


2025

TE PŪNGAO O TE REPO

Photovoltaic Energy Generation integrated with Wetland Restoration





KIRINI

Te Pūngao o te Repo

Photovoltaic Energy Generation integrated with Wetland Restoration:

A prototype for a 21st-century strategic climate infrastructure solution

Prepared for the Tiria Hohepa Harawira Whānau Trust

Prepared by Kirini Limited

September 2025

Contents

Summary

Te Pūngao o te Repo, the Papamoa Conservoltaic–Wetland Pilot is a prototype to test solar photovoltaic (PV) infrastructure co-existing with wetland restoration, generating renewable energy while enhancing ecological, cultural, and economic outcomes. The project will deliver proof of concept for a scalable system capable of replication across New Zealand, especially on marginal and flood prone land.

90% of wetlands in New Zealand have been drained. The restoration of wetlands provides broad benefits including carbon sequestration, biodiversity enhancement, flood attenuation and resilience to the effects of climate change. Repo (wetlands) are culturally significant to Māori.

Conservoltaics is an emerging technological system integrating PV panels with ecological enhancement. This pilot, combining PV panels with wetland restoration, is a world-first application of the approach.

The site for the pilot is on a 34-hectare Māori freehold site owned by the Tiria Hohepa Harawira Whānau Trust, an Ahu Whenua Trust. A 1-hectare PV installation will sit within a 3.5-hectare drained wetland which will be restored. Raised panels, positioned two to three metres above the ground, allows both native vegetation to develop and hydrological pathways to re-establish. Transdisciplinary design will ensure the PV system integrity and ecological function are coordinated with whānau intergenerational priorities. This integrated approach gives equal weighting to energy generation and wetland regeneration.

Delivery will combine staged wetland restoration over 36 months with PV installation, monitoring of energy, ecological and cultural outcomes, and adaptive management. The infrastructure cost is significantly higher than that of a conventional PV installation, reflecting the bespoke nature of this pilot project. Its limited scale, integrated ecological objectives, and novel design requirements contribute to a premium that is typical of first-of-its-kind demonstration systems. Funding pathways under consideration include a mix of philanthropic trusts, government and impact funding.

The pilot is supported by technical partners including Kirini Ltd., Lincoln University, and a multi-disciplinary design team.

This project represents a nationally significant, climate-adaptive model integrating renewable energy that supports New Zealand's energy transition goals, ecosystem recovery, and kaitiakitanga (Māori stewardship), providing funders with a clear, strategic pathway to both ecological and social impact.

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Ka tō he rā, ka ura he rā | A sun sets, a sun rises

This whakataukī reminds us that challenges are temporary and renewal follows. It speaks to the resilience of both the land and the people. As the sun sets and rises, land can recover, energy systems can stabilize, and people can adapt.

Wetlands and degraded lands are given a second chance: plants return, water quality improves, and habitats recover while the solar energy generated from the conservoltaic system provides communities with renewable energy. The multiple benefits, environmental restoration, climate resilience and energy security, strengthens whānau and whenua resilience, allowing communities to thrive.

Pekapeka Wetlands

Throughout this report are images of flora and fauna that we hope will thrive with the rising sun.

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Te Mana o Ngā Mātauranga (Intellectual Property)

The concept of locating PV panels above a wetland restoration project was suggested during a wānanga between Kirini Ltd. and the Tiria Hohepa Harawira Whānau Trust in July 2024.

The mātauranga (*knowledge, idea*) underpinning this concept sits with the Tiria Hohepa Harawira Whānau Trust.

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Acknowledgments

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This report has been prepared for Tiria Hohepa Harawira Whānau Trust by Kirini Limited in consultation with:

Babbage, Hamilton Locke, Lincoln University, Manaaki Whenua Landcare Research, Neil Walbran Consulting, Powerco, Sunergise, Sustainable Energy Association of New Zealand, Tau Manihera Resource Planning.

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Technical and Regulatory Acronyms

AEE – Assessment of Environmental Effects
BOPRC – Bay of Plenty Regional Council
LVA – Landscape and Visual Assessment
MBIE - the Ministry of Business, Innovation and Employment
NES-Freshwater – National Environmental Standards for Freshwater
NPS-FM – National Policy Statement for Freshwater Management
PPA – Power Purchase Agreement
PV – Photovoltaic
SH2 – State Highway 2
TCC – Tauranga City Council
USDG – Utility-Scale Distributed Generation

Kupu Māori

kaitiakitanga – stewardship, guardianship
mahinga kai – customary food gathering practices
mana motuhake – self-determination, autonomy
mātauranga - knowledge, wisdom
papakāinga –Māori housing development
rākau rongoā – traditional medicinal plants
repo – wetlands
rongoā Māori– traditional Māori medicine
tikanga– customary protocols
wānanga - event for learning, discussion, and deepening understanding
whānau – extended family group, including multiple generations
whenua – land, with deep ancestral and spiritual significance

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1. Purpose of this Report

- Establish inception-level viability for an integrated conservoltaic-wetland pilot project.
- Identify technical, environmental, regulatory, and cultural parameters critical to feasibility.
- Initiate early-stage alignment with Bay of Plenty Regional Council (BOPRC) and Tauranga City Council (TCC) planning and climate strategies.
- Provide funders with a strategic overview, including anticipated outcomes and budget framework.
- Clarify a pathway to develop a fully costed and consented design with supporting documentation.
- Outline potential funding and delivery models, including staged investment and Power Purchase Agreement (PPA) structures.

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2. Introduction

Wetlands

Wetlands provide essential ecosystem services that support climate resilience and food system security, including biodiversity, water purification, flood regulation, nutrient cycling, and carbon storage. Globally wetlands have been heavily degraded, primarily through drainage for agriculture and expanding urban areas, with an estimated 70% loss since 1900.

New Zealand has experienced an immense loss of wetlands. Prior to large-scale drainage, wetlands covered roughly 2.2 to 2.5 million hectares (about 10% of New Zealand's land area). Today, only 249,000 hectares (10%) of that wetland area remains. Recent assessments confirm this ongoing decline: about 6,000 hectares of freshwater wetlands were lost in the last two decades alone (Manaaki Whenua Landcare Research).

