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Kings Quarry, Stage 2

Residual Effects Management Plan

for: Kings Quarry Limited

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1 Introduction

This Residual Effects Management Plan (REMP) has been prepared for the Kings Quarry, Stage 2 project on behalf of Kings Quarry Limited. Kings Quarry Limited is proposing to expand its existing Kings Quarry operation with a Stage 2 pit and fill development, requiring the removal of 28.97 ha of indigenous vegetation (Bioresearches, 2025a; Figure 1), as well as the loss of thirteen streams totalling to 2,349 m of stream length (Bioresearches, 2025c; Figure 2). The Stage 2 area (Project area) is zoned 'Special Purpose Zone: Quarry' (SPQZ) under the Auckland Unitary Plan – Operative in Part (AUP) and the vegetation is identified as a significant ecological area (SEA) under the AUP (SEA_T_6454).

An Ecological Impact Assessment (Bioresearches 2025a) identified the vegetation composition as predominantly consistent with kānuka scrub/forest (VS2) and broadleaved species scrub/forest (VS5), both of which are classed as IUCN regional threat status of least concern (Singers et al. 2017). A small area of kauri, podocarp forest (WF11) will also be impacted on the north-east pit margin. The WF11 ecosystem type has an IUCN regional threat status of 'endangered' (Singers et al. 2017). The EcIA identified that the effect of removal of VS2, VS5 and WF11 vegetation would represent a 'high' level of effect without management, however after management all ecosystem types could be reduced to a 'moderate' level of residual effect (Bioresearches, 2025a). The removal of 2,349 m of stream habitat has been identified as a significant residual effect requiring compensation, with one stream assessed as having 'Very High' value; and eight streams assessed as having 'High' value (Bioresearches, 2025b).

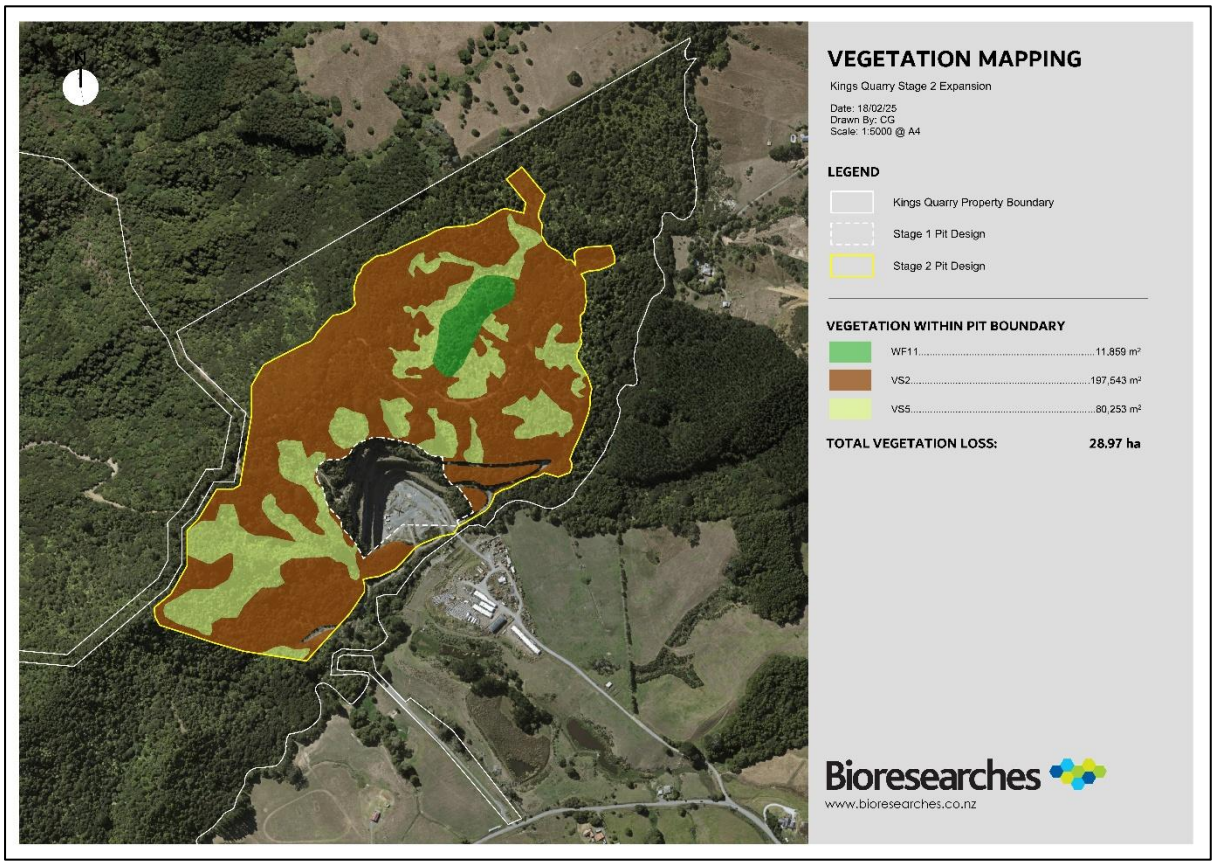

Figure 1: Map of vegetation within the Stage 2 pit

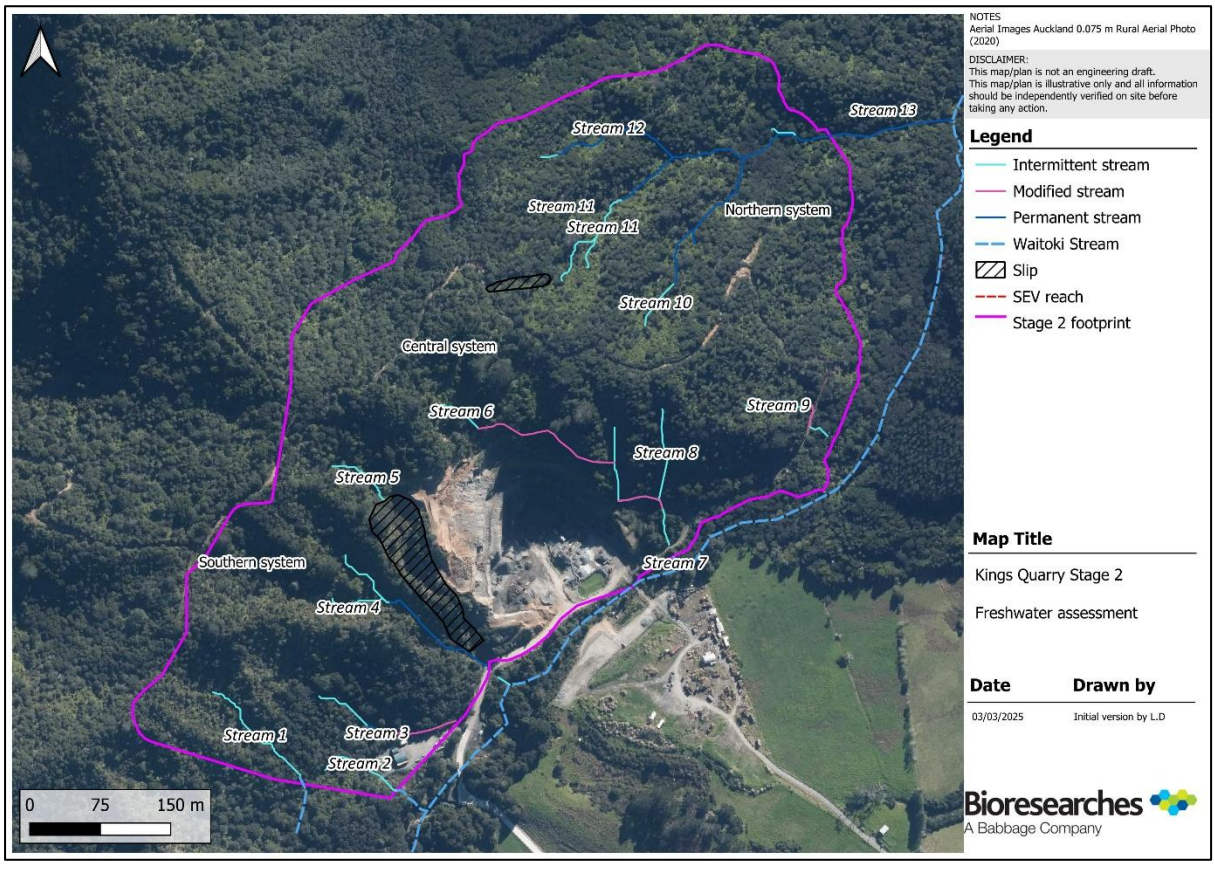

Figure 2: Map showing location of 13 streams to be lost within the Stage 2 footprint

Biodiversity Compensation Models (BCM) have been used to assess the level of compensation actions required to ensure biodiversity net gain[1] in terrestrial values (Bioresearches, 2025a). The Stream Ecological Valuation (SEV) and Environmental Compensation Ratio (ECR) have been used to calculate stream length required for offset (Bioresearches, 2025b).

The sites selected for offset/compensation actions both occur within the same ecological district (Rodney district) as the Kings Quarry impact site. 147 Oldfield Road, Wellsford (26 km north of Kings Quarry), presently contains some native vegetation, as well as stream and wetland habitat. Oldfield Road is proposed for the majority of offset/compensation actions, with terrestrial revegetation planting, enhancement planting, pest animal control as well as stream and wetland planting. In addition, 158 Hellyer Road (immediately north-west of Kings Quarry) is proposed for the remainder of the required riparian planting.

A summary of the proposed terrestrial offset and compensation actions has been provided below:

- Habitat restoration and enhancement measures within a 60 ha predator-proof fence including:
    - Enhancement and enrichment planting of 30.76 ha of existing vegetation, including 23.28 ha of VS2 and 7.48 ha of VS5 revegetation.
    - 28.42 ha of revegetation .
    - Elimination of mammalian pests. All mammalian pests would be eradicated within the fence, allowing for significantly improved habitat value for indigenous fauna species.
    - Weed control.
- Habitat restoration outside the fence which includes:
    - Enhancement and enrichment planting 57.52 ha of revegetation, including 40.04 ha of VS2, 16.6 ha of VS5 and 0.88 ha of WF11 revegetation.
    - 33.34 ha of revegetation. Planting outside the fence will act as a buffer for the higher quality habitat within the predator-proof fence.
    - Pest suppression across the remaining property (152 ha), including 57.52 ha of existing vegetation. This includes rats, possums, rabbits, mustelids and ungulates (pigs and goats). This action will provide biodiversity gains through restoration of functional forest regeneration and appropriate forest tiers. Removal of browsers will also assist with ensuring success of revegetation areas.

[1] The term net gain is used generically to refer to expected outcomes from the offsetting/compensation package. However we note that technically net gain relates to biodiversity offsetting while net positive is the appropriate term for biodiversity compensation' and aligns with criteria 3 of the Biodiversity Compensation Principles that are set out in Appendix 4 of the NPSIB.

- Weed control across the entire site

In addition, the following freshwater values will be offset and compensated within this Plan via the following actions at Oldfield Road and Hellyer Road:

- **Riparian planting:** 629 m of stream length at Oldfield Road will be riparian planted, with barriers to fish passage removed to ensure stream ecological function. Similarly, at Hellyer Road 2,264 m of stream length will be restored via riparian planting and fish barrier removal. Revegetation will include pest plant and animal control, as well as stock-proof fencing.
- **Wetland planting:** 6,400 m^2 of degraded wetlands at Oldfield Road will be planted, and buffer planted to 20m.

Following these actions, it is anticipated that a net gain in biodiversity values should occur following the completion of all compensation actions. A table summarising the losses and compensation actions to be discussed within this Plan can be found in Table 1.

Table 1: Table of ecosystem values to be lost and offset or compensated for, discussed within this Plan

Ecosystem Value	Quantity Lost to Kings Quarry Stage 2	Offset/ compensation Actions
Kānuka scrub forest (VS2)	19.75 ha	• Replanting of VS2 at Oldfield Road (46 ha) • Enrichment planting of existing VS2 at Old Field Road (63.32 ha) • Pest plant and animal control at Oldfield Road planting and enhancement sites
Broadleaved scrub forest (VS5)	8.03 ha	• Replanting of VS5 at Oldfield Road (8 ha) • Enrichment planting of existing VS5 at Oldfield Road (24.08 ha) • Pest plant and animal control at Oldfield Road planting and enhancement sites
Kauri, podocarp, broad-leaved forest (WF11)	1.19 ha	• Replanting of 7 ha of WF11 at Oldfield Road • Enrichment planting of existing WF11 at Oldfield Road (0.88 ha) • Pest plant and animal control at Oldfield Road

Stream habitat	2,349 m	• Riparian planting of 629 m of stream length at Oldfield Road, and 2,264 m of stream length at Hellyer Road • Wetland planting and additional 20m buffer planting of 6,400 m^2 of wetland at Oldfield Road

1.1 Contents of this Plan

This plan has been prepared within several frameworks, specifically:

- Appendix 16 of the Auckland Unitary Plan (AUP): Guideline for native revegetation plantings.
- Te Haumanu Taiao (Auckland Council, 2023) guidelines on restoring natural environments in Auckland

The following sections of this Plan will address:

1. Revegetation and enhancement of Oldfield Road;
2. Pest animal control of Oldfield Road;
3. A Biodiversity Outcome Monitoring Plan for terrestrial values at Oldfield Road; and
4. Riparian and wetland planting for Oldfield and Hellyer Road, including pest animal control and monitoring targets.

1.2 Draft Resource Consent Conditions

This Residual Effects Management Plan has been drafted to meet the requirements of the following recommended consent conditions. These conditions are provided to ensure appropriate ecological management and offset actions are applied to minimise, offset and compensate for adverse ecological effects:

Stream and Wetland Enhancement Restoration Planting Plan

4. Prior to the reclamation of any streams or associated vegetation removal, a Stream and Wetland Enhancement Restoration Planting Plan (**SWERPP**) is to be prepared and submitted to the Council for certification. The purpose of the SWERPP is to ensure that the offsetting and compensation riparian planting and aquatic habitat restoration and enhancements achieve a net gain in freshwater ecosystems. The SWERRP will confirm the timing and establishment of the riparian and wetland planting and maintenance, and any enhancement activities for each stream offset and wetland compensation location as per the Ecology Assessment and Freshwater Residual Effects Plan (**F-REP**) referenced in Condition 1 of the 'general conditions for all consents'. The SWERPP must be in general accordance with Ecology Assessment and F-REP referenced in Condition 1 of the 'general conditions for all consents'

The SWERPP must:

(a) Be prepared by SQEP(s)

(b) Include as a minimum

i. Demonstrate that the biodiversity no net loss/net gains identified in the F-REP will be achieved.

ii. The identification and description of all watercourses to be restored, including the predicted SEV values of the streams once the restoration is complete. The identification and description of all natural inland wetlands to be restored.

iii. Require that all riparian planting and aquatic enhancement required for offset and compensation for the loss of streams will be completed within three (3) planting seasons following the commencement of the removal of streams, or other stream works.

iv. Plans identifying the areas of any in-stream enhancement works will occur (i.e culvert works).

v. Timing, staging and programme of works.

vi. Stream restoration design details identifying all elements of the activities authorised by this consent and their associated locations. The plans must show the length of stream to be ecologically enhanced as well as clearly depicting the widths of all riparian margin.

vii. Methods to ensure fish passage is improved/maintained to the level reported within the application documents.

viii. Plans identifying all areas where riparian planting will be carried out.

ix. A list of plant species, numbers and sizes to be planted, their common and botanical names, method of planting, planting locations, eco-sourcing details and densities.

x. Details of all planting specifically required to address for stream loss.

xi. Pest plant and animal management programme that as a minimum targets species that threaten new or replacement planting.

xii. Describe fencing (location, type and maintenance requirements), stock exclusion, or any other physical works necessary to protect planted areas from livestock,

xiii. Describe the legal arrangements (covenanting in accordance with Condition XX) to be entered into to ensure the planted areas are protected and retained in perpetuity,

xiv. All planting must be consistent in accordance with the Auckland Regional Council Riparian Zone Management Strategy for the Auckland Region, Technical Publication 148, June 2001 (TP148) and/or Te Haumanu Taiao. Describe fencing (location, type and maintenance requirements), stock exclusion, or any other physical works necessary to protect planted areas from livestock,

xv. Describe the legal arrangements (covenanting in accordance with Condition 41) to be entered into to ensure the planted areas are protected and retained in perpetuity,

xvi. Describe the monitoring methods, schedule, and target outcomes for the wetland targeted for enhancement, and measures to be taken to achieve the objectives of the RWPEP should target values not be achieved.

Maintenance must occur until 80% canopy closure has occurred and a minimum survival rate of the plants (being 90% of the original density through the entire planting area(s)) has been achieved. The maintenance period must be a minimum of five years or until 80% canopy closure has occurred, which every is lesser. Plant maintenance includes the ongoing replacement of plants that do not survive.

Pest Control and Elimination Plan (PCEP) – Oldfield Road site

45. The objectives of the Pest Control and Elimination Plan (PCEP) are to achieve:

(a) A pest exclusion fenced area on the Oldfield Road site. This area will be eradicated of all target pest species, including mice, rats (Norway and ship), weasels, stoats, ferrets, possums, hedgehogs, feral cats, rabbits, hares, goats, pigs and deer, with ongoing pest surveillance and incursion response protocols, as well as fence maintenance and inspection protocols.

(b) Pest suppression in the planting and enhancement areas to reduce the impacts of browsers and to create a partial 'buffer' of protection for the fenced area.

46. The PCEP must be prepared by a suitably qualified and experienced ecologist and set out the procedures to be implemented by the Consent Holder to achieve the objectives set out in condition 43, and, as a minimum, specify:

(a) Target pest species, pest reduction targets and target thresholds to be aimed for to achieve the objectives of the PCEP;

(b) Methods to achieve target species outcomes, which will include descriptions of spatial configuration of baiting and/or trapping details including types of baits/traps and frequency of baiting/servicing;

(c) A description of monitoring/surveillance proposed in accordance with standard accepted practice.

47. The pest eradication shall commence once the mammalian pest exclusion fence has been constructed and must be maintained on an ongoing basis for the life of the consent.

