landscape projects focus on killing pests and assume this will increase biodiversity. If Wainuiomata supplies migrating species into the wider environment, then landscape management can assist their survival and wide dispersal and aid the return of missing species such as kaka, kokako and kakariki across the entire ecosystem.

Managing the 'halo'.

The 'halo' should be managed by progressively extending a predator-controlled area beyond the boundary, initially west into Brookfield and east into the Orongorongo catchment. This management will not need to start for at least five years and could be gradually extended into the Remutaka Forest Park. The long-term goal should be to have an intensively managed 'halo' starting with 5,000 hectares and extending progressively to 10,000 hectares surrounding the fenced area. In due course, several intensively managed patches can be set up in key locations (e.g. Catchpool and Gollan's valley). and broad scale management (1080 aerial application and intensive ungulate hunting) can be undertaken across the remaining 20,000 hectares.

Partnering with Predator Free NZ and ZIP

Predator Free 2050 Ltd has a policy of favouring those areas with fenced sanctuaries in the vicinity and seeks to fund and support landscape scale projects. They are a natural partner for the 'halo' management zone.

Zero Invasive predators (ZIP) is a DOC/private research partnership which is tasked with developing new and more effective pest control methods in open ecosystems. They are a natural partner in such a scheme as this would provide an unparalleled trial ground for them.

Several community care groups already do pest control in the Remutaka Forest Park (the Remutaka Conservation Trust) and East Harbour Regional Park (Project MIRO) and GWRC does work in selected Key Native Ecosystem (KNE) sites in the locality. DOC has jurisdiction over the Remutaka Forest Park but currently does almost no management there. These community groups and DOC are also natural partners.

Costs for managing the 'halo'

Intensively managed 'halo' outside the fenced zone. Current costs for setting up and maintaining an intensive pest management programme (including trapping, toxins, hunting) is likely to be as follows.

- First year (with set up costs) \$300 per ha over 5,000 ha = \$1,500,000
- Subsequent years \$200 per ha p.a. over 5,000 ha = \$1,000,000 p.a.

Broadscale management across the Remutaka ranges and East Harbour Parks. Current costs for setting up and managing a broad scale aerial toxin operation and intensive hunting across 20,000 hectares are likely to be as follows.

- Aerial application (3 to 5-year cycles) \$5 per ha p.a. over 20,000 ha = \$1,000,000 p.a.
- Intensive hunting. First year \$500,000 steadily reducing to managing 'hot spots' and incursions. = \$100,000 p.a.

It can be expected that over time these costs will reduce as new technology is deployed and efficiencies are built into the system.



2.7. Engaging the Community

Zealandia pioneered a community engagement model which has proven to be very powerful in marshalling public support and providing an economic ‘buffer’. This model has been successfully replicated on a smaller scale with other community sanctuaries. Zealandia has 15,000 members, 600 active volunteers and raises \$1,200,000 per annum directly from subscriptions and donations. Zealandia has been warmly embraced by the Wellington City community and such results should be at least replicated, if not exceeded, with Wainuiomata. The national scale of Wainuiomata will have a magic and public appeal all its own. The conservation and wider community will want ‘in’ on it.

The tried methods of mass community involvement are through membership, donation campaigns and volunteering. All of these are well proven and there is plenty of expertise available in these areas.

Membership

Direct membership of a trust is a much more powerful vehicle than ‘friends of...’ programmes. The payment of a small (range \$45 to \$65 p.a.) annual fee with automatic renewal builds a strong emotional attachment and ownership and creates a direct line of communication to a sympathetic constituency. This group can be quickly and easily put in place (Zealandia had 1,500 members within one year) and becomes an immediate source of donations and volunteers.

Donations

Many smaller businesses and philanthropic individuals want to donate to such enterprises. Zealandia receives grants and donations of nearly \$700,000 p.a. This can be a steady background income for the trust as the project unfolds. The scale of Wainuiomata will make it very attractive to philanthropy, not only locally but with large national donors who have tended to ignore Zealandia.