Restoring wetlands is essential not only for biodiversity and water quality, but also for enhancing climate resilience and maintaining the cultural values associated with freshwater ecosystems. Globally 411million hectares of wetlands (22% of the global total) have been lost since 1970. According to 2025 Global Wetland Outlook, the ecosystem services provided by remaining global wetlands are valued at up to USD 39 trillion annually.

Solar Energy

The New Zealand Government has set an aspirational target to reach 100% renewable electricity by 2030 (MBIE). With increasing electricity demand and the need to reduce greenhouse gas emissions, solar energy plays an important role in this transition.

Photovoltaic (PV) systems can have a net energy deficit over their lifetime (consume more energy than they produce) due to the significant energy required for their production, transport, and installation. By combining solar infrastructure while restoring wetlands, the ecosystem services such as carbon storage, water regulation, and biodiversity support offer measurable energy and climate benefits that help offset the initial energy investment.

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Conservoltaics

Conservoltaics is an emerging approach that combines solar energy generation with land management practices that enhance ecological and social outcomes. Unlike traditional PV farms, conservoltaic systems are designed to work with the existing landscape, allowing for vegetation growth, biodiversity support, and water management, while producing renewable energy.

This pilot proposes a conservoltaic system above a wetland being restored, demonstrating how renewable energy and ecosystem recovery can coexist. Solar panels will be positioned above a wetland undergoing restoration to allow native plants to thrive, support wildlife, and maintain natural water flow.

Potential for scale

The key value of this pilot is its scalability. It demonstrates how marginal or degraded land can deliver multiple benefits: enhancing biodiversity, strengthening climate resilience, and contributing to distributed renewable energy that supports New Zealand's energy transition goals.

Across Aotearoa, drained or marginal wetland areas (Fig. 1) face increasing pressures due to climate change, limiting their viability for agriculture. These areas are well suited to integrated wetland restoration and conservoltaic development. An additional advantage is the widespread location of wetlands, which would allow PV development close to market reducing pressure on transmission lines.

This project will quantify the trade-offs between optimising power output and enabling effective wetland restoration. There is potential to generate biodiversity and carbon credits to enhance financial returns and increase the strategic benefits of large-scale deployment.

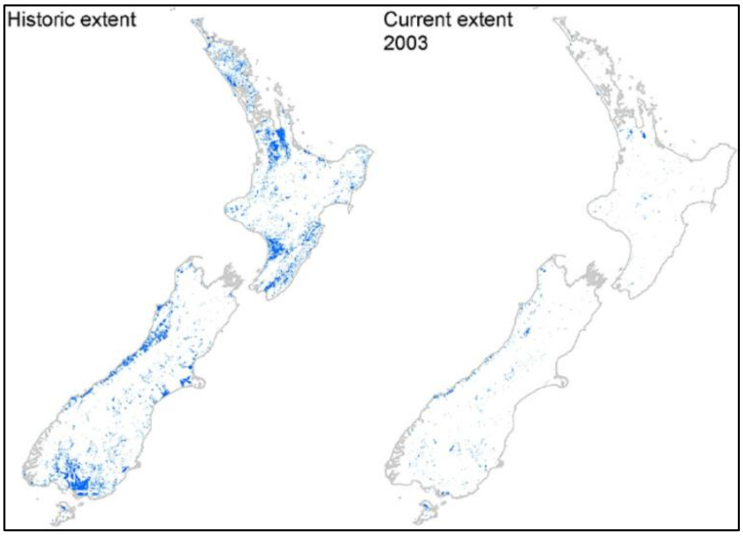

Fig. 1: Historic and Current Wetlands

Provision of Natural Habitat for Biodiversity: Quantifying Recent Trends in New Zealand (Ausseil, A.G., et al., 2011)

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3. Project objectives

This project aims to demonstrate, as a proof of concept, that installing PV panels above a restoring wetland can generate commercially viable renewable energy while maintaining or enhancing wetland regeneration.

The validated pilot model will be replicable across Aotearoa New Zealand, particularly on marginal or flood-prone land, demonstrating the integrated potential of ecological restoration and distributed renewable energy generation at landscape scale.

- **Environmental**: Improved wetland function, including attenuation of peak stormwater flows, delayed runoff release, alongside measurable gains in carbon sequestration and strengthened biodiversity across multiple trophic levels.
- **Economic:** Decentralised renewable energy generation, including potential sale of electricity to the grid, to fund papakāinga development, landscape management, and long-term climate adaptation. Potential carbon and biodiversity credits offer additional revenue opportunities.
- **Climate resilience:** Increased landscape capacity to buffer both drought and flood events, deliver downstream flood mitigation benefits to Papamoa's expanding residential areas, and help protect the adjacent roading and rail infrastructure.
- **Cultural**: Reconnection with tikanga and kōrero tuku iho (ancestral knowledge), strengthening whānau relationships with whenua and enhancing the mauri (lifeforce) of the whenua through culturally grounded, restoration activity including restoration of mahinga kai (traditional food gathering) and rākau rongoā (medicinal plants).

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4. Project description

Project Site

The proposed pilot site is a 1-hectare conservoltaic installation situated on a 3.5 ha drained wetland. The wetland is part of a 34 ha block of Māori freehold land held in Māori land ownership by Tiria Hohepa Harawira Whānau Trust, a registered Ahu Whenua Trust. The 16 ha of total historic wetlands on this land are situated on a high-risk floodplain, and formed part of what was once a vast expanse of coastal wetlands. These wetlands were drained for agriculture in the early 20th century.

Video 1: Aerial view of the conservoltaic pilot site and wetland (*click to play*).

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The site (Fig. 2) sits at a critical point in the Pāpāmoa floodplain, upstream of a rapidly urbanising residential area and adjacent to the nationally significant infrastructure of State Highway 2 and the East Coast Main Trunk (ECMT).

The site contains two drained wetlands, one of 12.5 ha and the other 3.5 ha, which have begun showing signs of ecological reversion.