48. A Pest Fence Construction and Maintenance Plan (PFCMP) must be prepared by a suitably qualified and experienced person and set out the procedures to be implemented by the Consent Holder to achieve the objective set out in Condition 45 and shall specify:

(a) The route of the fence;

(b) Design specifications of the mammalian pest exclusion fence including required vegetation clearance, the ground platform formation, the materials to be used to construct the fence, and the fence physical dimensions and gates for pedestrian and equipment access;

(c) Design specifications of the stream crossing including requirements to make the stream crossings pest proof and also allow native fish passage;

(d) Design detail of the stormwater management alongside and under the line of the fence; and

(e) Fence inspection maintenance and biosecurity requirements to sustain the fence in a state able to exclude all mammalian pests. This shall include an automated electronic alert / surveillance system which will immediately provide a notification of any damage or potential breaches of the fence. Relevant staff should respond within 12 hours or as soon as practicable thereafter of any fence breach alerts to undertake fence repairs.

49. Prior to commencement of the eradication programme within the pest-exclusion fence, a Pest Eradication Operational Plan (PEOP) must be prepared by a suitably qualified and experienced person. The operational plan PEOP must contain as a minimum:

(a) Feasibility study to identify all issues to overcome to deliver and sustain the stated goals and predicted outcomes with the maximum chances of success;

(b) An Assessment of Environmental Effects of the eradication;

(c) An Operational Plan, including a Risk Management Plan, to clearly outline the design, roles, actions, logistics and timeline to achieve project goals, meet legal requirements and undertake required mitigations;

(d) Peer review comments on each section;

(e) A record of revisions undertaken in response to the peer review; and

(f) A Biosecurity Plan that identifies potential sources of pest re-invasion and any necessary mitigations required to prevent/address this re-invasion.

50. The Consent Holder must ensure that the pest control management targets and management thresholds set out in Table 2 below, are met and sustained for the period specified in Condition X. These targets will come into effect one year after commencement of the MPCP for suppression, and one year after completion of the eradication.

Table 2: Pest control management targets and management thresholds

Pest Species	Management Target	Threshold	Monitoring frequency
Mammalian Pest Exclusion Area			
All (rats, mice, weasels, stoats, ferrets, possums, cats, hedgehogs, rabbits, hares,	All target species: 0% density	Any detection initiate control	Ongoing via advanced surveillance tools and cameras. Four times per year using a range of

goats, pigs, and deer)			detection devices including but not limited to trail cameras, wax-tags, chew cards, tracking tunnels, kill and live capture traps. Monitoring must also occur immediately following events that could cause a breech, and following any suspected incursion.
Mammalian pest suppression area			
Pest Species	Management Target	Threshold	Monitoring frequency
Rats	<10% CCI	>15% CCI	Four monitors per year in February, May, August, and November
Possums	<5% CCI	≥10% CCI	
Rabbits	Initiate control if observed	Any observation (incl. sign)	
Pigs and goats	Initiate control if observed	Any observation (incl. sign)	

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51. Pest populations shall be controlled to the targets specified in Table 2 above. Additional pest management will be required to meet targets if monitoring identifies that:

    (a) For the pest suppression area, a target has been exceeded on two consecutive monitoring occasions; or

    (b) Pest populations have met or exceeded a threshold: or

    (c) For the pest exclusion area ant pest has been detected.

52. All monitoring including trap catch and bait consumption information, will be made available to the Council within three months of each monitoring survey.

Finalised Residual Effects Management Plan

55. No less than 10 working days prior to commencement of any vegetation removal, the Consent Holder must submit to Auckland Council for certification a finalised Residual Effects Management Plan (**REMP**) prepared by a suitably qualified and experienced ecologist. The REMP is to be based on the outcomes of the Terrestrial Ecology Residual Effects Analysis Report for Kings Quarry, Stage 2, The objectives of the REMP are:

    (a) to ensure that sufficient quantity and quality of restoration planting and enhancement actions, as set out in the TEREAR, is achieved to demonstrate a net biodiversity gain or net positive outcome relative to residual adverse effects on biodiversity values.

(b) to ensure that the restoration plantings and enhancement actions are managed in an appropriate manner to facilitate the on-going survival and development of the restored habitats;

(c) to ensure that the restoration planting and enhancement actions are maintained for the life of the offset or compensation, and monitored to verify predicted outcomes within stated timeframes, and to inform adaptive management or contingency requirements for the values specified in section 4.1 of the draft REMP, including Tables 13 and 14.

56. The REMP must include the following:

(a) The identification and description of offsite sites where revegetation and enhancement is to occur.

(b) Timing, staging and program of planting and enhancement works.

(c) Plans identifying areas to be revegetated and enhanced.

(d) Monitoring and maintenance program, for the life of the consent, including pest control and weed management methods and any fencing requirements, to ensure targets are achieved in accordance with modelled outcomes of the REMP.

(e) A list of plant species, numbers and sizes to be planted, their common and botanical names, methods of planting, planting locations, eco-sourcing details and densities.

(f) Provision for adaptive management or contingency actions where monitored outcomes are not meeting targets

Advice note: Enhancement actions detailed in the REMP may be monitored over the life of the consent to reflect any advancements in pest control technology and monitoring of pest populations.

Biodiversity Outcome Monitoring and Reporting

106. An annual establishment monitoring report must be submitted to the Council for the first five years of commencement of planting and enhancement actions (browser control, pest predator elimination, enrichment planting or seeding) and at Oldfield Road. The purpose of the report is to confirm baseline conditions, timing and establishment of plantings and pest management, for each offset location as per the REMP. The annual establishment monitoring report must include:

a) Baseline conditions for existing native vegetation as determined from vegetation plots

b) Plant survival and growth

c) Note any species or specific areas that are performing poorly

d) Canopy cover

e) Plant species density and diversity

f) Weed presence and effectiveness of pest plant control

g) Effectiveness of pest animal elimination within the fence and browser control outside the fence

h) Effectiveness of pest weed control inside and outside the fence

i) Any adaptive management required to ensure each planting area develops in line within the monitoring targets set out in the REMP.

107. A Biodiversity Outcome Monitoring Report must be submitted to the Council for the life of the consent or until offset net gain or net positive outcome is demonstrated. The offset monitoring report must be submitted to Council every five years for each planting area and report on the performance of the planting and enhancement actions. The purpose of the biodiversity outcome l monitoring report is to:

a) Track the progress of identified biodiversity attributes in accordance with the following monitoring targets.

Biodiversity attribute	Offset / compensation action	5 years	10 years	15 years	20 years
Kānuka Forest (VS2) basal area (m^2/ha)	Revegetation	10.33	39.71	88.15	155.65
Broadleaved Species Scrub Forest (VS5) basal area (m^2/ha)	Revegetation	4.04	15.5	34.4	71.45
Kauri, Podocarp Broadleaved Forest (WF11) basal area (m^2/ha)	Revegetation	4.92	18.87	41.83	71.3
Bird diversity (species count)	Revegetation	3	9		
Tui abundance (Average abundance as measure by mean per 5mbc)	Pest-proof fence and all revegetation	1	2.4		
Kereru abundance (Average abundance as measure by mean per 5mbc)	Pest-proof fence and all revegetation	1	2.5		

b) Identify any additional actions necessary to ensure the offset is appropriately managed and maintained, and performing to targets set out in the REMP.

c) Report on outcomes of any additional actions undertaken and reported from previous offset monitoring, including remodelling if appropriate.

The reports must detail whether the modelled targets of the BOAMs have been reached, and where targets have not been reached, specify what further biodiversity offset actions are required to ensure a net biodiversity gain is achieved within the modelled timeframe. The

108. A Biodiversity Outcome Completion report must be submitted to the Council at year 20, or upon demonstration that offset actions, as detailed in the REMP, have achieved a net biodiversity gain outcome.

109. This report must include:

a) Confirmation that offset/compensation measures were completed in accordance with outcomes stated in the Table above and the REMP.

b) Detail of any adaptive management actions or contingency measures employed to ensure compliance with stated objective and intended outcomes.

c) Methods and results of offset and compensation activities and response of biodiversity to effects management measures. This includes the provision of relevant maps and representative photos.

d) Verification that offset/compensation actions generate net positive outcomes for biodiversity.

110. Biodiversity Outcome Completion report must detail all of the biodiversity attributes in accordance with monitoring targets as identified in Condition 107.

111. If a net gain outcome is achieved later than 20 years, then monitoring must continue, as per Condition 107, and all monitoring targets must be remodelled, using a biodiversity offset accounting model, or compensation model, until a net gain / net positive outcome is demonstrated.

Revegetation and enhancement areas to be protected

112. The consent holder must submit a covenant document to achieve the protection in perpetuity of the indigenous revegetation planting to the Council for approval within three months of the completion of the planting and commencement of enhancement works. The covenant document must contain, but is not limited to, the following:

(a) A schedule of the calculated areas(s) of the indigenous revegetation planting.

(b) A covenant plan (Land Transfer Plan) accurately depicting the area/s of indigenous revegetation planting as “areas to be subject to land covenant”.

(c) Inclusion, as a minimum, of the following clauses requiring the owner, or their successors in title to:

- Preserve in perpetuity the indigenous flora and fauna, wildlife habitats and the natural landscape within the “areas to be subject to land covenant”.
- Maintain any stock crossings and / or fish passage(s) in accordance with any easement(s) through the covenant areas.
- Not do anything that would prejudice the health or ecological value of the areas to be protected, their long-term viability and / or sustainability. Including but not limited to:
    - The land owner or their successors in title must not (without the prior written consent of the Council and then only in strict compliance with any conditions imposed by the Council) cut down, damage or destroy, or permit the cutting down, damage or destruction of the vegetation or wildlife habitats within the areas to be protected;

  - The landowner or their successors in title must maintain the protected area free from earthworks or land modification.
  - The landowner or their successors in title must not place any building and/or structure within the covenant area/s nor undertake any recreational or other activity that would affect the integrity of the covenanted area.

- Maintain a permanent continuous stock-proof fence (minimum seven wire post and batten fence with no gates) and other fencing (including demarcation posts) as approved by the Council in perpetuity around the perimeter of the area to be protected and keep stock out of these areas.
- Not be in breach of this covenant if any of the areas of planting to be protected die as a result of fire and/or natural causes not attributable to any act or default on their part for which they are not responsible.
- Pay the Council the fair and reasonable costs incurred by the Council in monitoring this condition. The owners will be advised of the costs, assessed under the Council's Schedule of Fees and Charges, as they fall due.

A copy of the updated Computer Register and/or Record of Title showing that the legal mechanism has been registered must be provided to the Council to secure compliance with this condition.

The legal mechanism under this consent will not be required if the land containing enhancement works is vested in the Council. If entered into, the legal mechanism may be extinguished if the land containing enhancement works is to be vested in the Council.

2 REVEGETATION AND ENRICHMENT PLANTING PLAN

2.1 Introduction

Oldfield Road is proposed to be revegetated with 61.8 ha of VS2, WF11 and VS5 habitat, with the addition of 88.28 ha of enhancement via weed control and enrichment planting. This plan specifies the planting and weed control elements of the terrestrial compensation actions at Oldfield Road. Pest animal control of Oldfield Road is discussed in Section 2.8.1.3 of this report.

This plan has been written based on the framework provided in Appendix 16 of the Auckland Unitary Plan (AUP): Guideline for native revegetation plantings, and Auckland Council's Te Haumanu Taiao restoration guidance document.

The following sections of this Plan address:

1. Weed removal and management;
2. Planting schedules;
3. Planting methodology; and
4. Maintenance requirements.

Specific monitoring targets for the revegetation and enhancement planting have been discussed in Section 4 of this report.

Planting will be separated into stages, with approximately 5.15 ha being planted per year for 12 years, until the required quantity of revegetation has been achieved. A planting schedule for each of these 12 stages is provided in Appendix B, along with the progressive loss of vegetation during the implementation of Kings Quarry Stage 2. This plan details planting lists for the entire Oldfield Road terrestrial offset site.

Plant maintenance will be initiated at the completion of each planting stage, with each stage subject to five years of plant maintenance at the completion of pioneer planting.

2.3 Planting and Restoration Areas

The 147 Oldfield Road site is located approximately 26 km North of Kings Quarry. The property is currently vegetated with a mosaic of grazed pasture, regenerating native broadleaved scrub (VS5), kānuka scrub forest (VS2) and regenerating fragments of kauri, podocarp, broadleaved forest (WF11). An existing raupo wetland is present within the proposed restoration areas, which will also benefit from the addition of buffer planting.

Existing native vegetation is often encompassed along the margins with exotic weeds, in particular woolly nightshade (*Solanum mauritianum*), pampas (*Cortaderia* sp.) and gorse (*Ulex europaeus*). Occasional pine trees (*Pinus* sp.) are present throughout. An existing Significant Ecological Area (SEA) overlay is present over the site.

The site is situated approximately 7 km west of Dome Valley, in which the Department of Conservation's Sunnybrook Reserve and Dome Forest Conservation Areas are located. Planting close

to an established reserve will help facilitate colonisation of plant and fauna species as the vegetation sites mature, contributing to ecological connections across the surrounding landscape.

Photo 1. Existing Raupo Wetland (WL19) (top) and its context at a landscape level.

Photo 2. One of the small fragments of Kauri, Podocarp Broadleaved Forest (WF11) that is emerging amongst the VS2/VS5 vegetation. This fragment is outside of the proposed predator-proof fence, within the centre of the eastern part of the Project area (see Figure 3).

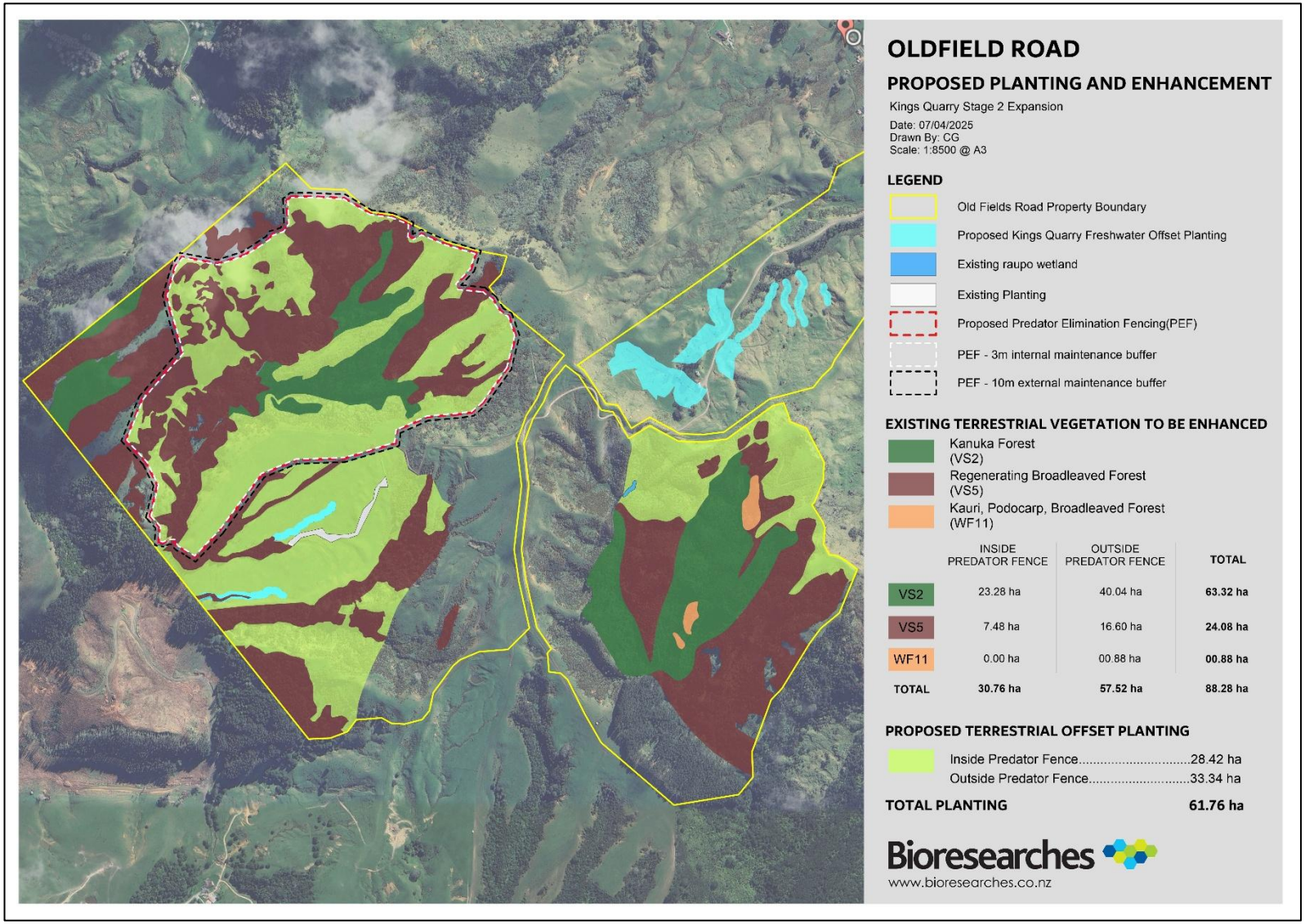


Figure 3. The location of all proposed offset and compensation actions at the Oldfield Road property.

Photo 3: Photos showing areas of VS2 and VS5 habitat at Oldfield Road, surrounded by gorse and woolly nightshade on the outer edges

Photo 4: Understorey of existing VS5 within the site.

2.4 Planting and Enhancement Plan

A multi-staged approach is adopted by the following plan to ensure the survival and establishment of plantings and successful revegetation.

Stage 1 - Spring/summer: prior to the winter restoration planting, site preparation involves removal of any environmental weeds within the enhancement and revegetation sites.

Stage 2a – Additional weed control undertaken at revegetation site if necessary.

Stage 2b – Autumn/winter: Pioneer species planted within revegetation site.

Stage 3 – Autumn/winter: Once the pioneer plants have reached sufficient size to shelter enrichment species (approximately three years), under-planting of canopy and enrichment species can commence within the revegetation site. Releasing or removal of pioneer plantings may be required to make room for the new plantings.