Volunteers

There is a hunger for people to get directly involved in conservation projects and it shows no sign of abating. Volunteers can contribute greatly to an enterprise through low cost labour and as dedicated supporters. Volunteering can be by way of aiding pest control and monitoring, conducting guided tours, assisting in administrative tasks and providing expert and professional services. Over time, the trust can collaborate and align activities with existing community groups, such as Brookfield Outdoor Education Centre, the Remutaka Conservation Trust and Project MIRO.

Iwi involvement

Taranaki Whānui ki te Upoko o te Ika, represented through the Port Nicholson Block Settlement Trust, are the mana whenua for the area.

They should be approached early to become involved as a founding partner. Taranaki Whānui have a history of involvement with the catchment.

Partnerships

Both Iwi and the community should be embraced at the start as genuine partners. This means providing a mechanism to be involved both in operations and at governance level – perhaps through places on the trust board or through advisory committees. Such mechanisms should be created when the trust board is formed.

2.8. The Economic Opportunities

Zealandia pioneered an economic model which has proven to be very valuable for Wellington City. Zealandia has been shown to contribute approximately \$30 million each year to the Wellington economy by way of direct expenditure and added economic value and is now (pre-Covid-19) largely self-funding. Given the national scale of this venture there is no reason why, in time, Wainuiomata should not match or exceed the value to the region created by Zealandia.

The Wainuiomata business model

Wainuiomata may not be able to recreate the Zealandia mass market/high visitor volume model which has 150,000 visitors per annum, as this may not work with the water supply function and Wainuiomata will be harder for visitors to get to. Wainuiomata also has more inclement weather. However, a lower volume, higher value model based on guided tours will be viable. Zealandia guided tours sell for \$55 to \$85 per head and are very popular. When it becomes fully operational (5 to 10 years), the catchment will be a highly attractive visitor experience and will likely become world renowned very quickly. Wainuiomata will be able to offer a different experience to Zealandia including a mature ancient forest environment and back country 'all day' tours.

A guided tour programme of 40,000 people per annum would return gross revenue of \$2,000,000 p.a. and operate on a 30% profit margin. Special low-cost provisions can be made for locals and members. In time (after 10 years' experience) selected parts of the valley which do not intrude on water supply safety could be opened for controlled freedom walking.

Additional trust businesses and revenue streams

Ancillary businesses can be developed around the recreation area entrance frontage (outside the fenced catchment) where there is plenty of space in which to grow and there is excellent access from Wainuiomata. This could include a visitor centre, a café and education facilities. An events venue (corporate meetings, private functions, weddings, etc) will be a very viable and lucrative revenue source. A campground and RV park can be located close at hand. As a charitable entity the trust will be able to access community and philanthropic funding sources to construct the needed infrastructure.

Area economic activity

The Hutt Valley and particularly the Wainuiomata township are likely to benefit the most economically from Wainuiomata. It will create a 'hub' for research and conservation management and the visitor businesses will benefit the surrounding community by creating jobs and attracting visitor spending. Wainuiomata will be the focus of national and international attention and will be a hive of activity.

Spin off activities will most likely arise in the surrounding area including bird tours in the Remutaka Park. A '**Great walk**' with overnight hut stays could be built starting in the catchment and finishing in the Catchpool valley. Walks like this have enormous economic benefit for the surrounding communities. The business opportunities are considerable.

The post Covid-19 world'

Many of these assumptions depend on a healthy economy and a viable tourism industry, neither of which are the case now. However, it is not expected that any visitor programme will be able to be launched for at least five years as the catchment will be off limits during fence construction and eradication for at least

that period. However, by starting now the venture will be primed to take advantage of a recovering economy and a world getting back to normal. It took Zealandia eighteen years (after the fence was built) to get its visitor programme to an optimum and sustainable level and this will require a similar time frame.

Relationship to Zealandia

Will Wainuiomata compete with or detract from Zealandia and will it ‘oversupply’ a limited market? These points are relevant:

- Wainuiomata is more of a national project and will attract even wider interest than Zealandia, especially with national species recovery programmes.
- Wainuiomata will be a different experience and will compliment what Zealandia offers.
- The market for authentic natural experiences is growing and (apart from Covid-19) has not yet peaked.
- Zealandia and Wainuiomata can co-operate to market Wellington Region as a biodiversity management and research centre of excellence and align the visitor experiences.
- Zealandia has a twenty-year head start and is well established and secure.