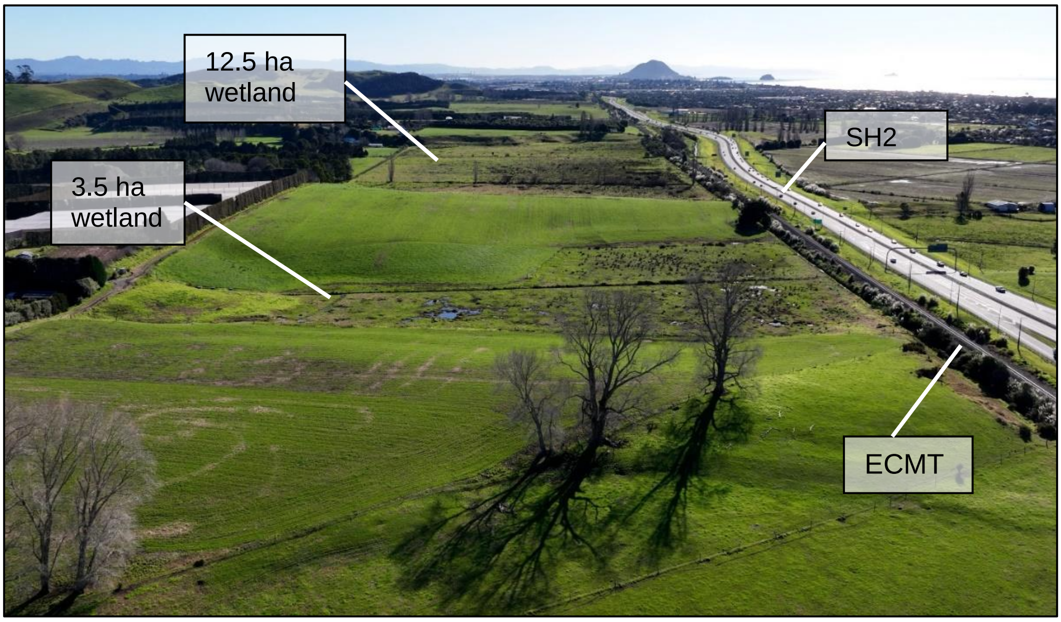

Fig. 2: 34-hectare block showing wetlands and proximity to State Highway 2 and the East Coast Main Trunk (ECMT).

Fig. 3: 34-hectare block showing wetlands and proximity to State Highway 2 and the East Coast Rail line.

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Once part of an extensive coastal wetland system (Fig. 3), this site (Fig. 4) now faces new challenges as climate change amplifies pressures through prolonged dry periods, extreme rainfall events, and rising temperatures. Modelling predicts prolonged dry periods, extreme rainfall events, and rising temperatures. Wetland restoration offers a nature-based solution to address these impacts, while also providing critical co-benefits including floodwater attenuation, carbon sequestration, biodiversity enhancement, and cultural revitalisation.

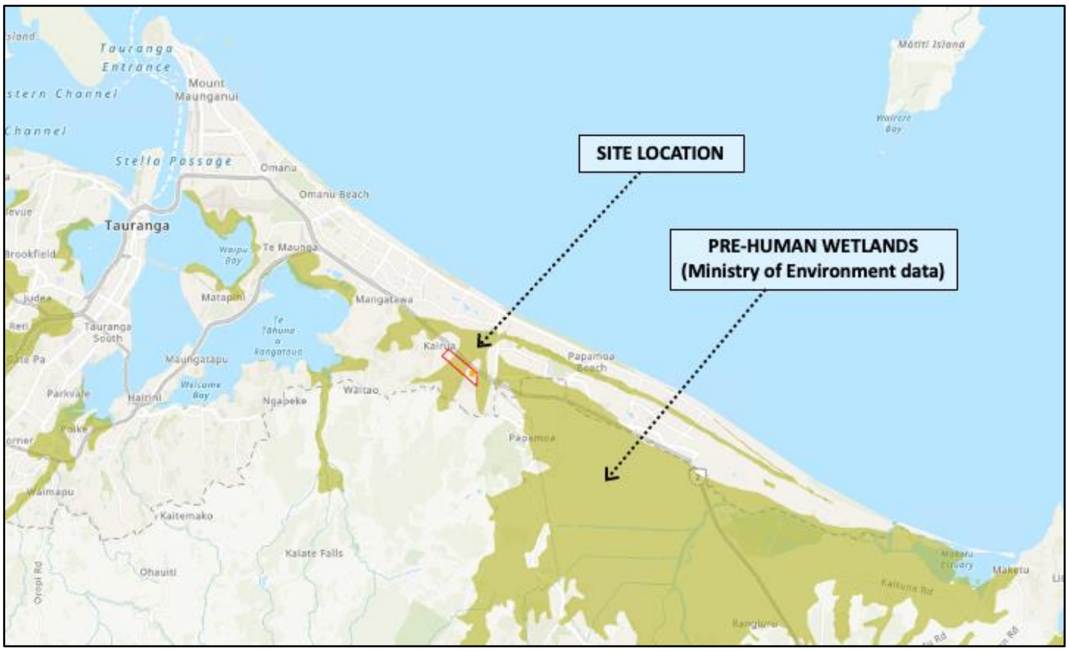

Fig.3: Site Location and historic wetland context.

Fig. 4: 3.5-hectare wetland July 2025

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Discussions around the restoration of the 3.5-hectare wetland have been held between the Trust, and BOPRC. The conservoltaic pilot will be integrated within this area to test and demonstrate the technical, ecological, and cultural potential of combining solar PV with wetland recovery. Wetland enhancement (Fig. 6) will be achieved by decommissioning the existing land drainage infrastructure and replanting indigenous wetland species in staged phases.