2.4.1 Stage 1 – Weed Removal and Management

Weed removal is required within the revegetation site before planting as well as within the enhancement areas, and throughout both enhancement and revegetation areas throughout the maintenance period. For the purposes of this plan, weeds are defined as plants that are either listed in Auckland Council's Regional Pest Management Plan 2020 – 2030 (RPMP 2020-2030), or The Ministry for Primary Industries National Pest Plant Accord (NPPA), including any updated versions of either list. Weeds can smother the existing indigenous flora and inhibit growth of any new plantings and ongoing weed control is vital to the success of restoration planting. Some weed species will need continued maintenance, as their seeds or rhizomes can persist in the ground.

At Oldfield Road, pasture, including kikuyu grass, is the dominant ground cover, and will require regular maintenance until canopy closure to prevent new plantings becoming smothered. Weed removal success is improved when carried out in the warmer months (October to March) and should be completed in the summer prior to planting activities commencing.

Weed control should be conducted to a level where no mature weeds are present on the site and any seedlings/saplings are removed within 6 months. Twice-yearly audits should be conducted to ensure that weed control is of a high standard, is not causing unnecessary damage to native species and that full site coverage is being achieved (see section 2.7 of this report). Weed control must continue for a minimum of 10 years, starting from initial site planting preparation.

2.4.1.1 Weed Removal Methods

Weed removal must be undertaken by an experienced and qualified practitioner, with strong plant identification skills, and should follow industry best practice guidelines. For non-grassland areas, weed removal will be undertaken by hand or using small machinery wherever possible. Given the large area that will require weed removal, chemical weed control is considered the most efficient method to use for pasture weeds such as kikuyu; however, care must be taken to apply herbicide in a responsible manner that does not cause additional harm to indigenous species or their habitats.

The following are recommended options for the removal of weeds within the Oldfield Road restoration site:

Kikuyu and pasture weeds:

- Mow at lowest possible setting; or
- Spray with glyphosate 20 ml/L during extended dry periods and with a minimum 3 m distance from watercourses.

Woody weeds (e.g. gorse, woolly nightshade, privet):

- Cut large shrubs/small trees (below 4 m in height) low and level to the ground and paste the stump immediately with metsulfuron gel.
- Large trees (above 4 m in height) to be removed by a qualified arborist.
- Gorse is present on the margins of the bush in the Oldfield Road restoration site. Gorse can aid restoration through soil conditioning and preventing pest animal access. Complete gorse removal is not required except where needed to provide access for restoration.

Pampas:

- Spray with glyphosate or haloxyfop during extended dry periods and with a minimum 3 m distance from watercourses. Follow-up treatment every six months.

Pine Trees:

- Small trees (less than three metres) can be felled, and sectioned logs place throughout restoration areas.

- Large trees (greater than three metres) may potentially provide bat roost habitat and should be drill and injected

Drill and inject methodology would employ the use of metsulfuron-methyl at 600 g/kg formulation per litre of water (Biosecurity New Zealand, 2025[13]). On multi-stem trees, each stem should be treated as a separate tree.

Holes should be drilled at even spaces around the trunk to ensure an even distribution of the chemical throughout the tree. Holes should be drilled into the base of the tree and prominent feeder roots as near to the ground as possible.

Holes should be drilled on a downward angle (45 degrees) to a depth of 4-8 centimetres excluding bark. Each hole should be deep enough to contain 10ml of herbicide formula. Herbicide should be applied immediately at 10ml of formula (600 g/kg metsulfuruon-methyl per litre) per hole.

The number of holes per stem required varies depending on the DBH of the stem and is outlined in the table below.

Table 2: Table from Biosecurity New Zealand (2025): Above: DBH of tree stems and below: number of holes required per stem for drill and inject methodology

10	20	25	35	50	80	100	105	110	120	125	135	140	160
1	1	2	3	4	6	8	8	8	9	10	11	12	13

A summary of pest plant species, and their suggested removal methodology can be found in the table below.

Table 3. Table listing pest plant species, both recorded within the restoration site or with the potential to occur, and their suggested chemical removal methodology should hand removal not be practical

Botanic Name	Common Name	Weed Control Method
Rubus fruticosus	blackberry	Cut and paste stumps with glyphosate gel (small patches only). For larger patches, spray with metsulfuron-methyl 7.5g/15L
Pinus radiata	monterey pine	Smaller trees – cut and paste stump with metsulfuron gel Trees > 10cm Diameter at Breast Height may be providing bat roost habitat. Trees should be drill and injected and left standing to prevent injury or mortality to native long-tailed bats.
Ligustrum lucidum/sinense	privet	Smaller trees – cut and paste stump with metsulfuron gel Trees > 10cm Diameter at Breast Height may be providing bat roost habitat. Trees should be drill and injected and left standing to prevent injury or mortality to native long-tailed bats.
Ulex europaeus	gorse	Cut across trunk and immediately paste the stump with metsulfuron or glyphosate gel Likely to be shaded out by natives and provides nursery canopy for new planting – complete removal in revegetation zones not required
Cortaderia selloana	pampas	Spray with glyphosate (20ml/L) during extended dry periods or haloxyfop and with a minimum 3 m distance from watercourses
Solanum mauritianum	woolly nightshade	Fell and immediately paste stump with 1-2mm layer of double strength glyphosate gel ensuring rim of stump is pasted
Araujia hortorum	moth plant	Remove plant from native plants prior to spraying. Spray with metsulfuron 0.5g per litre, with penetrant 1ml per litre.

		OR If stem is green, apply metsulfuron gel direct to stem. If stem has bark, scrape bark for 30cm then apply metgel
Asparagus scandens *Asparagus asparagoides*	climbing asparagus bushy asparagus	Foliage spray with glyphosate 20mL / L, without penetrant Remove plant from natives before spraying
Cenchrus clandestinus	kikuyu	Mow at lowest possible setting Spray with glyphosate 20 mL / L during extended dry periods and with a minimum 3 m distance from water bodies.
Tradescantia fluminensis	wandering willy	Foliage spray with triclopyr (600g/l) 6ml per litre with penetrant 1ml per litre

Herbicides should only be applied following a minimum of three (3) days without rainfall, and when rainfall is not forecast within 24 hours. This prevents run-off into watercourses, and the herbicide rapidly draining into groundwater. In addition, the following general guidelines apply when using herbicide control methods:

- Identify plants that will need to be retained prior to commencing weed removal activities;
- Keep a minimum of 1 m away from any native plants when applying glyphosate (and 3 m away when using herbicides with residual activity such as Metsulfuron); and
- Refrain from spraying directly next to watercourses – remain a minimum of 3 m distance from the wetted edge at all times.

The guidelines of the Auckland Regional Pest Management Plan (RPMP) should be strictly followed when new incursions of pest plants are recorded. New species should be noted on pest plant monitoring record sheets and controlled appropriately, in accordance with the RPMP.

It is recommended the use of the following chemical control substances is **avoided** due to their ability to accumulate in the environment:

- 2,4-D ester, MCPA and/or MCPB (often contained in herbicides marketed as 'broadleaf killers', e.g. 'Pasture-Kleen', 'Ken-ester Relay' or 'Pasture Guard');
- Picloram and/or triclopyr (often contained in herbicides marketed as 'brushkillers', e.g., 'Eliminate Brushkiller' or 'Tordon Brushkiller');
- Clopyralid (e.g. 'Void');
- Asulam (e.g., 'Asulan');
- Fluroxypyr (e.g., 'Tandus XL' or 'Starane'); and
- Saflufencil (e.g., 'Sharpen').

Always follow the manufacturer's instructions carefully and use the recommended safety precautions to protect the user and water health. A wetting agent, such as Boost, should be used to better adhere the spray adhere to the plant, allowing an increased efficacy of kill. Avoid spraying herbicide on windy days, when the droplets are likely to drift beyond the target area. The user

should be suitably qualified in applying chemicals, such as in possession of a GROWSAFE certificate.

Maintaining up-to-date records of agrichemical usage is a legal requirement for the management of agrichemicals as set under the Hazardous Substances and New Organisms (HSNO) Act and specified in the New Zealand Standard for Management of Agrichemicals (NZS 8409:2021). Risks associated with the use of agrichemicals are required to be managed as indicated on the label and other product information so that adverse environmental effects are avoided.

A diary should be kept of all weed control, planting, and pest control work carried out.

2.4.2 Stage 2: Planting and Schedules

This section outlines a description of the planting zone, and a plant list including pioneer and enrichment species. The plants have been chosen based on information on indigenous Auckland vegetation (Singers et al., 2017), Auckland Council's Te Haumanu Taiao Restoring the Natural Environment in Tāmaki Makaurau guidance document, recorded species from nearby reference sites, and with respect to the vegetation at both the site of loss and the site of offset.

2.4.2.1 Planting Descriptions

2.4.2.1.1 Terrestrial Offset Planting

The terrestrial offset planting at Oldfield Road has been designed with a pioneer and enrichment planting phase. The planting aims to connect existing vegetation fragments throughout the site.

Pioneer Planting – Ridge and Gully

The pioneer plant lists for the Oldfield Road restoration planting have been prepared with consideration to Auckland Council's Te Haumanu Taiao guidelines, with the aim of initiating the restoration of kānuka scrub forest (VS2; Singers et *al.,* 2017); broadleaved species scrub forest (VS5); and directing succession towards kauri, podocarp, broadleaved forest (WF11). The location of these planting zones throughout the site is informed by site topography, with light exposure, aspect and site contours dictating the suitability of planting areas to certain plant categories.

VS2 and VS5 habitats are both early pioneer forest types, which can be expected to mature into stable climax forest types. Within the Auckland region, kauri, podocarp, broadleaved forest type (WF11, Singers et *al.,* 2017) is recognised as a significant climax forest type which once would have occupied large areas. VS2 and VS5 forests often grow in a mosaic, with kānuka scrub forest usually occupying drier ridges and north-facing slopes, while broadleaved scrub forest is found in sheltered valleys and south-facing slopes. Planting across the site will follow this mosaic pattern, with the existing topographical variety and hydrology directing the planting mix type of pioneer species.

Enrichment Planting – VS2; VS5; and WF11

Enrichment species have been selected based on plant lists from the nearby Dome Forest (NZPCN) as well as Kings Quarry RECCE plot and walk-through data. Indicative planting lists have also been incorporated within the Terrestrial Ecology Residual Effects Analysis Report (Bioresearches, 2025a) modelling outputs, with predicted diameter at breast height (DBH) and growth rates of planted species used to inform expected revegetation outputs. The enrichment planting aims to achieve like-for-like indigenous biodiversity offsetting on the restoration site via the provision of planting that will mature into climax ecosystem types.

The enrichment planting has been separated into the three vegetation types (VS2; VS5; and WF11). As with pioneer plantings, enrichment planting has been divided between species more suited to drier ridges and north-facing slopes (VS2), and those with habitat preferences for cooler, damper sites (VS5).As VS2 and VS5 are both successional ecosystem types, enrichment planting includes later successional canopy species such as podocarps, as well as understorey species typically removed by browsers that are lacking throughout the site.

The WF11 enrichment planting includes later-stage podocarp and broadleaved species. Kauri is also included within this planting list and must be sourced from a nursery with a Kauri plant production plan that meets the requirements of rule 3 of the National PA Pest Management Plan, to limit the spread of Kauri Dieback. WF11 enrichment planting has been incorporated into two sections, with a section each in the predator elimination fence, and outside within the predator suppression zone. The intention of this placement is to create a seed source both within and outside of the predator elimination fence. The WF11 enrichment planting occurs along sloping ridge gradients, and is suitable for both gully and ridge species which have been incorporated within the WF11 enhancement planting list.

All enrichment planting zones will help to attract seed-dispersing fauna via habitat and food provision, in order to better support natural regeneration processes.

2.4.2.2 Existing Vegetation Infill Drone Seeding

RECCE plots of the Oldfield Road site indicate that the native VS2 and VS5 vegetation within the site has been severely degraded by pest plants and animals. The edges of the existing vegetation have been encroached by pest plant species such as gorse, woolly nightshade, and pampas. While the interior contains an almost exclusive native canopy, the understorey has been impaired by goat browsing and pig rooting.

The enrichment of existing native vegetation has been designed within a single plant list to replace palatable species removed by pest animals, as well as incorporate late-stage canopy species found within the VS2 and VS5 Kings Quarry RECCE plots. Tree ferns are currently present throughout the existing vegetation and are expected to naturally regenerate.

The large size of the area of existing VS2 and VS5 vegetation, as well as the steep terrain and lack of good access roads within the area, creates a physical challenge for planting of infill enhancement species. For this reason, drone seeding of these species has been implemented as part of this plan, in place of traditional planting.

2.4.2.3 Planting Lists – Pioneer and Enrichment Staging

The planting will occur in two stages for the terrestrial offset planting:

1. Planting of pioneer species within the planting zones; and
2. An enrichment planting of future canopy/late successional species within the revegetation zones. The enrichment planting can occur from 4 years after the initial planting.

The infill planting of existing vegetation within the Oldfield Road site will occur within a singular stage and can occur in conjunction with the terrestrial offset pioneer planting.

Stage 1a: Terrestrial Offset Pioneer Planting includes fast-growing plant species that provide natural protection for later successional canopy vegetation that may otherwise have difficulty thriving in exposed environments. Pioneer plants establish quickly and create a canopy cover that will reduce exposure and shade out weeds. Pioneer planting has been divided into ridge and gully-adapted species.

Stage 1b: Infill Drone Seeding of existing vegetation includes increased diversity and future canopy/late successional species within existing VS2 and VS5 ecosystem types on site. Natural regeneration and successional processes may have been impacted by mammalian browsers, so return of seed will help to restore these processes.

Stage 2: Terrestrial Offset Enrichment Planting of canopy trees can be undertaken at 4 years following pioneer planting. Canopy/climax trees are late successional species and are usually slower growing and longer living. It may be necessary to first release or remove some of the pioneer plants to create space for enrichment species.

The location of the planting and total area coverage can be found in Figure 4 and Figure 5. The below tables provide species lists for the planting plan of each restoration site. The tables include total plant numbers, accounting for 10% die-off during the initial period following planting.

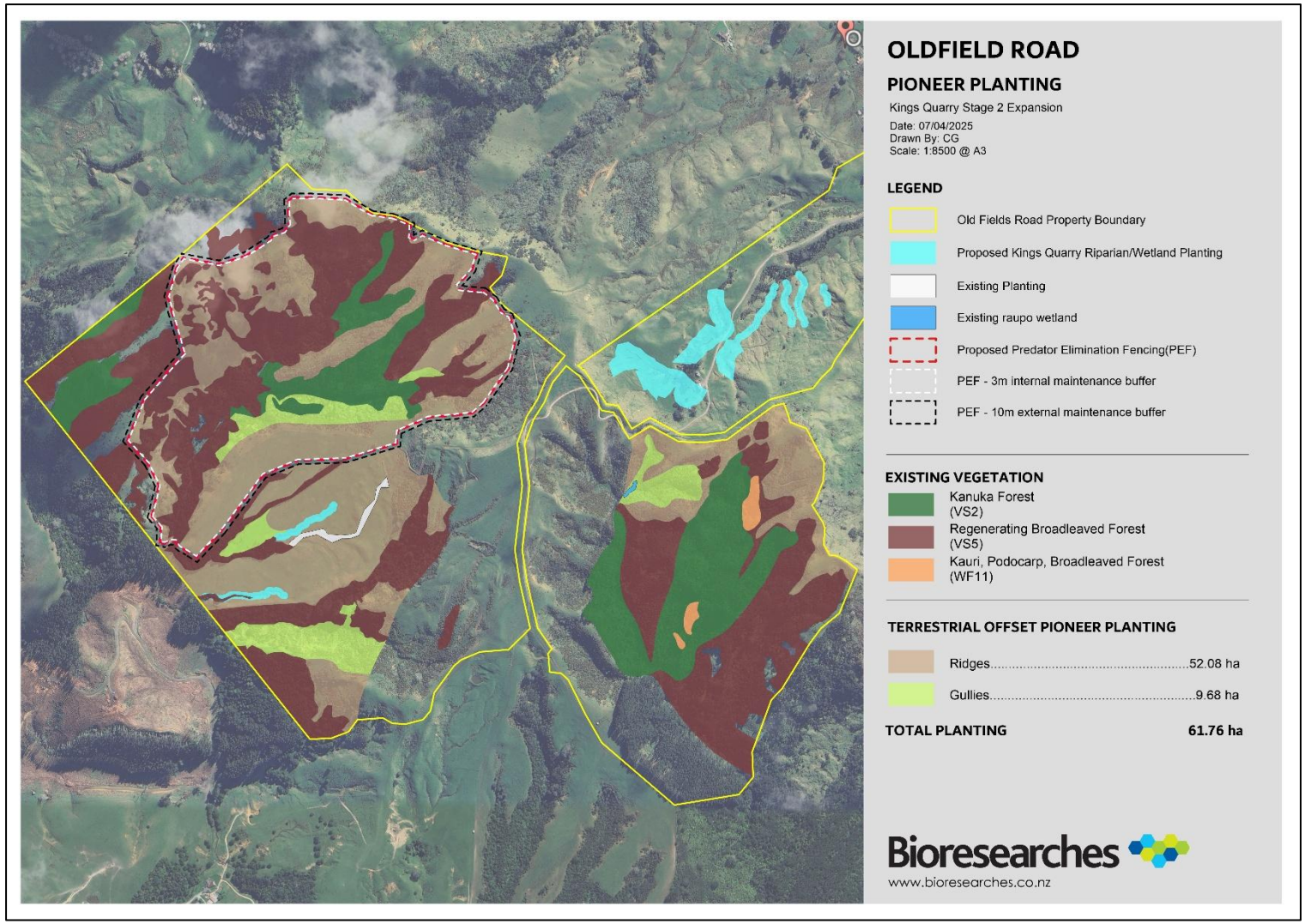


Figure 4. Map showing the location of pioneer planting (ridge and gully species) at Oldfield Road.