2.9. Wainuiomata Conservation Trust Financial Projections

The following section summarises the projected costs and potential revenue projections for the first ten years from the estimates provided in earlier individual sections and discusses how it can be funded.

Costs are presented as capital (one-off) and operating. Revenue are presented as funds required to be raised and potential revenue from partner contributions and business activities. No allowance has been made for GST or depreciation as these estimates are indicative only. It is assumed the trust managing the enterprise will be working towards annual fiscal neutrality.

Cost projections are derived from the assessments made in previous sections and compared against two benchmarks – Zealandia and Maungatautari. Zealandia had operating costs of \$5.3 million in 2019 and Maungatautari (equivalent size to Wainuiomata) had operating costs of \$1.3 million in 2019. Zealandia is less comparable because it operates a large and mature visitor programme and has been operating commercially for 20 years with an operating surplus for the last 5 years. It takes at least 20 years for these projects to become fiscally neutral when partner contributions can be reduced.

Long range revenue potential

It can be expected that an enterprise of this nature will still be largely dependent on partner contributions and donations for at least the first ten years. After that, with good management and barring financial shocks, the enterprise should become more self-sufficient and should break even in twenty years. The initial revenue sources will be members subs, donations, night and day guided tour and gate takings, café refreshments and merchandising. The water supply function may constrain some long term (post fifteen years) revenue options, but there is ample space in the recreation area just outside the valley entrance for development of compatible businesses and there are many possibilities which will not unduly intrude on the water function as follows.

Camp and RV ground. A 100-person serviced camp site and 50 vehicle serviced RV park could be built in the recreation area just outside the entrance. An attraction like Wainuiomata will be very popular with tourist campers.

Remutaka ‘Great walk’ A ‘great walk’ starting in the catchment and finishing at the Catchpool visitor centre could be very popular. This could have an overnight stay in the sanctuary and two other overnight huts. The capital cost to build huts and tracks is high but the revenue potential is good.

Events centre. A medium size (120 person) events centre which could cater for corporate events, weddings, private functions, education visits and training courses can be very popular as the area is close to a large population centre and the ‘remote wild’ atmosphere the sanctuary can offer could be very attractive and quite unique.

Local economic impact.

It has been estimated that Zealandia provides Wellington city with approximately \$30 million worth of positive economic added value each year from employment, local expenditure and attracting visitors to the city. It could be reasonably expected that in time Wainuiomata could at least match this added value and provide a significant and much needed economic boost to the Hutt Valley and Wainuiomata.

Costs

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Capital										
Fence	700	7,800	4,000							
Eradication			200	1,000	200					
Staff accommodation					500	500				
Visitor facilities						500	2,500	2,500		
Total capital req	700	7,800	4,200	1,000	700	1,000	2,500	2,500		
Operating										
Manager	150	150	150	150	150	200	200	200	200	200
Board ²		50	50	50	50	75	75	75	75	75
Support staff		50	100	100	100	200	200	200	200	300
Ops staff				150	150	150	150	150	250	250
Ops costs				100	100	100	100	100	100	100
Restoration staff				100	350	350	350	350	350	350
Restoration costs				100	150	225	225	225	225	225
General	20	20	20	40	50	100	100	100	100	100
Total Operating	170	270	320	790	1,000	1,400	1,400	1,400	1,500	1,500
Total Cap+op	870	8,070	4,520	1,790	1,700	2,400	3,900	3,900	1,500	1,500

Funding and Revenue Sources

Item	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Capital funds										
Facilities grant	5,000	5,000	5,000							
Community grant					6,000					
Total capital	5,000	5,000	5,000		6,000					
Operating Rev										
GWRC contrib.	250	250	250	250	500	500	500	500	400	400
HUTTCC contrib.	50	50	50	50	200	200	200	200	150	150
DOC contrib.				250	250	300	300	300	200	200
Member subs			30	40	50	100	150	200	250	250
Donations/grants			100	100	100	250	250	250	300	300
Revenue (net)					30	40	50	100	200	300
Total op rev	300	300	430	640	1,130	1,390	1,450	1,550	1,500	1,600
Total cap + op	5,300	5,300	5,430	640	7,130	1,390	1,450	1,550	1,500	1,600
Less expenditure	870	8,070	4,520	1,790	1,700	2,400	3,900	3,900	1,500	1,500
Cash flow +/-	+4,430	+1,660	+2,570	+1,420	+6,850	+5,840	+3,390	+1,040	+1,040	+1,140