Fig. 5: Discussion at the *Whenua* L-R Hayden Schick (BOPRC), Richard Morris (Kirini Ltd.), Rewakura Ngatai (Tiria Hohepa Harawira Whānau Trust)

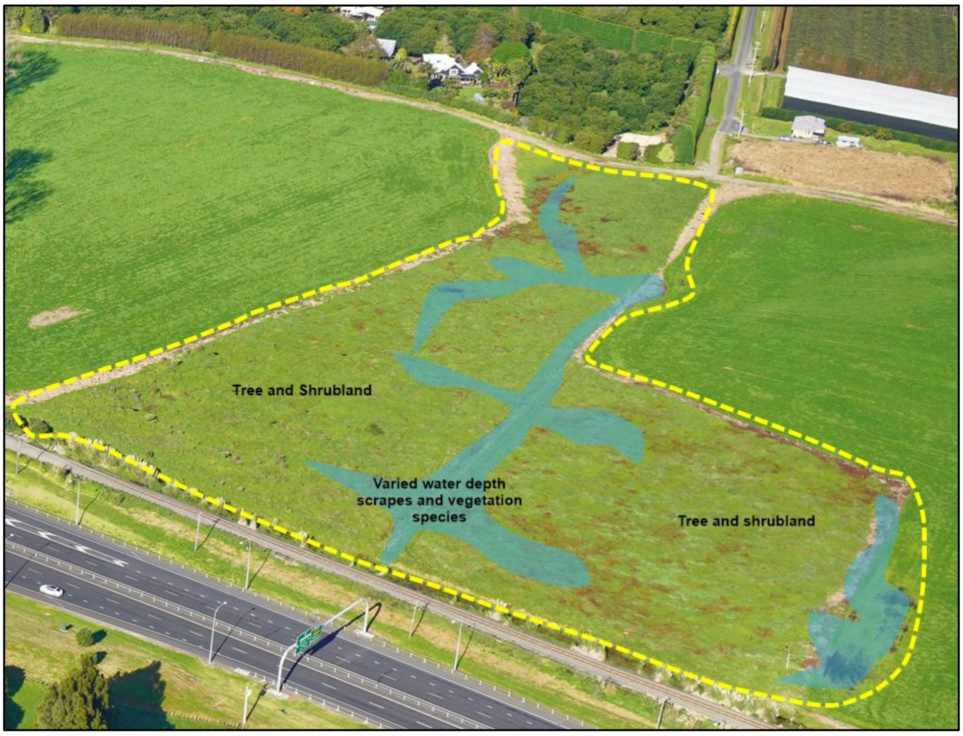

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Fig. 6: BOPRC 3.5-hectare wetland restoration concept

Conservoltaics

This site will test a hybrid land-use model that co-locates PV infrastructure with the restoration of an historic coastal freshwater wetland (Fig. 7).

Generated electricity will be exported to the grid, and in the future will support papakāinga (Māori housing) development and agroecological land-use transition on this whenua. The model could replicate on this site across the additional 12.5 hectares of restorable wetland within the same landholding.

Infrastructure will include fixed-tilt PV panels mounted on low-impact, flood-compatible foundations designed to maintain hydrological connectivity and withstand heavy rain and flooding. A dual-framework monitoring approach will be developed, integrating Western ecological science and mātauranga Māori to assess and track key indicators of wetland health.

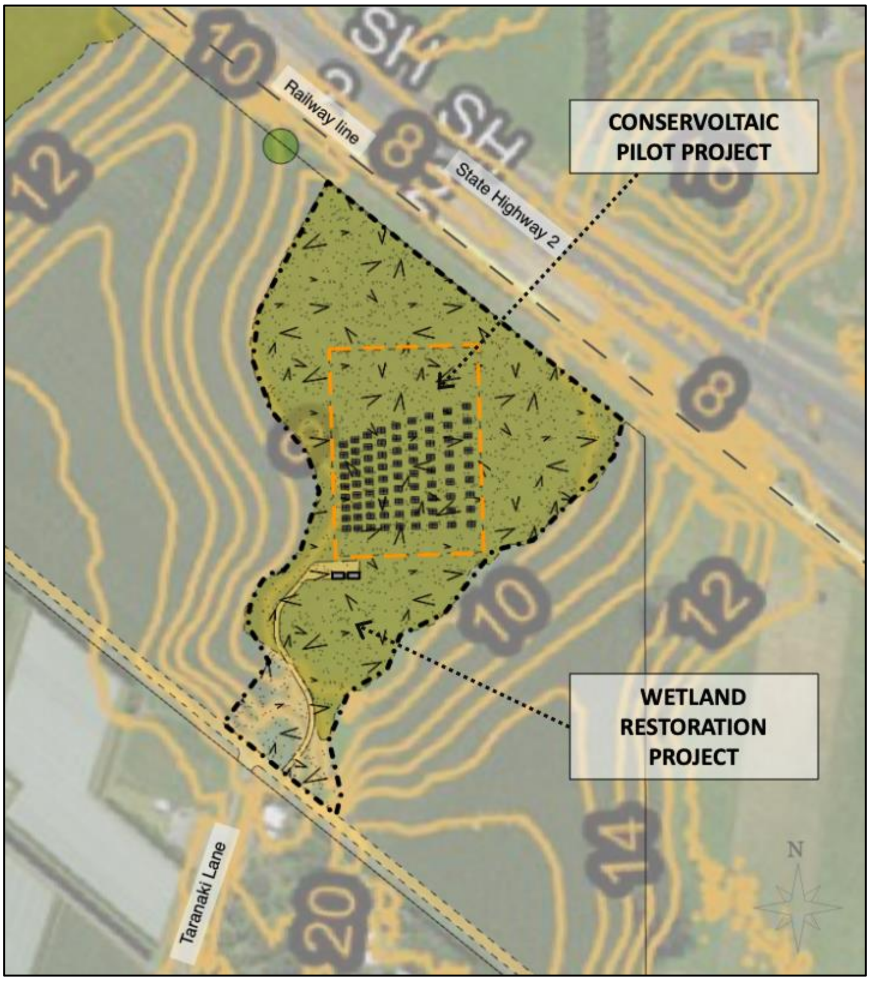

Fig. 7: Site layout plan (indicative PV layout only)

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This approach places equal emphasis on wetland restoration and energy generation. Energy output per hectare will be lower than that of traditional PV farms, however, ecological restoration, flood mitigation, and biodiversity gains compensate for the difference. The approach makes productive use of marginal land, avoiding the conversion of higher-value agricultural areas. Site design will accommodate taller native species such as kahikatea, swamp maire, coprosma, and harakeke, positioned to minimise impact on power generation.