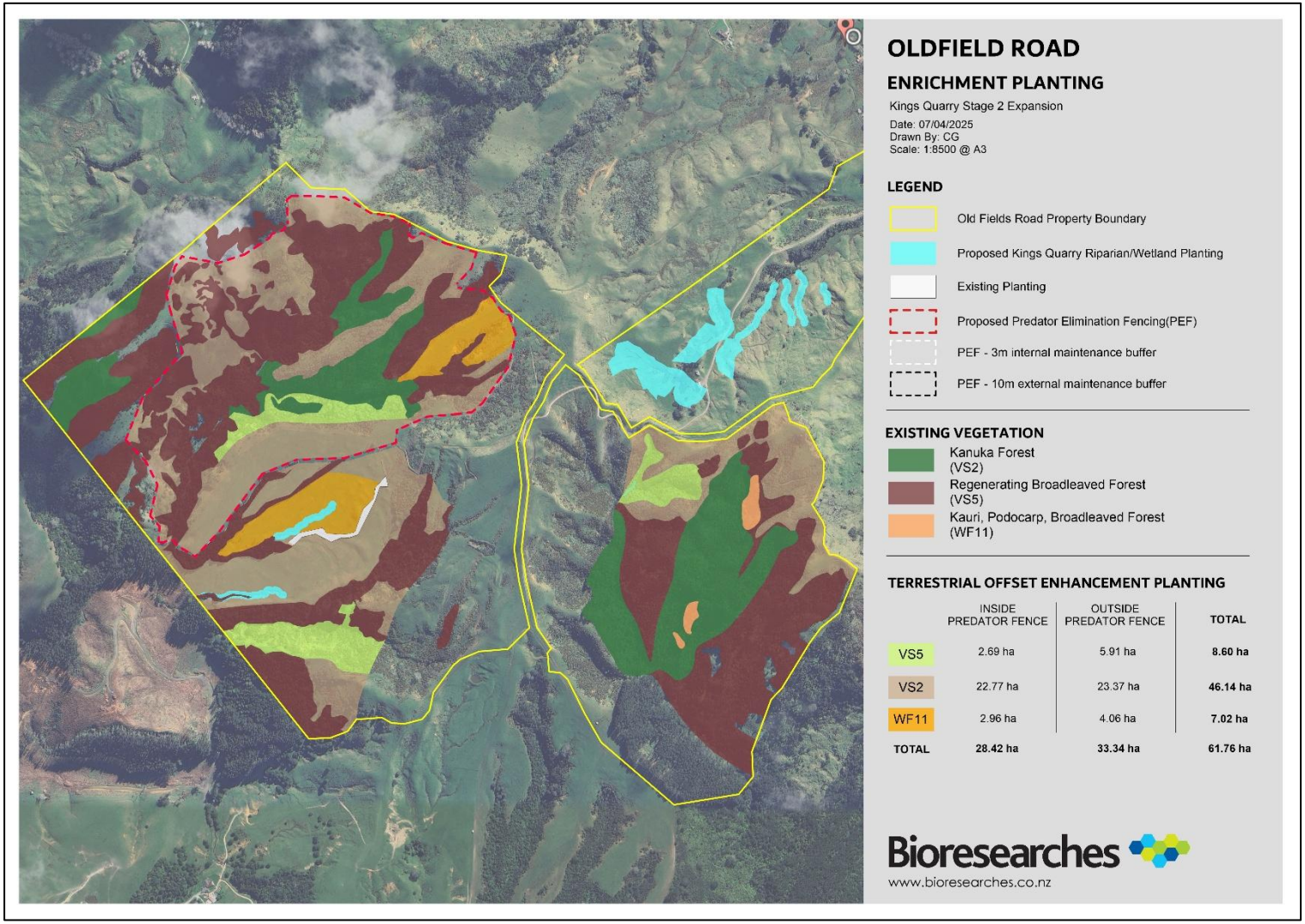


Figure 5. Map showing location of enrichment planting of VS2, VS5 and WF11 habitats.

STAGE 1a: TERRESTRIAL OFFSET PIONEER PLANTING

Table 4. Oldfield Road: Pioneer planting mix for gully species

Scientific Name	Common Name	Grade (L)	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Aristotelia serrata	Wineberry	1L / pb3	1.4	5	3461	3807
Brachyglottis repanda	Rangiora	1L / pb3	1.4	5	3461	3807
Carpodetus serratus	Putaputawētā/marble leaf	1L / pb3	1.4	5	3461	3807
Coprosma robusta	Karamū	1L / pb3	1.4	10	6921	7613
Cordyline australis	Cabbage tree	1L/pb3	1.4	5	3461	3807
Hedycarya arborea	Porokāiwhiri	1L / pb3	1.4	5	3461	3807
Kunzea robusta	Kānuka	1L / pb3	1.4	10	6921	7613
Leptospermum scoparium	Manuka	1L / pb3	1.4	15	10382	11420
Melicytus ramiflorus	Māhoe	1L / pb3	1.4	10	6921	7613
Myrsine australis	Māpou	1L / pb3	1.4	10	6921	7613
Olearia furfuracea	Akepiro	1L / pb3	1.4	5	3461	3807
Pittosporum tenuifolium	Kōhūhū	1L / pb3	1.4	10	6921	7613
Podocarpus totara	Tōtara	1L / pb3	5	5	968	1065
Total:				**100**	**66719**	**73391**

Table 5. Oldfield Road: Pioneer planting mix for ridge species

Scientific Name	Common Name	Grade (L)	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Coprosma robusta	Karamū	1L / pb3	1.4	10	37237	40961
Coprosma robusta	Karamū	1L / pb3	1.4	10	37237	40961
Cordyline australis	Cabbage tree	1L / pb3	1.4	5	18619	20480
Hoheria populnea	Hohere	1L / pb3	1.4	5	18619	20480
Kunzea robusta	Kānuka	1L / pb3	1.4	35	130330	143363
Leptospermum scoparium	Mānuka	1L / pb3	1.4	5	18619	20480
Melicytus ramiflorus	Māhoe	1L / pb3	1.4	10	37237	40961
Myrsine australis	Mapou	1L / pb3	1.4	5	18619	20480
Pittosporum tenuifolium	Kōhūhū	1L / pb3	1.4	5	18619	20480
Pseudopanax arboreus	Five-finger	1L / pb3	1.4	5	18619	20480
Pseudopanax crassifolius	Horoeka	1L/pb3	5	5	18619	20480
Total:				**100**	**372372**	**409609**

STAGE 1B: INFILL DRONE SEEDING OF EXISTING VEGETATION

Table 6: Existing vegetation infill enrichment list

Scientific Name	Common Name	Grade (L)*	Spacing (m)	% Plant mix	NO. PLANTS	NO. PLANTS + 10%
Alectryon excelsus	Tītoki	3L / pb5	35	5	1261	1387
Beilschmiedia tarairi	Taraire	3L / pb5	35	5	1261	1387
Beilschmiedia tawa	Tawa	3L / pb5	35	5	1261	1387
Brachyglottis kirkii var. *angustior*	Kirk's tree daisy	1L / pb3	35	3	1261	1387
Coprosma arborea	Māmāngi	1L / pb3	35	5	1261	1387
Coprosma autumnalis	Kanono	1L / pb3	35	6	1513	1665
Didymocheton spectabilis	Kohekohe	3L / pb5	35	5	1261	1387
Fuchsia excorticata	Tree fuchsia	1L / pb3	35	2	504	555
Geniostoma ligustrifolium	Hangehange	1L / pb3	35	6	1513	1665
Knightia excelsa	Rewarewa	3L / pb5	35	5	1261	1387
Melicytus macrophyllus	Large-leaved mahoe	1L / pb3	35	5	1261	1387
Nestegis lanceolata	White maire	3L / pb5	35	5	1261	1387
Olearia rani var. *rani*	Heketara	1L / pb3	35	5	1261	1387
Pectinopitys ferruginea	Miro	3L / pb5	35	5	1261	1387
Pennantia corymbosa	Kaikōmako	1L / pb3	35	6	1513	1665
Phyllocladus trichomanoides	Tanekaha	3L / pb5	35	5	1261	1387
Prumnopitys taxifolia	Matai	3L / pb5	35	5	1261	1387
Pseudopanax arboreus	Five-finger	1L / pb3	35	6	1513	1665
Schefflera digitata	Pate	1L / pb3	35	6	1513	1665
Vitex lucens	Pūriri	3L / pb5	35	5	1261	1387
Total:				**100**	**25727**	**28300**
***n.b. Grade sizes for infill enrichment only applicable where drone seeding has not been successful and manual planting is to be implemented**						

STAGE 2: TERRESTRIAL OFFSET ENRICHMENT PLANTING

Table 7: Oldfield Road Broadleaved scrub species VS5 enrichment planting list (gullies)

Scientific Name	Common Name	Grade	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Beilschmiedia tarairi	Taraire	3L / pb5	5	5	860	946
Beilschmiedia tawa	Tawa	3L / pb5	5	5	860	946
Coprosma arborea	Māmāngi	1L / pb3	1.4	5	3075	3382
Didymocheton spectabilis	Kohekohe	3L / pb5	5	10	1720	1892
Nestegis lanceolata	White maire	3L / pb5	5	5	860	946
Pectinopitys ferruginea	Miro	3L / pb5	5	10	1720	1892
Pennantia corymbosa	Kaikomako	1L / pb3	1.4	5	3075	3382
Phyllocladus trichomanoides	Tanekaha	3L / pb5	5	5	860	946
Piper excelsum var. excelsum	Kawakawa	1L/pb3	1.4	5	3075	3382
Prumnopitys taxifolia	Matai	3L / pb5	5	10	1720	1892
Rhopalostylus sapida	Nīkau	1L / pb3	1.4	5	3075	3382
Sophora microphylla	Kōwhai	1L / pb3	5	5	860	946
Total:				**75**	**21758**	**23934**

Table 8: Oldfield Road Kānuka scrub forest VS2 enrichment planting mix (ridges and dry areas)

Scientific Name	Common Name	Grade	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Alectryon excelsus	Tītoki	3L / pb5	5	5	4614	5075
Carpodetus serratus	Putaputawētā/Marble leaf	1L / pb3	1.4	5	16495	18145
Coprosma arborea	Māmāngi	1L / pb3	1.4	10	32990	36289
Elaeocarpus dentatus	Hīnau	3L / pb5	5	5	4614	5075
Knightia excelsa	Rewarewa	3L / pb5	5	10	9228	10151
Metrosideros robusta	Northern Rātā	3L / pb5	5	10	9228	10151
Phyllocladus trichomanoides	Tanekaha	3L / pb5	5	10	9228	10151
Piper excelsum var. excelsum	Kawakawa	1L/pb3	1.4	5	16495	18145
Podocarpus totara	Tōtara	1L / pb3	5	5	4614	5075
Prumnopitys taxifolia	Mataī	3L / pb5	5	5	4614	5075
Sophora microphylla	Kōwhai	3L / pb5	5	5	4614	5075
Total:				**75**	**116734**	**128408**

Table 9: Oldfield Road WF11 enrichment planting mix

Scientific Name	Common Name	Grade	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Agathis australis	Kauri	3L / pb5	3	5	1158	1274
Beilschmiedia tarairi	Taraire	3L / pb5	5	5	702	772
Beilschmiedia tawa	Tawa	3L / pb5	5	5	702	772
Carpotedus serratus	Marbleleaf	3L / pb5	1.4	5	2510	2761
Coprosma arborea	Māmāngi	1L / pb3	1.4	5	2510	2761
Dacrycarpus dacryidioides	Kahikatea	3L / pb5	3	5	1158	1274
Dacrydium cupressinum	Rimu	3L / pb5	5	5	702	772
Knightia excelsa	Rewarewa	3L / pb5	3	7	1622	1784
Laurelia novae-zelandiae	Pukatea	3L / pb5	5	3	421	463
Pectinopitys ferruginea	Miro	3L / pb5	5	5	702	772
Phyllocladus trichomanoides	Tanekaha	3L / pb5	5	5	702	772
Piper excelsum var. excelsum	Kawakawa	1L/pb3	1.4	5	2510	2761
Prumnopitys taxifolia	Matai	3L / pb5	5	5	702	772
Sophora microphylla	Kowhai	3L / pb5	5	5	702	772
Vitex lucens	Pūriri	3L / pb5	5	5	702	772
Total				**75**	**17504**	**19255**

Spacing has been provided for in the plant lists in Tables 2-7 above. Plants with a spacing given of 5m are expected to grow into large trees. This 5m spacing is to be measured from other plants with the equivalent spacing requirements, but they may be planted 1.4m away from other species with 1.4m planting space requirements.

Plants should be planted in a random mix within each area, avoiding rows or patterning, to best replicate a natural environment.

2.5 Plant Sourcing

All plants must be eco-sourced from within the Rodney/Eastern Northland ecological district (9.01). Eco-sourcing protects the genetic lineage of plants in the area and ensures plants are adapted to their specific regional climatic conditions, making them more resilient to weather extremes. Examples of eco-source nurseries for this region include Scrub Nursery, Ngā Uri o Hau Native Nursery, Akerama Marae Nursery and South Kaipara Landcare Nursery.

Plants should be ordered from an appropriate eco-source nursery as early in the project as possible to ensure that the appropriate species and numbers are grown on to be ready for planting. A minimum of one year's notice is recommended. In conjunction with the Threatened Plant Management Plan for the Kings Quarry site, seed may be collected directly from the impact area to be utilised within the planting areas.

All plantings from the Myrtaceae family (for example kānuka and mānuka) shall be sourced from a nursery that is a signatory to the Myrtle Rust Nursery Management Declaration V6, 11 October 2017, certifying that the plant producer has implemented the New Zealand Plant Producers Imported Myrtle Rust Nursery Management Protocol (Myrtle Rust Nursery Management Protocol – V6, 11 October 2017).

Kauri must only be sourced from a nursery that has a Kauri plant production plan that meets the requirements of rule 3 of the National PA Pest Management Plan to prevent the spread of Kauri Dieback disease.

2.6 Planting Procedure – Offset Revegetation Planting

The planting season runs from May through to August.

During planting, the following procedures should be followed to ensure maximum survival of plants and optimal growth and health.

- Prior to planting, ensure all plants are thoroughly watered and have been allowed to drain out of direct sunlight.
- Set the plants out on site according to the recommended spacing. Aim to follow a randomised planting layout rather than straight lines, to achieve a "natural" rather than uniform look. Plant species should be mixed to avoid large single-species groupings.
- Dig a hole 1.5 – 2 times wider than the plants' root ball. Ensure the edges of the hole are roughened, especially in clay soil, to avoid a "pot effect" and the drowning of plants. Back-fill with a small amount of soil to cover the base.
- Carefully remove the plant from the bag and place within planting hole.

- Back-fill the hole with part new soil and part existing soil. Break up clumps of existing soil with a shovel as much as possible. As you fill, avoid stomping firmly on the soil, as this may over-compact the ground and restrict root growth. Some moderate firming with your foot or by hand once planted is adequate.
- Fill the planting hole until the top of the root ball sits exactly level with the ground surface. If the plant is planted too deep (plants sitting in indentations) water will pool and the plant may rot. If the plant is planted too high (plant is sitting in a mound) water will wick up through the soil and the plant will dry out.

2.6.1 Physical Protection

New seedlings are susceptible to grazing by pests such as possums and rabbits, and adequate measures need to be taken to ensure plants are protected. As livestock are present on-site, fencing will be required to prevent the trampling of new and existing plants, both within the revegetation and enhancement areas. Pest animal control, described in Section 2.8.1.3 of this document, shall begin prior to, or concurrently with, planting in order to protect new plantings from pest damage while they are establishing.

2.6.1.1 Fencing

A predator proof fence is proposed to be installed surrounding 60 ha of vegetation within the site. The details of this fencing can be found in Section 2.8.1.3 of this report.

Fencing should be installed surrounding the remaining planting and enhancement area outside of the predator proof fence (referred to as the 'predator elimination zone'), and is to be of a stock-proof standard – timber post and wire design:

- Consisting of a minimum 5 horizontal wires, preferably 7;
- To be built with timber round or half round posts, spaced at 3 to 5 m apart; and
- On rolling hills (>7 °gradient), posts to be installed a maximum of 3 m apart.

Fencing should be inspected annually and maintained to a stock-proof standard. Protection via fencing, in line with covenanting requirements, is required in perpetuity.

The location of proposed fencing can be found in the figure below.

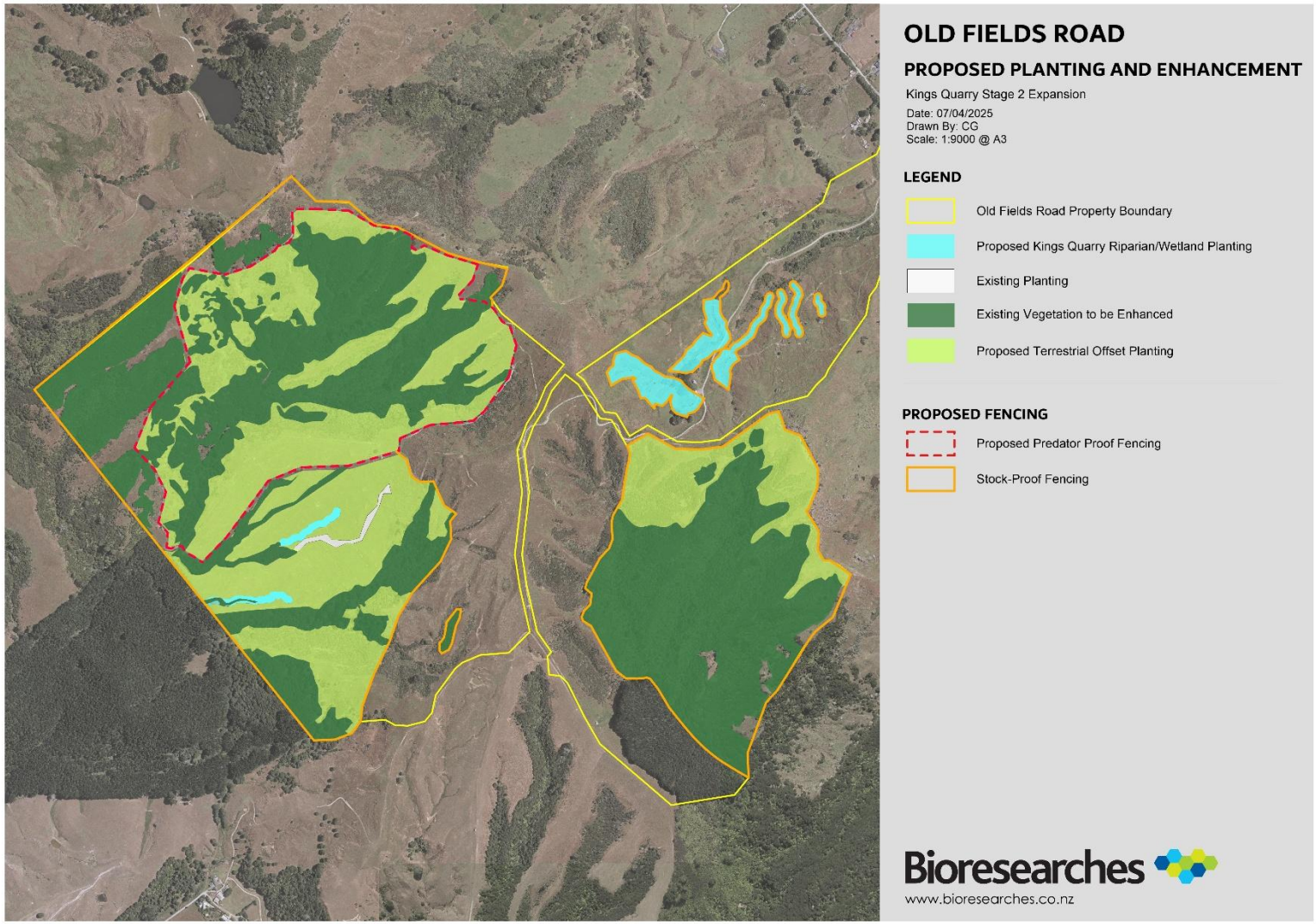


Figure 6: Map showing the location of fencing to be installed surrounding enhancement vegetation and proposed new planting, including a 60ha Predator Proof Fence, as well as stock-proof fencing surrounding remaining planting and vegetation.