Cost assumptions

- A total cost for the fence of \$12,500,000 and 3 years to plan and build.
- A total cost for the eradication of \$1,300,000. Planned before the fence is complete and finished within 18 months.
- A staff accommodation block costing a total of \$1,000,000. Note some existing GWRC buildings may be repurposed for this. An inventory of available assets needs to be undertaken.
- A modest visitor centre costing \$6,000,000. This would not need to be on the scale or cost of Zealandia's visitor centre as it is not built on a fault line and will not need to deal with the high volumes Zealandia caters for. Also, it would not be necessary to replicate the Zealandia exhibition.
- Vehicles and other field equipment would be supplied during the eradication.

Funding and revenue assumptions

- A Government facilities/stimulus grant of \$15,000,000 should be applied for to cover the fence and the eradication plus ancillary costs. It is assumed this would be drawn down over three years.
- A GWRC contribution of initially \$250,000 p.a. is assumed. This is the sum the GWRC and Wellington Water currently spend on pest control in the two catchments. It is envisaged that this contribution be doubled from year five and will begin reducing in year eight.
- A Hutt City Council contribution is assumed of \$50,000 p.a. for the first four years rising to \$200,000 p.a. after that and reducing from year eight. This is assumed because the Hutt City will be the major economic beneficiary of this scheme.
- A DOC contribution of \$250,000 p.a. from year four rising to \$300,000 p.a. after year six and reducing after year eight is assumed. This is broadly equivalent to the restoration programme costs and is predicated on the assumption that DOC will benefit by having a facility to house deeply threatened species.
- It is assumed that membership subscriptions and donations can be tapped into very early: as soon as the fence is completed.
- Revenue projections are based on guided tours run by volunteers, augmented by refreshment sales and merchandising. It is assumed these activities will be self-funding with a 30% profit margin. The net surplus after costs is included.

2.10. Risks and Contingencies

A project of this scale, while achievable, has many risks which need to be identified and managed carefully. Following is a provisional risk analysis for the proposal.

Risk	Likely or significant	Prevention	Mitigation if it happens anyway.
Fence Water function incompatible	Unlikely/significant	NA	Negotiate with Wellington water
Fenceline is longer than expected	Likely/not significant	Won't be big variation (5% max)	Add a contingency sum (done)
Private landowners don't co-operate.	Unlikely/significant	Early negotiation	Redraw route to avoid conflicts
East route proves impractical	Unlikely/critical	Survey route as first action.	Review other possible routes
Fence costs higher than expected	Likely/significant	Peer review estimates	Add a contingency sum (done)
Resource consent application fails	Possible/critical	Make the case/there is a precedent.	Reapply or abort project.
Construction difficulties and delays	Likely/significant	Excellent project management	Revise time frames.
Windthrow on east boundary.	Likely/significant	Clear route of risky trees	Drone/electronic surveillance
The fence is 'leaky'	Unlikely/significant	Excellent design and construction	Excellent surveillance/response

Eradication			
Remnant pest populations	Likely/not significant	Excellent project management	Hunt down remnants.
Unable to eradicate mice	Likely/significant	Mouse-proof fence design.	Live with mice
Weather and delays	Likely/not significant	Allow for in planning	Extend time frames
Restoration (after 5 years)			
Some species don't 'stick'	Likely/significant	Excellent planning	Adjust translocation technique; increase founder population size and/or number and frequency of individual transfers.
Inadequate source populations	Unlikely/not significant	Excellent planning -affects few species	Alter programme
Governance/management/finance			
Funding not available for fence	Likely/significant	Promote the multiple benefits	Proceed/scaled down version
No interest from potential partners	Unlikely/significant	Early commitment and sell benefits	Proceed/scaled down version
Commercial prospects don't happen	Unlikely/significant	Excellent business management	Proceed/scaled down version.

2.11. References and Acknowledgements

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