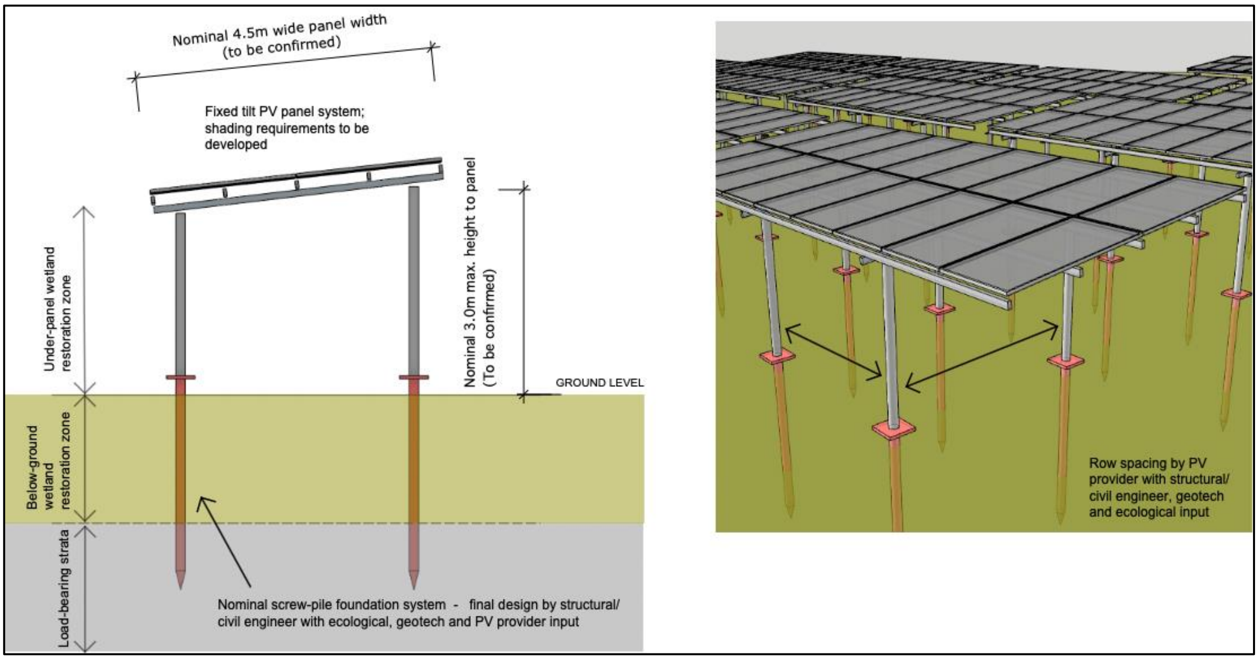

Fig. 8: Conservoltaic system

Raised structures will support the panels at 2 to 3 metres above ground (Fig. 8), establishing a stabilised microclimate (temperature and humidity) and enabling comparative monitoring of restoration occurring under panel and under open sky.

With input from the transdisciplinary design team, the solar infrastructure will be configured to enable both ecological regeneration and reliable energy generation. The design will promote biodiversity, allow for maintenance access, and safeguard the commercial viability of the investment.

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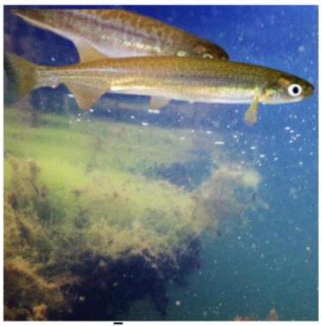
5. Anticipated outcomes

- **Ecological restoration:** Quantifiable improvement in wetland condition, biodiversity values, and ecosystem services, including flood attenuation, nutrient cycling, and habitat provisioning.
- **Distributed renewable energy:** Generation of clean electricity with grid export capability and scalable design.
- **Cultural reconnection:** Strengthen kaitiakitanga of the whenua through whānau-led restoration, co-design of infrastructure, and revitalisation of Māori practices such as mahinga kai and rongoā Māori.
- **Employment:** Generates skilled and unskilled jobs in construction, environmental services, and energy sectors, supporting regional development.
- **Additional Income:** Potential for carbon and biodiversity credits to enhance project revenue while delivering measurable ecological benefits quantified.
- **Demonstration and replication:** A nationally significant prototype demonstrating the integration of renewable energy with ecosystem recovery suitable to be scaled and replicated.
- **Monitoring and knowledge generation:** Co-designed monitoring will track both western science and mātauranga Māori indicators and data, supporting adaptive management and providing insights for the wider sector.


Poaka


Īnunga


Mingimingi

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6. Key challenges

- **Regulatory integration:** The conservoltaic model sits at the intersection of renewable energy infrastructure and wetland restoration, two planning domains that are not well-aligned under current consenting frameworks. Demonstrating the net ecological benefits requires a carefully integrated and well-supported approach.

- **Technical integration:** Engineering design must maintain PV system integrity and safety while protecting ecological function and allowing floodwater movement. Achieving this will require close coordination between civil, structural, hydrological, and ecological experts.

- **Servicing and End of Life:** Design must accommodate standard PV maintenance and eventual decommissioning with minimal ecological disturbance to the emerging wetland.

- **Innovation risk:** The novelty of the model presents uncertainties for planners, funders, and consenting authorities. These will be addressed through rigorous design documentation, transparent risk management, and reference to emerging international precedents.

- **Equity and governance:** Long-term social, cultural, and ecological outcomes require governance that prioritises mana whenua (incorporates intergenerational perspectives) and supports mana motuhake (self-determination).

- **Funding:** Cost for this trial are higher than standard PV due to bespoke foundations and small-scale trial conditions. Pending further analysis in the developed design phase, the prototype model will likely require philanthropic and/or government funding to allow the full study, bridging the gap between innovation risk and eventual commercial uptake.