2.7 Drone Seeding – Existing Vegetation Infill

Scattering of seed, via drone, over existing areas of VS2 and VS5 vegetation at the Oldfield Road site is intended to increase diversity within existing vegetation. The plant list for this infill enrichment seeding can be found in Tables 4 and 9, and includes both future canopy species, as well as species vulnerable to browsing pressure from pest animals.

2.7.1 Seed collection

Seed collection will be seasonal and must be done under the supervision of an experienced botanist or horticulturalist. Seed collection must follow eco-sourcing protocols, with priority given to the geographically closest natural seed sources for each species. Seed should only be collected from healthy plants, with a minimum of 20 parent plants for each species (ideally greater), and no more than 1/3 of seed should be removed from any one plant. Proportions of seed for each species should follow those provided in Table 4 and seed quantity should be no less than 1000 seeds per species, per year.

Different species produce fruit/seeds seasonally. Therefore, seed collection must be done at appropriate times throughout the year, to ensure seed from all species is collected. Table 10 provides an approximate timeframe for seed collection for each species. Note that this is a general guide only, as localised adaptations or seasonal fluctuations may alter seed production times.

Variation in seed production from year to year may occur. Many native species exhibit mast seeding, where abundant seed or fruit is produced one year and little in others. Unexpected weather events may also impact seed production or availability for collection. Should a poor seeding year occur, for any species, an additional year of seed collection and scattering for the affected species shall be added to the schedule. In a low-seed production year, lesser quantities of seed should still be collected, if possible.

It is recommended that, in addition to the seed collected for scattering, some seed shall be collected for traditional nursery cultivation, as a contingency against unexpected circumstances using this technique.

Seed must not be stored longer than a week to ensure best possible seed viability.

Table 9: Approximate seed collection times for infill species. Seasonality referenced from iNaturalist phrenology records from the district and NZPCN database.

Common Name	Scientific name	Seed collection timing
Alectryon excelsus	Tītoki	September - November
Knightia excelsa	Rewarewa	October - January
Fuchsia excorticata	Tree fuchsia	December - February
Melicytus macrophyllus	Large-leaved mahoe	December - February
Pseudopanax arboreus	Five-finger	December - February
Olearia rani var. *rani*	Heketara	December - March
Beilschmiedia tawa	Tawa	January

Coprosma autumnalis	Kanono	January - April
Nestegis lanceolata	White maire	February - March
Geniostoma ligustrifolium	Hangehange	March
Didymocheton spectabilis	Kohekohe	March - April
Pectinopitys ferruginea	Miro	March - April
Pennantia corymbosa	Kaikōmako	March - April
Phyllocladus trichomanoides	Tanekaha	March - April
Prumnopitys taxifolia	Matai	March - May
Beilschmiedia tarairi	Taraire	April - May
Brachyglottis kirkii var. *angustior*	Kirk's tree daisy	April - June
Schefflera digitata	Pate	April - October
Coprosma arborea	Māmāngi	June - July
Vitex lucens	Pūriri	Year round, winter best

2.7.2 Drone seed scattering

Drones shall be used to scatter seed from infill species over existing VS2, VS5 and WF11 vegetation at Oldfield Road. This will provide a more effective and efficient coverage of the area, than that expected to be produced by planting by hand. Multiple seed applications per year will be required in order to scatter seed from each species as soon as it has been collected. Drone scattering for infill enhancement must:

- Be supervised by the project botanist, who, with reference to the site map, will direct distribution to best distribute seeds over appropriate habitat (e.g. gully or ridge);
- Be conducted during still weather, to prevent rain blowing seeds out of the area;
- Be conducted at a low altitude, close to the existing canopy, to ensure accuracy of seeds reaching appropriate areas;
- Be completed no more than 5 days after seed is collected for any one species. Many native species have seeds with short viability, so seed should always be scattered fresh and never stored; and
- Begin no earlier than the first rounds of pest animal control and weed control are completed and continue for a minimum of three years.

2.7.3 Monitoring and contingency

The vegetation across the site shall be monitored via surveys of permanent RECCE plots at Oldfield Road, as described in Section 4 of this report. Because many of species in the infill enrichment list are not included in either pioneer or enrichment planting lists, their presence will indicate success from drone seed scattering. Should monitoring at 5 years not demonstrate the

presence of infill species, to levels of abundance that would be expected from comparable hand-planting, the drone scattering will be halted and planting by hand shall replace this technique.

2.8 Maintenance Plan

The maintenance plan of this report details the required plant aftercare, including replacement plants and weed control. Maintenance shall occur for a minimum of 10 years following planting, with successful planting indicators including 80% canopy closure and a minimum survival density of 90% of the original planted density.

In the instance that planting targets are not being met (i.e., plants continue to fail despite replacement planting), a substitute species may be used subject to the approval of a consulting ecologist. Replacement plants should be at least of the same size (relative to surrounding plants).

Annual monitoring of the planting is required and described in Section 4 of this Report.

2.8.1 General Activities

Maintenance should occur for a minimum period of 10 years. Maintenance of revegetation planting will include:

- Manually removing weed species should they re-establish; and
- Replacing any plants that do not survive during the initial 5-year post-planting period.

Revegetation planting maintenance will occur every second month for the first year (or for 12 months after planting/initial weed control). Thereafter, the planting areas shall be maintained quarterly for at least 3 years after initial planting, and twice a year in years 4+ if planting targets are being met. The maintenance frequency adopted in this report is in line with the restoration planting guidelines outlined in Auckland Council (2023[2]).

Successful planting targets include at least a 90% canopy closure, and a minimum of 90% of the original density of plants specified has survived.

Weed control of the planting areas should be undertaken twice per year and should be conducted to a level where no mature weeds are present on the site and seedlings/saplings are removed within 6 months. Audits should be conducted after each control session to ensure that weed control is of a high standard, is not causing unnecessary damage to native species and that full site coverage is being achieved (see section 2.7). Weed control must continue for a minimum of 10 years, starting from initial site planting preparation.

A sample schedule of the plant maintenance and management activities required at the revegetation planting and enhancement areas are presented in the tables below.

[2] Auckland Council. (2023). Te Haumanu Taiao: Restoring the natural environment in Tāmaki Makaurau.

Table 10. Planting and Maintenance Activity Schedule

Time	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year One	Initial weed control												
	Initial planting												
	Fence and pest control installation												
	Plant maintenance												
Year two	Plant maintenance												
Year three	Plant maintenance												
Year four	Plant maintenance												
Year five +	Plant maintenance												
All Years	Enhancement Area Weed control and plant maintenance												

2.8.1.1 Summer Activities

Summer (late November - late March) activities will include pest plant and animal control, as well as watering plants during periods of drought.

2.8.1.2 Autumn and Winter Activities

Autumn and Winter (April – September) activities will include continued weeding (spraying may become inappropriate due to rain and wind), and the replacement of any dead plants. Plant replacement should be of the same species in the same grade as specified in the planting list. Should a particular species continue to fail, a substitute species may be used subject to the approval of a consulting ecologist.

2.8.1.3 Spring Activities

Spring activities require ongoing weed control to target new spring growth.

3 PEST CONTROL AND ELIMINATION PLAN

3.1 Introduction

This Pest Control and Elimination Plan (PCEP) has been prepared for Kings Quarry Limited, to detail the control and elimination regimes for the proposed offset/compensation site at Oldfield Road, as part of the Residual Effects Management Plan. A separate Mammalian Pest Control Plan (MPCP) has been developed for the quarry site and adjacent site at 306 Pebble Brook Road, Waitoki.

Pest management to address residual effects will involve the implementation of two approaches:

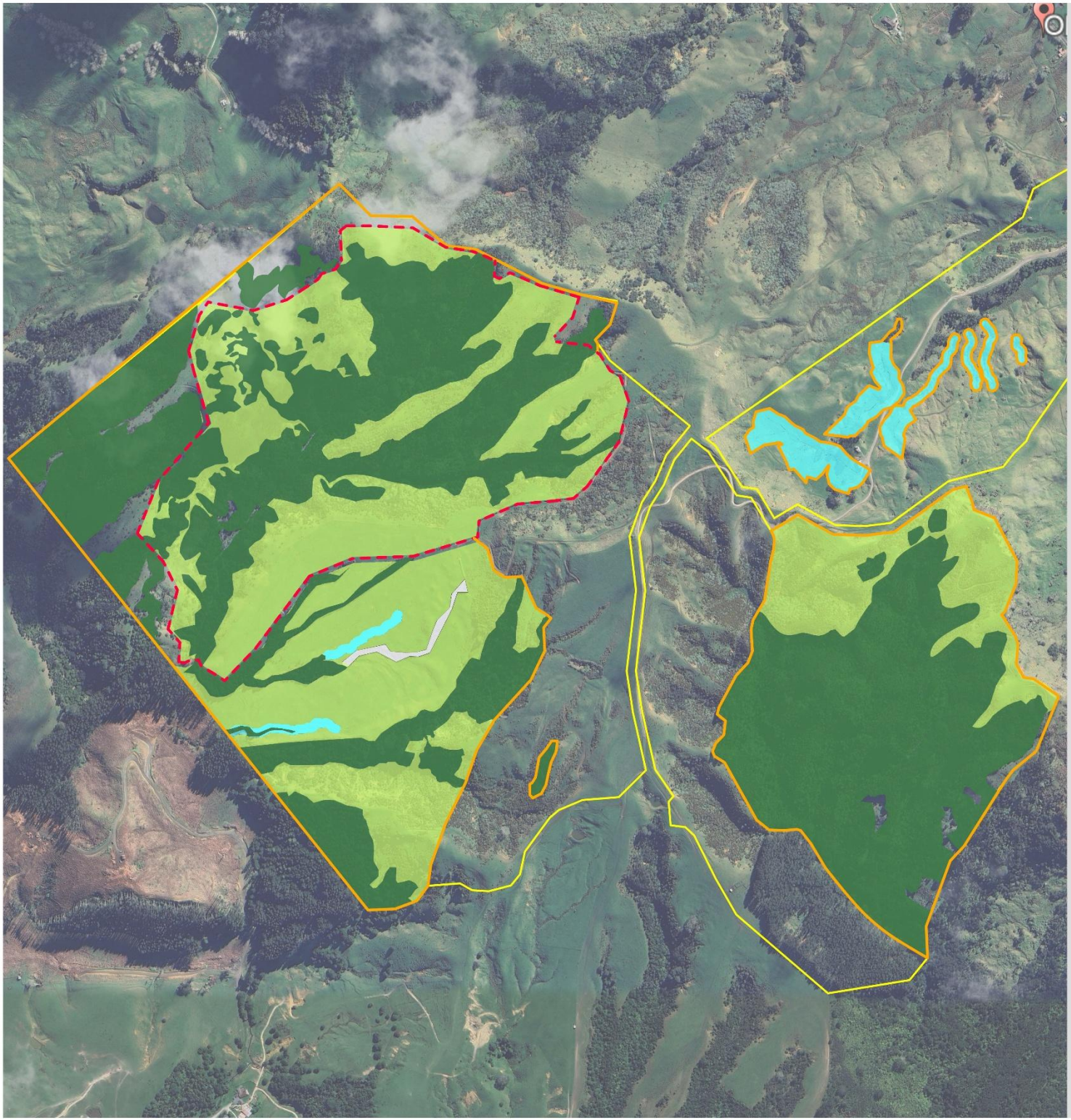
1. The inclusion of a 60 ha pest exclusion fence, within which all mammalian pests (including mice, rats, mustelids, possums, feral cats, hedgehogs, rabbits, hares and any pigs or goats) will be eradicated; and
2. Pest suppression in the planting and enhancement areas to reduce the impacts of browsers and to create a partial 'buffer' of protection for the fenced area. Pests to be suppressed will be rats, possums, mustelids and ungulates (pigs and goats – deer are not thought to be present). Reducing pests in this area will also help to create a network of pest-free vegetation corridors to support native birds.

The Oldfield Rd Pest Control and Elimination Area (PCEA), is outlined in Figure 7. Pest elimination will occur over 60 ha and suppression over 98.45 ha outside the fence for the life of the consent. The pest exclusion fence will likely have a lifespan beyond this, with a longevity of 35 – 50 years.

The inclusion of a pest-exclusion fenced area is currently a novel approach for residual effects management; however, the use of exclusion fences provides substantial benefits and certainty of biodiversity outcomes. Dr John McLennan of Pestproof Fences Ltd (one of the leading pest exclusion fence design and construction companies in New Zealand), has visited the site and undertaken a feasibility study (McClennan, 2025. Appendix C). His report concluded that it was "*entirely feasible to build a predator-proof fence along the proposed route"*. The report also concludes that "*minimal earthworks and vegetation removal would be required to establish the building platform*", making the fence construction itself a relatively straightforward process with low impacts.

An overview of the benefits of pest suppression and exclusion are provided in the following sections.

Figure 7 (following page). Location of the predator-proof fence and the mammalian pest exclusion area within the fence, and the mammalian pest suppression area outside the fence.



OLDFIELD ROAD

PEST ANIMAL CONTROL

Kings Quarry Stage 2 Expansion

Date: 07/04/2025
Drawn By: CG
Scale: 1:8500 @ A3

LEGEND

- Old Fields Road Property Boundary
- Proposed Kings Quarry Riparian/Wetland Planting
- Proposed Terrestrial Enhancement Vegetation
- Proposed Terrestrial Offset Revegetation Planting
- Existing Planting

PEST ANIMAL CONTROL

- Proposed Predator Proof Fence - 60 ha
  Predator Elimination Zone
- Predator Suppression Zone - 101.66 ha

Bioresearches
www.bioresearches.co.nz

3.2 Benefits of pest suppression

Rats, mustelids, possums, and feral cats are major predators of bats, birds, lizards, frogs and invertebrates in New Zealand, and are the major reason for the continued decline of many native animal species (Innes et al., 2010; McLennan et al., 1996; O'Donnell et al., 2015).

In New Zealand, pest suppression is a primary means of biodiversity restoration, which involves controlling the target pest species to low levels. It is a widely used conservation tool throughout the country to generate ecological benefits for indigenous flora and fauna, and has known and extensively documented conservation outcomes (Byrom et al., 2016; Fea et al., 2021; Miskelly, 2018; O'Donnell & Hoare, 2012). For example, possum-focussed control benefits vegetation by increasing foliage and fruit production, and by reducing tree mortality. Control of both ship rats and possums improves populations of birds and large-bodied invertebrates (Byrom et al., 2016; MacLeod et al., 2015). Widespread pest suppression has significant and long-term effects on the survival and growth of native fauna populations both at the site and in a wider landscape-scale context (Bombaci et al., 2018; Miskelly, 2018). Several native bird species known or likely to be present in the landscape surrounding the Oldfield Road PCEA (e.g. whitehead, kākāriki, tūī, kākā, and kererū) have previously shown population level recovery in areas subject to predator control (Fea et al., 2021).

Possums (canopy foliage), deer, goats, and pigs (seedlings and saplings on the forest floor), and rats (seeds and foliage) cause significant damage to forest canopies and seedlings. This damage hinders the regeneration of many palatable plant species and diminishes the health and availability of habitat for native fauna. Plant biomass and diversity is therefore expected to increase as grazing and browsing pressure is reduced and the diversity and abundance of more palatable species will increase as seedling survival improves. Māhoe, hangehange, pate, wineberry, kohekohe, and large leaved coprosma species are palatable to ungulates and will benefit from ungulate control, while kohekohe, swamp maire, māhoe and kaikomako (among others) will show recovery in canopy foliage density as a result of possum control (Department of Conservation, 2014).

As vegetation health improves in an environment with reduced pest density, the carrying capacity for many indigenous animal species will increase. While lizards, frogs, and invertebrates will benefit from the increased diversity and abundance of habitat, they may not experience the same level of benefit from the management of the target pest animals as birds do (Byrom et al., 2016).

3.3 Benefits of pest exclusion

Ring-fenced sanctuaries are relatively uncommon in New Zealand, despite the conservation outcomes within these areas being significantly highly than if pest numbers are suppressed (Clapperton and Day 2001). Flora and fauna inside the fence are free from predation and competition from pests year-round, offering the maximum biodiversity benefit.

There is now a substantial body of evidence demonstrating the biodiversity benefits obtained within ring-fenced ecosanctuaries (Innes et al., 2019), compared to non-fenced sanctuaries and peninsula-fenced sanctuaries. As outlined in Innes et al, 2019, fences offer three significant advances for management:

(1) reinvasion can be limited to near zero;

(2) many more pest species (up to 14 mammals) can be targeted at once, thus limiting inter-specific responses to removal of a predator or competitor and enabling more diverse restoration gains; and

(3) toxin use can be greatly reduced as only occasional re-invaders need to be targeted.