Kōtare


Kapowai


Raupō

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7. Key risks and considerations

Hydrology and flood modelling

- The site is situated within a documented floodplain zone, and all proposed interventions must demonstrate that they will not increase upstream or downstream flood risk. Hydrological modelling and design strategies will support the site's attenuation potential to ensure neutral or beneficial outcomes across the broader floodplain catchment.
- Conservoltaic infrastructure must be elevated on flood-resilient substructures to allow unimpeded natural flow paths and accommodate episodic inundation, while ensuring structural integrity during high-flow events. Wetland restoration is expected to attenuate peak flood velocities by enhancing the landscape's capacity to retain and slow water movement.
- Design parameters will be informed by high-resolution, site-specific flood modelling to ensure appropriate freeboard, structural resilience, and hydrological compatibility with surrounding wetland functions.


Hoehoe


Toetoe upoko-tangata


Kōtuku ngutupapa

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Visual impact and landscape character

- The pilot site's location at a lower elevation than State Highway 2, combined with the presence of the intervening railway line on a raised embankment, provides effective visual screening from the highway. Proposed boundary planting to mitigate train noise will also service to further visually screen the pilot project. However, the site may remain partially visible from elevated vantage points within the Papamoa Hills Regional Park.
- This visual impact will be scrutinised through a comprehensive Landscape and Visual Assessment (LVA), which will assess site visibility from key vantage points - including Papamoa Hills Regional Park and potential airspace considerations relating to Tauranga Airport. As part of this process, glint and glare modelling may be required to determine potential reflectivity impacts on aviation operations and surrounding residential areas.
- Design responses may include low-reflectivity PV modules to minimise visual glare, irregular panel configurations to reduce visual monotony, and vegetative buffers that enhance both biodiversity and landscape integration. These interventions contribute to a forward-looking model of climate-resilient infrastructure that combines renewable energy generation with ecological restoration, while aligning with 21st-century expectations for multifunctional land use and landscape sensitivity.


Kōkopu


Matuku-moana


Karamū

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Wetland ecology and legislative compliance

- The site is classified as a degraded natural wetland and is therefore subject to stringent regulatory oversight under the NES-Freshwater and the NPS-FM. These frameworks impose clear obligations: any proposed activity must be demonstrably beneficial from an ecological standpoint, ensuring not only the avoidance of further degradation or functional loss, but also the delivery of measurable net gain in wetland condition, biodiversity, and ecosystem services.
- A transdisciplinary ecological approach will be taken from the outset, combining the expertise of local Māori repo (wetland) restoration specialists and western-trained academic ecologists. This integrated team will collaboratively define both restoration objectives and success indicators, ensuring alignment with tikanga, mātauranga Māori, and national biodiversity frameworks.
- Monitoring, ecological testing, and site evaluation methodologies will be co-designed to support both Māori and Western ecological frameworks, enabling whānau-centred knowledge generation alongside western-scientific data collection. This dual-perspective approach enhances project legitimacy while providing a more robust holistic understanding of wetland recovery dynamics.
- Emerging markets for carbon and biodiversity credits may offer financial incentives, however, will require verification protocols, regulatory alignment, and careful design to ensure eligibility. Investigating these options will form part of the feasibility analysis.


Kōura


Rautahi


Tūī

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Foundations, PV access and geotechnical considerations

- Subsurface conditions including an estimated two metres of alluvial sediments, as indicated by local geotechnical observations, pose both structural and ecological design challenges. High groundwater tables, variability in sediment density, and the potential for lateral sediment movement introduce complexity in terms of load-bearing capacity and long-term foundation stability.
- Low-impact, removable foundation systems such as screw-piles are strongly preferred, both to minimise ecological disturbance during construction and to enable future reversibility. A technical concept under consideration involves the use of sacrificial structural materials - for instance, untreated mild steel - engineered to undergo controlled in situ corrosion (refer Fig. 4). In the case of steel, upon decommissioning these materials are expected to degrade gradually into iron oxide (FeO), a chemically stable and ecologically inert compound, thereby providing a passive, low-toxicity end-of-life pathway consistent with long-term biogeochemical goals for the wetland substrate.
- The foundation network will also be designed to accommodate light-duty access infrastructure for photovoltaic array servicing and ecological monitoring operations. This access must be engineered to avoid disruption of hydrological flows and wetland vegetation recovery.
- A site-specific geotechnical investigation will be undertaken to determine bearing capacity, assess liquefaction susceptibility, and meet seismic performance standards, thereby informing the detailed structural and civil design phases.

Mānuka

Pūkeko

Piriiwai

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Grid connection

- As the regional electricity distribution provider, Powerco operates the regulated network within which the project is located. The proposed installation will be subject to interconnection requirements established by the Electricity Authority under its Distributed Generation (DG) framework. This includes compliance with Powerco's technical and procedural guidelines for standard DG and Utility-Scale Distributed Generation (USDG) systems.
- PV systems rated below 1 megawatt (MW) are eligible for Powerco's standard DG application process, which typically involves simplified technical assessments, reduced documentation requirements, and faster approval timelines. Systems above the 1MW threshold are required to follow the more rigorous USDG pathway, which includes network capacity studies, detailed protection and compliance planning, and formalised connection agreements.
- Although the pilot array is anticipated to fall below the 1MW threshold, the project may consider to voluntarily pursue the USDG application track. This approach provides enhanced due diligence, supports strategic engagement with Powerco's planning team, and establishes a future-proofed regulatory foundation in anticipation of potential system expansion and grid export scenarios. This also positions the pilot as a scalable, policy-aligned exemplar within New Zealand's evolving distributed energy landscape.


Kekewai


Matuku-hūrepo


Harakeke

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Consenting and compliance

- Dual resource consents will be required from BOPRC and TCC, addressing both regional and district plan provisions relevant to renewable infrastructure and wetland restoration within a high-value ecological zone.
- A consolidated, joint Assessment of Environmental Effects (AEE) is recommended. This AEE will synthesise multiple technical disciplines, including floodplain hydrodynamics, ecological baselining and functional gain projections, structural and civil engineering input, cultural values assessments under Te Ao Māori (Māori worldview) frameworks, and detailed landscape and visual impact modelling.
- It is anticipated that a range of expert technical reports will be required. These will include but not be limited to:
    - Ecological impact assessments under NES-Freshwater
    - Civil and geotechnical engineering inputs addressing inundation resilience,
    - Cultural assessments aligned with kaupapa Māori (Māori approach) based evaluation protocols
- A qualified local planning consultant is acting on behalf of the Trust and as lead planning advisor. The consultant will coordinate the engagement process, ensuring that all statutory requirements are embedded within a bi-cultural planning framework.


Pūrei


Toitoi


Pīwakawaka

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8. Monitoring and evaluation

A dual-framework monitoring and evaluation plan will be implemented to assess ecological performance, infrastructure function, and cultural outcomes over time. This plan will be co-designed with whānau kaitiaki and technical experts to ensure alignment with both western science and mātauranga Māori.

- **Biodiversity and ecological indicators:**
  Baseline and post-intervention surveys will quantify changes in vegetation composition, aquatic macroinvertebrates, avifauna, and habitat complexity. Wetland condition will be assessed using metrics aligned with the Wetland Condition Index (WCI) and other nationally recognised methodologies.
- **Hydrological monitoring:**
  Surface water dynamics, including ponding duration, infiltration rates, and seasonal fluctuation, will be tracked through strategically placed piezometers and shallow wells. These data will inform the adaptive refinement of both the wetland restoration approach and the PV array's foundation system.
- **PV system performance and maintenance:**
  Routine measurement of energy output (kWh), capacity factor, and system uptime will support operational efficiency and inform future system scaling. Maintenance logs and seasonal inspection protocols will be documented in alignment with Powerco requirements and manufacturer standards.
- **Cultural monitoring and whānau-led indicators:**
  A kaupapa Māori-based evaluation frameworks will be developed in collaboration with local kaitiaki to track indicators such as the return of taonga species (treasured species) and whānau engagement in active kaitiakitanga. Tools may include regular wānanga for the co-interpretation of monitoring results, intergenerational transmission of mātauranga, and integration of seasonal observations from whānau living near the site.
- **Data governance and reporting:**
  All monitoring outputs will be stored securely as agreed with whānau. Annual reporting will support both adaptive management and external funder accountability, while also contributing to broader knowledge sharing in the emergent field of conservoltaics.

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9. Partnerships and governance

A layered partnership model underpins the implementation and long-term viability of the conservoltaic pilot. It reflects a strategic alignment between whānau aspirations, technical delivery, policy integration, and knowledge transfer.

- **Trust leadership and governance:**
  The project is led by the Tiria Hohepa Harawira Whānau Trust, who serve as both kaitiaki and landowners. Their authority and oversight will guide all aspects of design, implementation, monitoring, and adaptive management. Governance structures will be designed to ensure that cultural values, long-term vision, and intergenerational equity are central to project decision-making, and that the Trust exercises mana motuhake over this project.
- **Technical collaborators:**
  Kirini Ltd. is providing project leadership, strategic planning, and design coordination across disciplines, supported by a wider team of consultants including civil and structural engineers, ecologists, flood modellers, landscape architects, and renewable energy system designers. Local planning expertise (Ngāi Te Rangi-affiliated) will assist in navigating the district and regional consenting processes, helping to align the proposal with regulatory pathways.
- **Energy sector stakeholders:**
  Powerco has provided early-stage advisory input in recognition of the project's innovation potential. This support has informed preliminary considerations relating to grid connection feasibility, network safety parameters, and the broader scalability of distributed generation infrastructure. The procurement route, potentially including design–build contracts, public–private partnership models, or whānau-led ownership structure, will be confirmed during the developed design phase and shaped by technical and financial options elucidated through this feasibility process.

This approach brings together technical, cultural, educational, and regulatory expertise, supporting whānau-led, climate-ready infrastructure that shows how communities can adapt strategically in the 21st century.

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10. Program

Wetland restoration programme

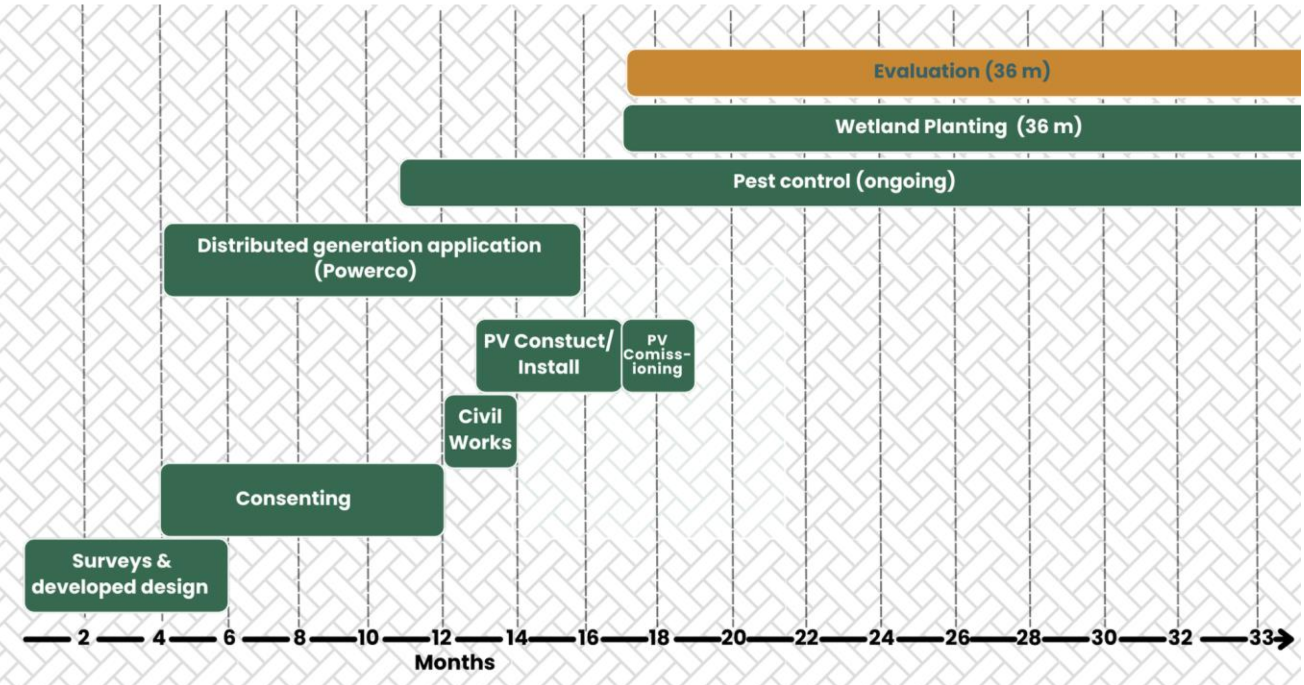
- **Duration:** 36 months (2027–2030)
- **Scope:** Hydrological modification (e.g. bunding, weirs, as required), native planting, weed and pest management six-months prior to planting., and staged restoration of 3.5 hectares of degraded wetland.
- **Lead delivery:** Tiria Hohepa Harawira Whānau Trust and BOPRC, supported by Kirini Ltd. and a transdisciplinary ecological team combining mātauranga Māori experts and wetland scientists.
- **Monitoring:** The project will track changes in wetland health using indicators like plant cover, return of native wildlife, and water quality. Monitoring methods will be co-designed to reflect both mātauranga Māori and western ecological science.