Specific examples of biodiversity benefits reported from fenced sanctuaries include:

- Densities of endemic bird species are higher in fenced sanctuaries, and introduced bird species are outcompeted once predation is reduced (Bombaci et al., 2018; Miskelly 2018; Binny et al. 2021; Fea et al. 2020);
- The abundance of mammal-sensitive vegetation, native frogs, lizards, and large invertebrates increases (Burns et al., 2012; Reardon et al. 2012; Innes et al. 2019; Watts et al. 2022);
- Nesting success rates are higher (Fea & Hartley, 2018);
- Beneficial mutualisms re-establish (for example, resulting in greater pollination) (Iles & Kelly, 2014);
- Increases of saplings of fleshy-fruited tree species that are sensitive to browsing and seed predation (Tanentzap & Lloyd, 2017);
- Translocation and reintroduction potential – for example enabling the return of some highly pest-sensitive taxa such as tīeke, hihi, and tuatara that previously persisted only on offshore islands (Burns et al., 2012); and
- Spill-over benefits provide a "source" population, which provides gains over to the wider region for flighted birds (Clarkson & Kirby, 2016; Fitzgerald et al., 2019; Tanentzap & Lloyd, 2017).

The 2017 study on spill-over benefits conducted by Tanentzap and Lloyd (2017), provided conclusive evidence that exclusion-fenced areas in New Zealand restored the populations of threatened flora and fauna both inside and *outside* the fence, extending conservation benefits into the wider landscape. Their surveys demonstrated that over an 8-year period, fruiting trees not only became more plentiful within the fenced area, but they also increased in numbers outside the fenced area as far as 500 meters away. Similarly, fruit-eating birds which become abundant inside the exclusion fence were also seen as far as 20 kilometres from the fenced area.

Multiple studies (e.g. Innes et al. 2019, Parkes et al. 2017; Linklater & Steer 2018), have provided evidence to support the idea that the best path to achieving known benefits from current pest control tools is a network of pest-fenced eco-sanctuaries with surrounding “halos” of less intensive control.

3.4 Pest Management Areas

The Oldfield Rd Pest Control and Elimination Area (PCEA), is therefore divided into two areas (Figure 7), with separate management protocols and targets for each area.

1. **Mammalian Pest Exclusion Area**– A mammalian pest exclusion fenced area of approximately 60 ha, this area contains a mix of vegetation, predominantly VS2 and VS5 (30.76 ha), with the remainder being pasture/weeds (Figure 7), along with a small waterway. Revegetation and weed control will occur throughout this area. Protocols for eradication and ongoing surveillance of all target animals within the fenced area are outlined in Section 3.6. Details on fence construction and specifications are provided in a separate Pest exclusion fencing feasibility report (McClennan, 2025, Appendix C).
2. **Mammalian Pest Suppression Area** – Control of browsing pests, including rats, possums, goats and pigs as well as mustelids on approximately 100 ha of remaining land, of which 57.52 ha is VS2, VS5 and WF11 forest (Figure 7). These areas are subject to control targets and thresholds. Protocols for ongoing trapping, toxic control, ungulate control, pest monitoring, and thresholds for additional control of target animal pests are outlined in Sections 3.7.

Figure 8: Catchment area which will be contained within the proposed Pest Exclusion Fence.

3.5 Target pest species

3.5.1 Rats

There are three rat species present in New Zealand, with Norway rats (*Rattus norvegicus*) and ship rats (*R. rattus*) being the most common on the mainland. Rats are generalist omnivores; their diet includes seed predation and preying on small animals such as invertebrates, reptiles, amphibians, and juvenile birds. They compete with native birds for nests and burrows, and have been implicated in the decline of a number of threatened birds, particularly seabirds (Auckland Council, 2019). Although rats are not as wide-ranging as mustelids, they are capable of invading areas quickly over short distances and have a high reproductive rate.

Rats will be eliminated within the Pest Exclusion Fenced Area via brodifacoum, and populations will be suppressed in the Pest Suppression Area using a combination of bait stations and traps.

3.5.2 Mice

There is evidence to suggest mice are predators on native lizards, frogs, and invertebrates (Egeter et al., 2015; Norbury et al., 2014; Wedding, 2007), and mouse populations may increase when larger predators (particularly rats, mustelids, and feral cats) are removed from an area.

Mice will be eliminated within the Pest Exclusion Fenced Area using brodifacoum.

3.5.3 Possums

In New Zealand, possums are both a predator of native wildlife and a heavy browser of many species of native trees. Although possums are mainly herbivorous and feed on flowers, fruit, and leaves, they will also opportunistically eat eggs, chicks, and invertebrates. Predation by possums on the eggs and nestlings of native bird species such as kōkako, kiwi, and kererū is widespread throughout New Zealand (James & Clout, 1996). Possums also disrupt ecological processes such as flowering, fruiting, seed dispersal and germination. In addition, they also serve as vectors of bovine tuberculosis (TB).

Possums will be eliminated within the Pest Exclusion Area (via brodifacoum) and controlled to low levels within the Pest Suppression Area with a combination of toxins and traps.

3.5.4 Mustelids

Three species of mustelids are present in New Zealand, all of which are likely to be present in the area. Stoats (*Mustela erminea*) and ferrets (*M. furo*) are particularly well-documented for their devasting impacts on native fauna. There are currently few adequate control options for weasels (*M. nivalis vulgaris*), the smallest of the mustelids in New Zealand, although some may be caught with the tools used for targeting rats and other mustelids.

Mustelids will be eliminated within the Pest Exclusion Area (via secondary poisoning from brodifacoum). They will be controlled via traps in the Pest Suppression Area, mainly to reduce potential reinvasion risk into the fenced area and to enhance spillover benefits.

3.5.5 Hedgehogs

Hedgehogs are mainly insectivorous but have proven to be a major predator on eggs and have been known to kill and eat chicks of a variety of ground-nesting birds as well as native lizards

(Department of Conservation, 2021). Hedgehogs are commonly captured in single-set trap networks targeting rats and mustelids, which also means that traps triggered by hedgehogs are no longer available to these target species until the trap is checked and cleared. Reducing the hedgehog population will consequently increase the effectiveness of the trap network as well as reducing predation pressure on some native fauna. Hedgehogs will be eliminated within the Pest Exclusion Fenced Area. They will be caught incidentally within the Pest Suppression Area, although they will not be specifically targeted.

3.5.6 Goats

Goats (*Capra hircus*) are a major pest browser at the site. They are social animals, typically travelling in small groups comprising one male and a group of smaller females. Goats are generalist herbivores that browse a wide variety of plant species but do prefer to feed on a small number of favoured species. Similar to feral pigs, goats destroy the understorey of vegetation and, when combined with possum damage to the upper canopy, can cause severe deterioration of native forests, often with associated pest plant invasion.

Feral goats will be eliminated within the Pest Exclusion Fenced Area and will be controlled in the Pest Suppression Area using professional hunters.

3.5.7 Pigs

Pigs can have devastating impacts on local flora and fauna, particularly regenerating forest understorey or areas of revegetation by uprooting trees and saplings and eating native plants and invertebrates. Feral pigs eat a wide variety of food including grasses, roots, seeds, and other plant material, as well as carrion, invertebrates, and ground-nesting birds.

Feral pigs will be eliminated within the Pest Exclusion Fenced Area and will be controlled in the Pest Suppression Area using professional hunters.

3.5.8 Rabbits

Rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*) are agricultural pests which can severely impact on ecological and cultural values. They browse on native vegetation and are particularly problematic during revegetation efforts. Rabbits can pose a risk to pest exclusion fenced areas due to digging, and as such, will be eliminated within the Pest Exclusion Fenced Area. Rabbits will also be controlled in the Pest Suppression area via pindone to ensure plant survival is high.

3.6 Pest exclusion fence

3.6.1 Overview

A pest exclusion fence is a fence designed and built to exclude predators, typically rats, mustelids, possums, feral cats, hedgehogs, rabbits/hares —and in some instances, including the Oldfield Road PMA, mice — and ungulates (namely deer, pigs, and goats). Optimised fence designs now exist, with over 30 years of research and development going into the success of these fences (see Figure 9 for an example).

Existing ring-fenced sanctuaries (a fence that fully surrounds an area, as is proposed at Oldfield Road) include: Maungatautari (3,2404 ha), Wairakei Golf Course (180 ha), Rotokare Scenic Reserve (230 ha), Bushy Park (98 ha), Brook Waimarama Sanctuary (690 ha), Zealandia (225 ha), Orokonui Ecosanctuary (370 ha), the kiwi crèche at Lake Opouahi (40 ha), Warrenheip (16 ha), Macraes Flat 1 and 2 (22 and 11 ha) and Driving Creek Wildlife Sanctuary (1.5 ha).

3.6.2 Design

The pest exclusion fencing feasibility report (Mclennan, 2005), outlines the details of the fence design.

The current 'best practise' design for pest exclusion fences consists of a fence height of 1.8–2.0 m off the ground (see Figure 10). Wire mesh is attached to wooden posts and a wide horizontal mesh skirt facing outwards, extending no less than 400 mm from the base of the fence, is pinned 50–100 mm underground. A folded and/or rolled sheet steel hood is mounted on top of the mesh, which extends 250–350 mm horizontally towards the outside of the protected area. These specifications are beyond the jumping ability of medium to large mammals (such as feral cats and possums) and also prevent animals from digging or burrowing under it. As mice are also being excluded, the aperture size of the mesh must be 6 mm or less across one dimension (the smallest aperture any adult or juvenile mouse can fit through; Bell, 2014).

Specially designed culverts and watergates (Figure 11) will be installed at the stream crossing to prevent pests entering the exclusion area while allowing free movement of native fish up and down stream.

Biosecurity protocols will be developed for anyone (including visitors, maintenance crews and other workers) entering the fenced area to minimise the risk of target species re-invading the sanctuary, either while access gates are open or as stowaways in equipment or bags.

Figure 9. A pest exclusion fence (as constructed by Pestproof Fences Ltd).

Figure 10. Diagram of a standard predator-proof fence (above and below ground),

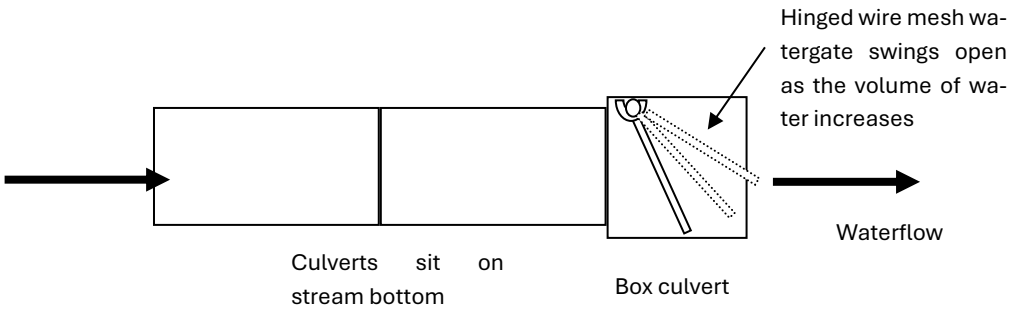


Figure 11. Cross-sectional diagram of a pest exclusion fence watergate.

3.6.3 Eradication methodology

Following fence construction, eradication of all target species (rats, mice, weasels, stoats, ferrets, feral cats, possums, rabbits, hares, hedgehogs, deer, goats, and pigs) will occur. The methodology outlined in this section presents the currently recommended regime for eradication based on other successful projects; however, it is possible the specifics of these methods may vary following further consultation once the project has commenced.

It is proposed that the primary tool for eradication will be aerial applications of cereal pellets containing the anticoagulant toxin brodifacoum, applied in late winter/early spring (between 1 June and 1 November) when bait uptake by rodents is highest (Speedy et al., 2007). Brodifacoum is the most widely used toxicant for eradications in New Zealand, and of the 12 projects that aerially applied brodifacoum in accordance with DOC standards, all 12 (100%) were successful at eradicating mice (Broome et al., 2017). Successful mouse eradications include much larger

areas such as Enderby Island (710 ha), as well as mainland ring-fenced sanctuaries such as the smaller cells of Maungatautari (35 ha and 60 ha).

As per current DOC best practice (Broome et al., 2017), and per the protocol which was successful for the pest mammal eradications on Motutapu/Rangitoto (Griffiths et al., 2015; Griffiths & Towns, 2008), toxic bait will be applied in up to three separate aerial applications (via helicopter or drone) at least 14 days apart, at a rate of 8 kg/ha. The bait proposed for use is 10 mm (2 g) Pestoff 20R rodent bait containing brodifacoum at 20 ppm.

Bait will be applied along parallel flight lines guided by GPS and spaced to 50% of the effective swath width produced by the sowing bucket (i.e. swath overlaps of 50%). The orientation of flight lines will be different for each application.

The aerial bait applications will be accompanied by hand-spread baits immediately inside the fence to ensure complete coverage, along with trapping, and ground-based bait stations where necessary. There is likely to be at least a 10 m buffer inside the fence boundary where aerial bait application will not be targeted to minimise the bait that falls outside of the fence. A follow-up on-the-ground hand operation will occur to a) hand-sow baits along the inside boundary of the fence where aerial bait application did not achieve the required application rate, and b) to collect bait that landed on the outside of the fence.

3.6.4 Trapping grids

A trapping grid (left unset) will be established within the fenced areas prior to the bait application occurring. This grid will serve two purposes: firstly, to help with the eradication efforts by targeting any survivors of the aerial control, and secondly, to provide for a permanent control infrastructure which can be left in place for monitoring and incursion response purposes. This trapping grid will be set on lines 100 m apart with a trap station every 50 m along these lines. Traps will also be placed every 75 m on the outside perimeter of the fence.

One month following the first application of bait, the trapping grid will be activated and run continuously until no target pests have been trapped for a period of six months, after which time the trapping effort will be reduced.

The trapping grid for rodents, mustelids and hedgehogs will use a variety of trap types to account for the phobic behaviour some individuals may have towards a certain trap type. This will include iDOC 200 and 250 traps in wooden tunnels (both run through and single set), new resetting traps with remote notifications (e.g. AT220, CSL Multi-trap), as well as live-capture traps. Possums and feral cats will be targeted by live-capture and kill-traps (e.g. Flipping Timmy traps or CSL Multi-traps for cats and possums, AT220 and Trapinators for possums only). Leg-hold traps (e.g. Victor 1½ hard jaw traps) may be deployed by contractors should these be considered suitable for use on site. Some traps are capable of capturing the full range of target species including mice (e.g. CSL Multi-trap); however, mice are too small to trigger the DOC and AT220 style traps in which case an additional mouse-specific trap should be set.

A permanent trapping network will also be placed outside the fence (see Section 3.5.6).

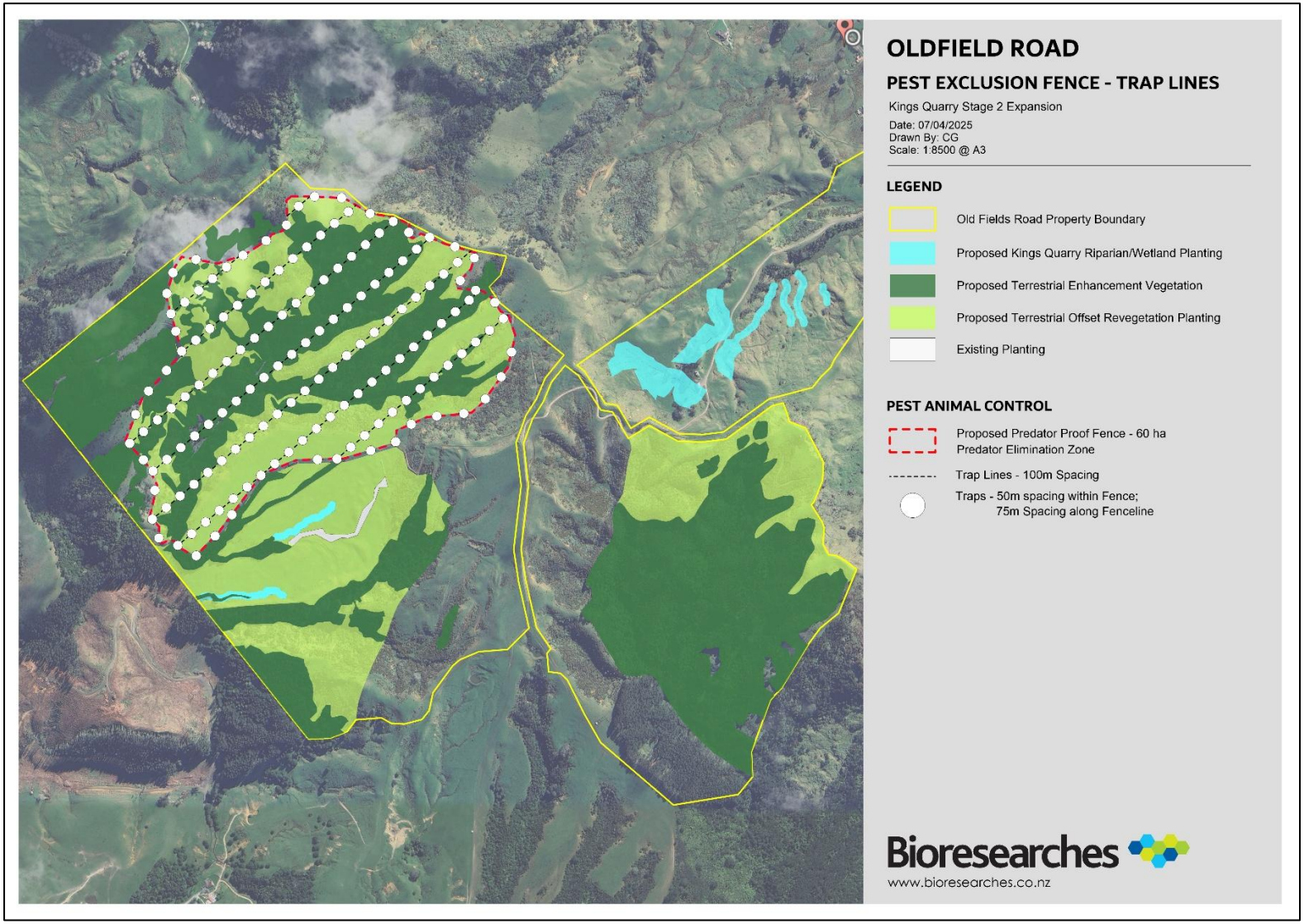


Figure 12: Approximate eradication network: pest exclusion fence.

3.6.5 Mop-up phase

In the mop-up phase, eradication survivors will be detected via an intensive monitoring regime, including via chew cards (for rats and possums), tracking tunnels (for rats, mice, and hedgehogs), and camera traps (for rodents, possums, mustelids, cats, and ungulates).

Cats, possums and rabbits will be shot during spotlighting operations. Thermal scopes will be used to better locate any survivors. Trained predator detection dogs will also be required in follow up work to assist in detecting the presence of surviving pests.

Within two weeks after the second application of bait, a programme targeting surviving rabbits will commence.

Detection of any remaining pests will initiate a targeted response. The removal techniques used will depend on the species and will be selected from a wide repertoire of options depending on the species, the location/habitat type, and the other methods previously utilised. Options include live-capture traps, intensive trapping, toxic bait pulses at a high device density, shooting (including using thermal scopes), and pest detection dogs. For example, each time a mouse or rat is detected, alternating rat traps (or mouse traps in tracking tunnels), and brodifacoum bait in bait stations, will be placed in a 25 × 50 m grid covering a 200 × 200 m area around the location of the detection, as per the methods of Watts et al (2022).

3.6.6 Ongoing maintenance, surveillance, and detection post eradication

For most existing ring sanctuaries (i.e. not peninsula sanctuaries where predators may swim or walk around the ends at low tide), the main cause of incursion is through fence damage, such as due to wear and tear causing a wire to break forming a hole, or following a storm that may cause the grates on waterways to be blocked or a tree to fall on top of the fence (Bell, 2014).

With this in mind, the fence should be inspected weekly and following any events that may cause damage to the fence or surrounding vegetation (e.g. storms, heavy rain, and/or high winds), with an intensive check every month (as per Maungatautari; Bell, 2014). An automatic, instantaneous alert system will also be fitted to the fence that will provide alerts if the fence experiences a major breach, such as a tree falling on top of the fence or a stream gate held open (similar to that used around Maungatautari Sanctuary Mountain).

A permanent trap network will be maintained outside the fence (see Figure 12). Traps along the outside of the fence are effective as many of the target species are likely to encounter the fence as they move through the landscape and then move along it, effectively funnelling them towards the deployed traps. These are to be checked weekly year-round (in line with weekly fence checks). If a remote notification system is used on these traps, this checking interval can be reduced. Lures will also be replaced weekly (unless a long-life lure or dispensing system is used).

Automated surveillance and detection tools (e.g. thermal cameras with real-time notifications) will be employed inside the fence to provide instant notifications and alerts of pest breaches. In addition, conventional pest monitoring will occur quarterly, and further monitoring and control infrastructure will be deployed inside the fence following any breach or suspected incursion.

Following eradications, approximately two years of monitoring without pest detections is required to declare an eradication successful. This gives time for any remaining pests including

mice at least two breeding seasons to breed up to a level where they are likely to be detected, if present.

3.6.7 Targets and Thresholds in Elimination Area

The target pest densities within the Exclusion Area are 0% (Table 11). If at any stage a reinvasion or survivor is detected the Incursion Response Plan will be initiated (see following section).

Table 11: Pest targets and thresholds within the Exclusion Fenced area at Oldfields Rd.

Pest Species	Management Target	Threshold	Monitoring frequency
Mammalian Pest Exclusion Area			
All (rats, mice, weasels, stoats, ferrets, possums, cats, hedgehogs, rabbits, hares, goats, pigs, and deer)	All target species: 0% density	Any detection initiate control	Ongoing via advanced surveillance tools and cameras. Four times per year using a range of detection devices including but not limited to trail cameras, waxtags, chew cards, tracking tunnels, kill and live capture traps. Monitoring must also occur immediately following events that could cause a breech, and following any suspected incursion.

3.6.8 Incursion response

An Incursion Response Plan will be developed following the completion of the pest exclusion fence. The response plan will contain the names and contact details of the key personnel to be alerted following a breach or suspected breach, where all the equipment is located, and the steps to follow. A copy of the response plan will be kept on site.

A breach may be detected during routine pest monitoring inside the fence (e.g. on camera or on chew cards), or through the observation of any sign of target pests (e.g. prints or scat). A suspected breach may occur if the fence is damaged (e.g. following a storm, tree fall, or blocked water gate).

The Incursion Response Plan will be based on the following steps:

1. **Ensure all key personnel are alerted and initiate these response protocols.**
2. **Determine the target pest(s) present, the number of individuals, and their approximate location within the fenced area.** This may involve deploying cameras, chew cards, live capture traps, and AI technology (e.g. AI traps, smart AI cameras, once available)

throughout the fenced area. Species-specific detector dogs may also be used to locate and kill the invading target individual(s).

3. **Determine the location of breach/pathway of entry, and immediately fix any breaches in the fence (simultaneously with Step 2).** This will involve a detailed inspection of the fence, including all access gates and water gates, proximity of surrounding trees to the fence (e.g. overhanging branches or fallen trees), potential burrows or erosion around the base of the fence, holes in the fence mesh, and any damage to the top wire and hood of the fence. The automated alert system will also be reviewed for locations of any breaches.
4. **Deploy a variety of control tools, appropriate to the target species and the number of individuals suspected to be present.** Ongoing monitoring (initiated in Step 1) will help pinpoint effective locations for control efforts. Live-capture traps (and lures) will be checked daily, and kill traps (and lures) will be checked every 3 days. All traps will be GPS recorded, and robust data management and recording practices will be implemented. Control devices/techniques may include:
    - Rats – Live capture traps, appropriate kill traps, rodent detection dogs, localised toxic control.
    - Mice – Mouse traps at very high density (e.g. a 10 x 10 m grid) within a localised area (defined based on monitoring results), and lured with a range of lure types). Toxic control if appropriate (noting substantial monitoring efforts will be required to determine if the target individual is still present).
    - Possums – Live capture traps, appropriate kill traps, possum detection dogs, night shooting (spotlighting).
    - Hedgehogs – Live capture traps, kill traps (DOC250s).
    - Mustelids – Live capture traps, kill traps (with a wide variety of lure types), mustelid detection dogs.
    - Feral cats – Live capture traps, kill traps (e.g. SA2 Kat traps, SA Coni Traps, Timms traps), night shooting.
    - Ungulates – Shooting.
    - Rabbits/Hares – Night shooting operations (spotlighting).
5. **Monitor to ensure all invading individuals have been eliminated.** Monitor for up to one month once all individuals are believed to have been eliminated (e.g. confirmed via carcasses in traps or following shooting) and no further sign has been observed. Monitor for at least three months if toxic methods have been used (i.e. 3 months since the last known sign was observed).
6. **Report the results, and any lessons learned** (i.e. the cause of the breach, what was successful and unsuccessful, and any improvements to pest management practices).

Once an incursion has been detected or is suspected, these steps and an on-the-ground response should be initiated within 48 hours. Sufficient control tools, equipment and personnel resources must be in place to allow a rapid response (e.g. unset traps and monitoring equipment

either deployed inside the fence or in storage nearby, and contacts for suitably qualified contractors or personnel capable of conducting shooting operations).

3.7 Pest suppression area

3.7.1 Overview

Pest suppression will occur in the planting and enhancement areas (see Figure 7), to reduce the impacts of browsers and to create a partial 'buffer' of protection for the fenced area. Pests to be suppressed within this area will be rats, possums, rabbits, mustelids and ungulates (pigs and goats). Reducing pests in this area will also help to create a network of pest-free vegetation corridors to further support native birds, and will enhance the spill-over benefits provided by the exclusion fenced area. Methods outlined in this section are only for the pest suppression area. Methods for the exclusion fenced area are provided in the previous sections.

3.7.2 Control methods – kill traps

A kill-trap, by definition, must kill the target animal and do so quickly and consistently. Traps that have passed testing under the guidelines laid out by the National Animal Welfare Advisory Committee (NAWAC) are considered to be humane for that species. An up-to-date list of traps that have been tested under NAWAC guidelines and either passed or failed can be obtained from https://www.bionet.nz/rules/performance-traps.

Rats, mustelids, hedgehogs, possums, and feral cats can all be effectively controlled by trapping if appropriate trap type, spacing and lures are used. A mixture of trap types for each species is generally the best approach as individual animals will respond differently to different trap types and there will always be some animals that will avoid one trap type but may go into another.

Multiple new traps have been developed recently, or are currently under development, including AI self-resetting kill traps. Resetting kill traps offer multiple benefits, including offering constant control between services and reducing the amount of servicing required (decreasing costs and reducing any target avoidance of traps due to human scent left during frequent servicing). AI-triggered traps also allow for a more open trap housing to overcome neophobia of target species, and thus potentially increasing trap rates while nearly eliminating risk to non-target species.

Table 12 outlines kill traps which are recommended for each target species, and it is recommended that traps are selected from this list. Figure 12 shows the approximate location and spacing of the trap and bait station network. However, each trap location will need to be micro-placed upon deployment (i.e. refined on a fine scale within several metres in the field, based on the broad-scale locations in Figure 12). This ensures each trap is placed within suitable micro-habitat for the target species to maximise capture success.

Most of the target predators are attracted to cover, so traps should be placed under cover, such as under trees or shrubs. The trap entrance needs to remain clear, so any vegetation around it needs to be cleared. Rats and mustelids also tend to move along waterways and linear features such along habitat boundaries, tracks, and fence lines.

Table 12. Summary of control tools and spacing for each target species at the Oldfields Road site for suppression purposes. These tools should be updated as new technology becomes commercially available.

Target species	Suitable approved traps	Suitable approved toxins	Recommended spacing
Rats (ship and Norway)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro CSL Multi-trap* AT220* (NAWAC approved for ship rats only)	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines (excluding pasture areas)
Possums	SA2 Kat trap Flipping Timmy AT220 CSL Multi-trap	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Based on a grid pattern with lines 100 m apart and a trap & bait station set at 100 m intervals along these lines (excluding pasture areas).
Mustelids	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Mustelid-capable traps at 200 m intervals on the grid.
Rabbits	n/a	Pindone	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evident

*Denotes a resetting trap (as opposed to a single-set trap).

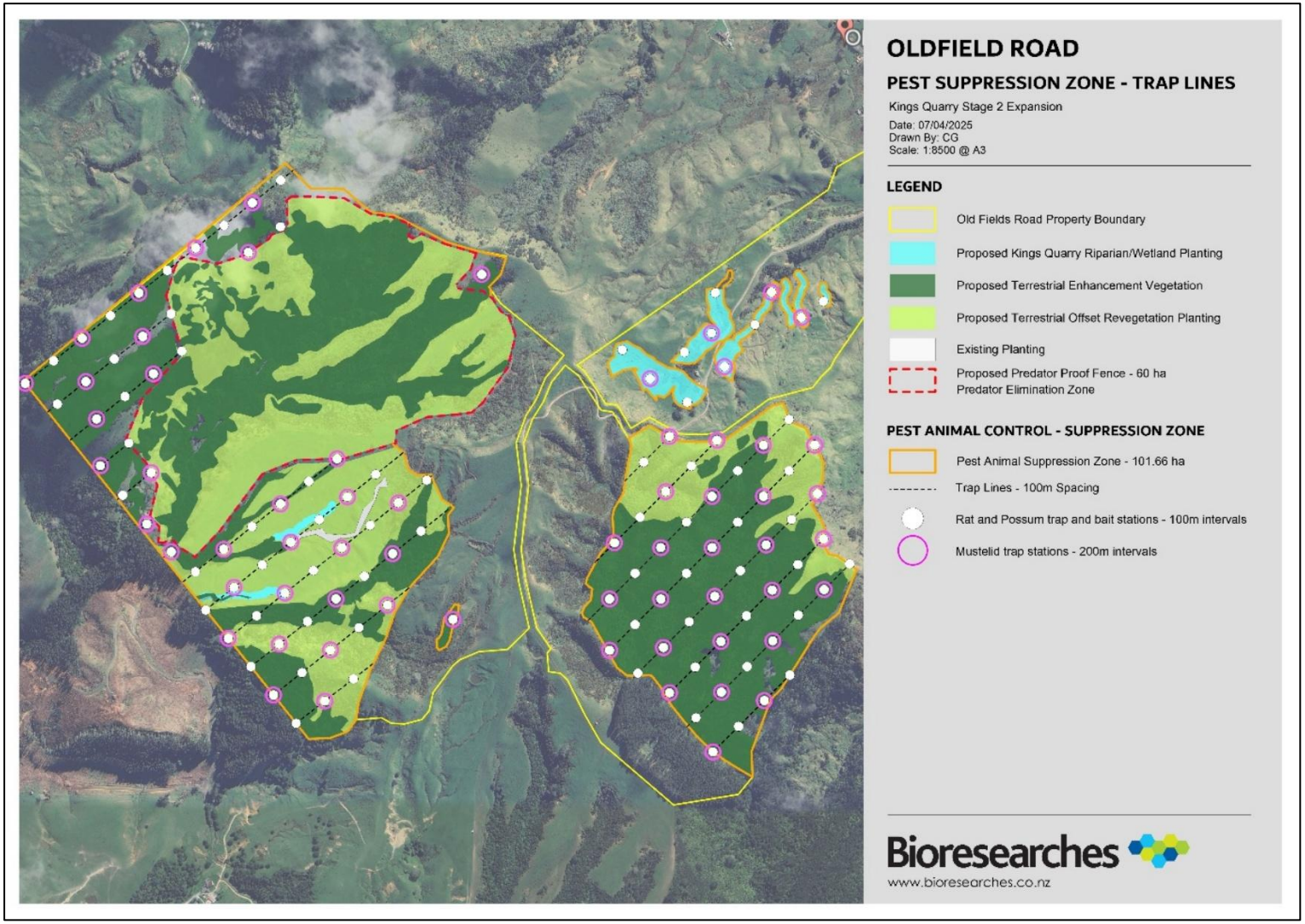


Figure 13. Map showing location of pest control in the pest suppression zone outside of the predator elimination fence.

3.7.3 Control methods – toxins

A permanent bait station network will be established across the suppression area, targeting rodents and possums, and supplemented by the permanent trap network. Recommended bait station locations are described alongside the trap spacings in Table 12 and Figure 12. Baiting for rats and possums should adhere to the following specifications:

- To continue to suppress the resident rodent and possum population, both of these species will be targeted using tree-mounted Philproof bait stations containing either DoubleTap (diphacinone and cholecalciferol) or cholecalciferol. Neither of these toxins require a Controlled Substance License to use, and both are low residue and are effective for these target species. Cholecalciferol, where used, will require pre-feeding for best effect.
- Each toxic control operation should last until bait take has ceased (not including any pre-feeding, if required). After toxic bait is deployed on day 1, the amounts of bait in each bait station should be checked between days 6 - 10 (as per label instructions), and topped up if required (cholecalciferol operations may require more frequent top-ups if bait take is high to ensure target animals are able to ingest a lethal dose). Bait should then be checked and refilled (if required), after another 3 – 4 weeks. After each toxic control operation has ceased, all remaining bait will need to be brought in to reduce the risk to non-target species and the risk of target species receiving a sub-lethal dose and becoming bait-shy. If mice, rat or possum numbers exceed the thresholds outlined in Table 14, an additional toxic control operation will need to be conducted.

For rabbit control in areas where planting is occurring, pindone baits in bait stations should be used as per the following protocol:

- Apply bait (in bait stations) in all areas where rabbit signs are found. Avoid long grass and scrub. Provide sufficient bait to allow rabbits to feed over two or three nights.
- If all the bait is gone after the first night, more needs to be provided. In this instance, a second application of bait will be required four days after initial baiting to ensure all rabbits receive a lethal dose.

3.7.4 Control frequency & timing

Trapping and baiting should occur year-round across the Oldfields Road PMA for suppression purposes. However, the frequency of trap checks and baiting varies depending on trap type and the time of year.

- In the first year, a toxic operation should occur three times: in August, December, and end March/early April (~4 months apart), see Table 13. This timing aims to knock down target populations before and during the main native fauna breeding season, and to further reduce population numbers of survivors before winter (offering the maximum

biodiversity benefits for the required effort). An initial knock-down operation helps to suppress pest numbers in subsequent years, when effort may be able to be reduced.

- In all subsequent years, toxic control operations will occur twice per year in spring and autumn. This timing aims to suppress target populations before (or early in) the main native fauna breeding season, whilst reducing the burden of toxins on the environment.
- Trapping is to be undertaken between toxic operations to continue to suppress pest populations. Any single-set kill traps should be checked once per month year round. Any self-resetting kill-traps need to be checked at least once every two months year-round to ensure the trap is still functional, replace the lure/battery (if required), record the number of kills on the counter (if used), and collect and dispose of any carcases in the vicinity. Many of the newer trap designs remotely report to the user the battery level, remaining lure, number of target kills and undertake of a self-check on functionality. If this communication is received, traps can be serviced as identified or at a minimum every two months.
- For pindone operations, bait should be used when rabbit sign is evident (i.e. via sign of plant browse, burrows and scat).
- Goat and pig control should be conducted if they are noted on site (either directly or via sign), and at a minimum three times per year.

3.7.5 Pest animal monitoring

Ongoing monitoring and adaptive responses are key to effective predator management. Well-established monitoring tools will be used to monitor pest presence and assess their densities against the intended targets (see Section 4). Further control will be initiated if particular thresholds are exceeded.

3.7.6 Chew cards

For rodents and possums, chew cards are a common, cost-effective, and sensitive detection and monitoring tool suitable for providing a coarse index of relative abundance of a range of pests, including rats, mice, and possums. Protocols for the use of chew cards (as per National Pest Control Agencies, 2015), will be followed including:

- Chew card lines will contain 10 chew cards spaced 20 m apart (i.e. along 180 m-long lines), as per best practice for possums (National Pest Control Agencies, 2015).
- The same chew card lines are to be used year to year to enable trend monitoring and comparisons. However, lines may be repositioned in future if, for example, access becomes difficult.
- Chew card monitors (of three nights each) will be repeated four times per year (simultaneously with camera trap surveys): in February, May, August, and November. The three-night monitoring period is as recommended by Ruffell et al. (2015) for monitoring both

rats and possums, and also matches the best practice monitoring for possums (National Pest Control Agencies, 2015).