Conservoltaic pilot delivery

- **Duration:** 36 months (2026–2029)
- **Scope:** Design and installation of infrastructure for PV pilot. Will include civil works, commissioning and ongoing maintenance
- **Lead delivery:** by Kirini Ltd. and a transdisciplinary team

Monitoring: The project will track energy generation and maintenance requirements.

Delivery Timeline



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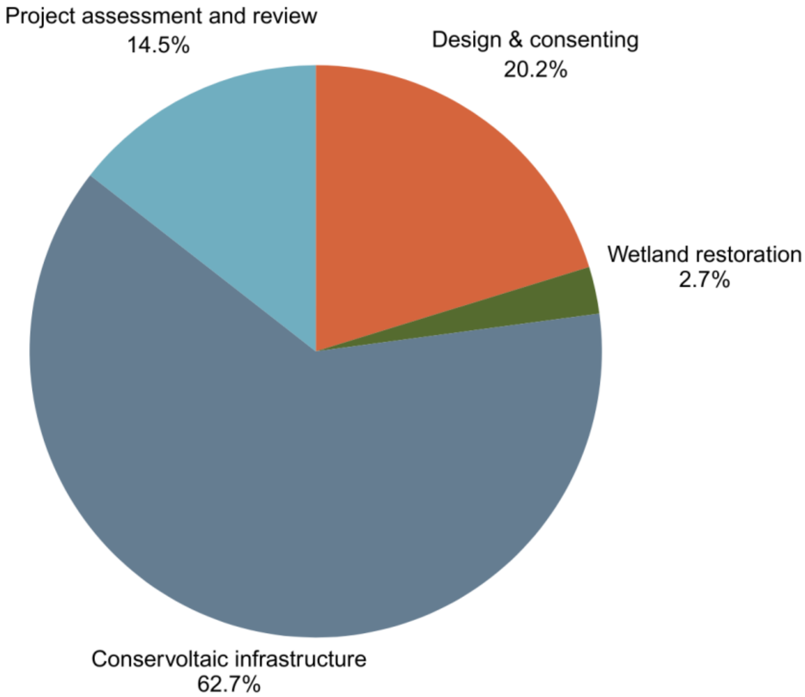
11. Investment

Estimated Investment required in this project over three years for this project is $4.3M.

The majority of project costs are attributable to infrastructure, which is notably higher than a typical PV installation due to the project's small scale, integrated ecological design, and the technical complexity associated with piloting an innovative system. Future installations will benefit from learnings gained in this project and of larger scale, reducing this cost differential. The infrastructure budget also includes three years of maintenance as part of the study; the intention being that ongoing maintenance beyond this period will be funded from energy sales.

Initial design and consenting are estimated at approximately $850,000. This covers an extended transdisciplinary team, including ecological, wetland, and hydrological specialists, as well as planners, electrical engineers, landscape architects, and surveyors. It also includes local and regional council land-use consents, USDG consenting, and connection requirements.

Wetland restoration is a relatively small component of the overall budget, estimated at around $100,000 over three years. Project assessment and review over the same period is estimated at approximately $600,000, covering expert co-design, technical expertise, oversight and research activities.



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Funding models

This project is a proof of concept, with higher costs than a typical development due to its smaller scale, experimental nature, and the additional monitoring required. While it is not expected to generate a net positive return from energy sales, it will provide a modest financial contribution alongside valuable learnings to inform future, larger-scale developments.

Three possible models of development are:

- **Whānau ownership:** The Trust funds 100% of the capital expenditure (CapEx) through financing or targeted grants. This option maximises mana motuhake and long-term returns but carries higher financial exposure.
- **Co-investment model:** The Trust contributes approximately 50% of CapEx and enters a joint venture (e.g. a Special Purpose Vehicle or SPV) with a development partner. This approach offers shared governance, defined revenue from power generation, and reduced upfront cost.
- **Developer-led model:** A commercial partner provides 100% of CapEx and leases the land from the Trust. Benefits to the Trust include a secure lease income and potential preferential access to electricity produced, though long-term ownership and control are limited.

Power Purchase Agreement (PPA) options

Potential energy off-takers are unlikely to commit to purchasing electricity from a proof-of-concept project at a fixed price, as it will not meet a significant share of their overall electricity demand. Such entities generally require assurance of consistency, reliability, and cost-effectiveness before entering into long-term PPAs. In addition, the lack of transparency in private market pricing presents a challenge.

Further work is needed to identify the most suitable options for structuring and securing offtake arrangements.

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Funding partners

Co-investment from philanthropic groups, and impact investors who can see the returns on scale, are critical to ensure this pilot can proceed. Engagement is underway with BOPRC, TCC, central government agencies, social funders, grant providers, philanthropic foundations, Māori and iwi development funds, private sector investors (including private equity and impact investment funds), and other climate-focused funding sources. These funding options will be further evaluated during the developed design phase.

Fig 8: Visit to the whenua by BayTrust, August 2025

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