- Any bite marks recorded on the chew cards need to be identified to species level and CCI calculated to gain an estimate of relative population abundance for each target species.

3.7.7 Proposed pest control and monitoring schedule

A summary of the pest control and monitoring is provided in Table 13, below. Rabbit control is excluded as that should be undertaken as and when rabbit sign is identified.

***Table 13. Summary of timings of pest animal control and monitoring operations detailed in this plan for pest suppression.* NOTE: If pest animal thresholds are exceeded, further control will occur in addition to this schedule.**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Control operations												
Single-set kill trap checks servicing	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly
Resetting kill trap servicing*	x		x		x		x		x		x	
Toxic operation (Yr 1)			x					x				x
Toxic operation (Yrs 2+)			x						x			
Monitoring												
Chew card monitor		x			x			x			x	

*If resetting traps have remote communications fitted, then this servicing interval can be adjusted based on trap information received.

3.7.8 Proposed control targets

Management targets in pest control relate to the "maximum allowable residual pest abundance targets" which allow native species to recover (Brown et al., 2015). That is, the management target for each species is the ideal goal that the control actions aim to achieve. The proposed management targets for rodents, possums, cats and mustelids, as well as the thresholds for initiating additional control measures, are based on the Chew Card Index (CCI) or camera trapping index (CH) for each target species. If monitoring identifies that the targets are not met (on any single monitor), this will trigger a requirement for further control (such as an additional toxin pulse or trap check).

Pig and goat control should be undertaken if these species (or their impacts) are observed within the pest suppression area.

***Table 14: Pest management targets and thresholds for proposed pest* suppression area at Oldfields Rd. CCI is a chew-card index.**

Pest Species	Management Target	Threshold	Monitoring frequency
Rats	<10% CCI	>15% CCI	Four monitors per year in February, May, August, and November
Possums	<5% CCI	≥10% CCI	
Rabbits	Initiate control if observed	Any observation (incl. sign)	
Pigs and goats	Initiate control if observed	Any observation (incl. sign)	

3.8 Data management & reporting

For both the pest suppression and elimination areas, all control data (including both trapping and toxic control), and all monitoring data need to be entered into a single, cohesive data management system as soon after field work as possible. TrapNZ is the recommended platform, as it is widely used across New Zealand, user friendly, and can record spatial distribution of traps and catches.

The data management system needs to be set up as soon as possible. The GPS waypoints of all ground-truthed traps and their type need to be entered into the system. This includes traps that are either pre-existing or those deployed as per this plan.

All contractors and other persons undertaking pest control need to record all trapping data on the selected system. Each person/group that needs to access the system, will need an account and be instructed on how to enter the required information correctly.

For each trap check, all data needs to be accurate and complete, as per the minimum information to be recorded below:

- Date of servicing;
- Name of the trap/toxin servicer;
- Device location, unique identifier, model type and model name;
- Lure type and whether the lure was refreshed;
- Whether the trap has been triggered (trap status);
- Trap catch (species); and if possible/relevant: sex and age of individual, number of individuals, or record trap catch as zero if nothing is caught;
- Bait type and quantity deployed (for bait stations); and
- General comments (e.g. if trap needs fixing or replacing, if bait is gone).

Maintaining accurate and precise records of both pest control and pest monitoring are crucial to evaluate the success of predator control at each site. Spatial and temporal trends in pest populations and catch rates can be identified in the analysis of this data, which can then inform future pest management decisions.

An annual pest management report will be prepared and provided to Auckland Council. Each annual report (submitted by end of June each year) needs to include:

- A summary of all pest control activities undertaken in the preceding 12 months, detailing dates, and methods of each control activity:
- Maps of control devices/area, labelled by type;
- Summaries of trap catch statistics by species (both target and any non-target catch), including by trap type, trap location, lure type as well as CCI and CCH of rats, possums, and mustelids, with comparison to management targets and thresholds for additional control;
- Summaries of results of toxic control operations, including target species, bait type and bait take;
- Any trends in the data, such as high-catch/high bait-take locations, the main species caught and comparisons to previous years; and
- Any challenges/issues encountered in undertaking control or monitoring, and how these

difficulties were overcome or if they remain ongoing.

Pest control tools, technologies, and methods are evolving at a rapid rate, with many new tools coming into the market. These new tools will greatly enhance the efficiency of predator control regimes. A review of emerging pest management tools and technology should be undertaken annually. Any new tools should be incorporated into the following years' pest management practice if suitable. The tools recommended for use in this plan are based on those currently available at the time of writing. However, they should be supplemented or replaced with improved tools with proven efficacy as those come to market, where there is benefit in doing so.

4 TERRESTRIAL OFFSET BIODIVERSITY OUTCOME MONITORING PLAN

Monitoring residual effects biodiversity compensation actions is critical to determining overall success, and ultimately, whether a biodiversity net gain is achieved. Should stated offset/compensation outcomes fall short at any point in the monitoring process, then contingency actions are provided here to counterbalance those shortfalls.

Compensation outcomes would be measured annually at the compensation sites. The purpose of the monitoring is to:

1. Track the progress of identified biodiversity indicators and the response to proposed offset/compensation measures. This includes an intensive baseline monitoring programme prior to commencement of offset/compensation actions .
2. Provide feedback with recommendations for any additional management required to ensure the offset performs to targets.
3. Identify any requirements for contingency actions early, where any shortfalls could affect offset outcomes.
4. Provide a monitoring report, following each monitoring occasion, to demonstrate that the offset is developing as expected and is being appropriately managed and maintained.
5. Provide a final biodiversity outcome report at 20 years that demonstrates that the biodiversity offset and compensation actions met their specified targets.

4.1 Monitoring Targets and Contingencies

Monitoring targets are provided in Table 15 and Table 16. While ultimate success for within the pest-proof fence will be determined at 12 years and revegetation at 20 years, the targets provide an indication of expected values for attributes at each 5-yearly intervals with the gradual development and maturation of the offset vegetation. Failure to meet biodiversity indicator targets prior to 12 or 20 years may not necessarily result in failure of the offset/compensation, however monitoring outcomes that result in values that are short of the targets would inform adaptive management actions, such as additional planting, provision of fertilisers, or wind protection.

This section addresses monitoring targets and contingencies as modelled for each BOAM.

Table 15. Monitoring targets for revegetation offset planting. Targets are for basal area, as measured by DBH, only for those species that will achieve a final DBH of >10 cm at 20 years (see the TEREAR for further details. Targets prior to offset outcome (20 years) are indicative only and should prompt management response.

Biodiversity attribute	Offset action	5 years	10 years	15 years	20 years
Kānuka Forest (VS2) basal area (m^2/ha)	Revegetation	10.33	39.71	88.15	155.65
Broadleaved Species Scrub Forest (VS5) basal area (m^2/ha)	Revegetation	4.04	15.5	34.4	71.45
Kauri, Podocarp Broadleaved Forest (WF11) basal area (m^2/ha)	Revegetation	4.92	18.87	41.83	71.3

Table 16. Monitoring targets for revegetation planting and enhancement of existing vegetation for fauna values. Targets for fauna are modelled to be achieved at 10 years after fence completion and associated pest elimination.

Biodiversity attribute	Offset/compensation action	5 years	10 years
Bird diversity (species count)	Revegetation	3	9
Tui abundance (Average abundance as measure by mean per 5mbc)	Enhancement	1	2.4
Kereru abundance (Average abundance as measure by mean per 5mbc)	Enhancement	1	2.5

Table 17. Contingency table for revegetation values at offset/compensation sites. Attributes are managed either through revegetation or enhancement as indicated.

Biodiversity attribute and offset action	Required biodiversity value by endpoint (12 or 20 years)	Contingency if not met at endpoint years	Rationale for Contingency
Kānuka Forest (VS2) basal area (m^2/ha)	155.65	Adaptively manage. If expected 10-year target is not met investigate causes of slow canopy establishment and seek to remedy through manipulation of environmental factors such as improved plant nutrition, watering, or wind protection. Plant additional specimens of appropriate species if a particular species found not to be thriving. If 15-year target subsequently not met recalculate the model using known data and increase overall area of Kānuka Forest planting accordingly.	The establishment of canopy cover is crucial to the creation of suitable sheltered habitats for understorey and groundcover species. The manipulation of environmental factors or additional planting of hardy species may be necessary to creation of these habitats. If the timescale for the development of more sheltered habitats is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.
Broadleaved Species Scrub Forest (VS5) basal area (m^2/ha)	71.45	Adaptively manage. If expected 10-year target is not met investigate causes of slow canopy establishment and seek to remedy through manipulation of environmental factors such as improved plant nutrition, watering, or wind protection. Plant additional specimens of appropriate species if a particular species found not to be thriving. If 15-year target subsequently not met recalculate the model using known data and increase overall area of broadleaved species scrub Forest planting accordingly.	The establishment of canopy cover is crucial to the creation of suitable sheltered habitats for understorey and groundcover species. The manipulation of environmental factors or additional planting of hardy species may be necessary to creation of these habitats. If the timescale for the development of more sheltered habitats is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.
Kauri, Podocarp Broadleaved Forest (WF11) basal area (m^2/ha)	71.3	Adaptively manage. If expected 10-year target is not met investigate causes of slow canopy establishment and seek to remedy through manipulation of environmental factors such as improved plant nutrition, watering, or wind protection. Plant additional specimens of appropriate species if a particular species found not to be thriving. If 15-year target subsequently not met recalculate the model using known data and increase overall area of Kauri, Podocarp, Broadleaved Forest planting accordingly.	The establishment of canopy cover is crucial to the creation of suitable sheltered habitats for understorey and groundcover species. The manipulation of environmental factors or additional planting of hardy species may be necessary to creation of these habitats. If the timescale for the development of more sheltered habitats is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.
Bird diversity (species count)	9	Adaptively manage. If expected 8-year target is not met investigate causes of low diversity. Plant additional specimens of appropriate species that are known to be suitable food sources/nesting habitat for absent species. If 12-year target subsequently not met recalculate the model using known data and increase overall area of planting accordingly.	The establishment of forest habitat, including sufficient food sources, pest control and nesting locations is crucial for attracting indigenous forest bird species. The manipulation of planting regimes or additional planting of hardy species may be necessary to creation of these habitats. If the timescale for the development is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.

Tui abundance (Average abundance as measure by mean per 5mbc)	2.4	Adaptively manage. If expected 8-year target is not met investigate causes of low Tui abundance. Should complete eradication of predators within the pest-proof fence be insufficient to increase Tui abundance, it may be necessary to plant additional specimens of appropriate species that are known to be suitable food sources/nesting habitat for Tui both inside and outside the fence. If 12-year target subsequently not met recalculate the model using known data and increase overall area of planting or pest control accordingly.	The establishment of forest habitat, including sufficient food sources, pest control and nesting locations is crucial for attracting indigenous forest bird species. Pest eradication should see a rapid increase in Tui abundance. If not, the manipulation of planting regimes or additional planting of hardy species may be necessary to create additional food sources and suitable habitat. If the timescale for the development is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.
Kereru abundance (Average abundance as measure by mean per 5mbc)	2.5	Adaptively manage. If expected 8-year target is not met investigate causes of low Kereru abundance. Should complete eradication of predators within the pest-proof fence be insufficient to increase Kereru abundance, it may be necessary to plant additional specimens of appropriate species that are known to be suitable food sources/nesting habitat for Kereru both inside and outside the fence. If 12-year target subsequently not met recalculate the model using known data and increase overall area of planting or pest control accordingly.	The establishment of forest habitat, including sufficient food sources, pest control and nesting locations is crucial for attracting indigenous forest bird species. Pest eradication should see a rapid increase in Kereru abundance. If not, the manipulation of planting regimes or additional planting of hardy species may be necessary to create additional food sources and suitable habitat. If the timescale for the development is found to be longer than expected, additional revegetation area is required to offset this greater than expected time lag.

4.2 Monitoring methods

Monitoring will be undertaken annually for the first five years, followed by two yearly monitoring thereafter. A detailed quarterly report will be prepared at Years 5, 10, 15, & 20, assessing the progress of the revegetation planting against the biodiversity offset targets and BOAMs. These reports must identify any major contingencies that need to be implemented such as remodelling of any biodiversity attributes in response to actual results or adjustment of timescales and adaptive management. As planting will be undertaken over a ~12 year period, the required annual and 5 year monitoring will be based on the dates that planting was undertaken, resulting in overlapping monitoring requirements. A schedule of monitoring is provided in Appendix B, Table 26 for each of the revegetation blocks, assuming ~5 ha of planting will occur each year.

4.2.1 Monitoring of establishment phase: Years 1 - 5.

4.2.1.1 Revegetation

Planting completion

At the completion of the planting in each identified planting area a planting completion report should be prepared by a suitably qualified person verifying that planting has been completed in accordance with the detailed restoration planting plan for the area.

Annual monitoring

Annual monitoring in the first 5 years for each planting area should include the following assessment parameters at a minimum:

- Plant survival and growth.
- Note any species or specific areas that are performing poorly.
- Weed presence and effectiveness of pest plant control.
- Effectiveness of pest control.
- Plant species density and diversity.
- Canopy closure.
- Tui and Kereru abundance, and overall species diversity (Five-minute bird counts).

Monitoring reports should identify any adaptive management required in the coming year to ensure each planting area develops in line with the BOAM and the detailed restoration planting plan for that biodiversity type.

Five-year establishment report

At the end of Year 5, 20 x 20m permanent plots must be established in each biodiversity type revegetation area and measurement of the parameters set out in Table 18 undertaken. An Establishment Report is to be prepared setting out the results of the plot measurements at year 5 and assessing whether the revegetation area has the appropriate species diversity and structural characteristics to enable it to meet the modelled targets and adhere to the detailed restoration

planting plan. Any major adaptive management actions, contingencies or adjustments to the model should be identified at this time and appropriate action taken.

4.2.1.2 Enrichment planting and weed control

In addition to planting and weed control requirements for revegetation, enrichment planting and weed control will be undertaken to improve the ecological value and integrity of existing vegetation at the Oldfield Road site. This will be undertaken both within and outside the predator-proof fence. Enrichment planting will be undertaken within existing VS2 and VS5 forest, by planting canopy species, to help accelerate forest recovery. Weed control will be undertaken as needed, particularly around forest margins where extensive areas of gorse and woolly nightshade are established. Further details about this process are provided within the revegetation and enrichment planting plan (Section 2).

4.2.1.3 Predator-proof fence

The predator-proof fence and pest eradication within it should be completed by the end of year 2. Once pest animal species are eradicated, the necessary monitoring should be ongoing to ensure structural integrity of the fence and no other means of access by pest animals is possible (e.g. overhanging vegetation). Ongoing monitoring of pest presence is also required to ensure that any incursions are rapidly detected and controlled prior to establishment of new pest populations. Details about these methods are provided in Section 2.8.1.3.

4.2.1.4 Pest control outside the predator proof fence

Pest control of browser species only (e.g. possums, pigs, goats and deer) will be undertaken within the existing vegetation at Old Field Road (Figure 3). Pest animal control methods would follow current industry best practice, and Auckland Council's "*Pest animal control guidelines for the Auckland region*"[3] provides a suitable guidance document. The details for the quantity, frequency and methodology of pest control are described in Section 2.8.1.3

4.2.2 Long term Monitoring Years 5 – 20

Annual monitoring of each planting area and enhancement area will be undertaken over the first five years, then at years 10, 15 and 20 at the established permanent plots. In addition to the collection of the data as set out in Section 4.2.2.1 and 4.2.2.2, photo points must be established at each plot to provide a visual record of progress

The 10-year and 20-year reports must detail whether the modelled targets of the BOAMs have been reached and where targets have not been reached, whether further biodiversity offset actions are required to ensure a net biodiversity gain is achieved and the success of the model.

[3] https://www.tiakitamakimakaurau.nz/media/v1wpc30z/pag-2-0-for-web-july-22.pdf

4.2.2.1 Data collection sites

- Plot locations should be representative of the average condition of the total area of re-vegetation and should aim to provide wide spatial coverage where offset monitoring requires multiple plots.
- Plot locations should be permanently marked, and data collection repeated at the same locations in every monitoring year.

Monitoring data will be collected from revegetation and enhancement sites within 14 standard 20 x 20 m RECCE plots at the following general locations at the Old Field Road offset site:

1. Within predator-proof fence
    a. Revegetation areas
        i. 1 plot in replanted Kānuka Scrub/Forest (VS2)
        ii. 1 plot in replanted regenerating broadleaved scrub/forest (VS5)
        iii. 1 plot in replanted Kauri, podocarp, broadleaved forest (WF11)
    b. Enhancement areas
        i. 2 plots in existing Kānuka Scrub/Forest (VS2)
        ii. 2 plots in existing regenerating broadleaved scrub/forest (VS5)
2. Outside predator-proof fence
    a. Revegetation areas
        i. 1 plot in replanted Kānuka Scrub/Forest (VS2)
        ii. 1 plot in replanted regenerating broadleaved scrub/forest (VS5)
        iii. 1 plot in replanted Kauri, podocarp, broadleaved forest (WF11)
    b. Enhancement areas
        i. 2 plots in existing Kānuka Scrub/Forest (VS2)
        ii. 2 plots in existing regenerating broadleaved scrub/forest (VS5)

Monitoring of bird abundance should be undertaken at fixed locations both within the enhancement and revegetation sites, inside and outside the predator proof fence. Sites should be distributed to account for changes in abundance within each ecosystem type (VS2 and VS5) as well as each of the revegetation ecosystem types (VS2, VS5, and WF11). Permanent count station locations should be established that are spaced at a minimum of 200 m apart. The maximum available number of bird count stations should be used to improve statistical robustness.

Pest control eradication within the predator-proof fence, and outcomes of control actions for pest browser species across the enhancement areas will be monitored as part of the overall predator management plan for the area.

4.2.2.2 Data collection

The following data collection methods should be used.

Table 18. Measurement of biodiversity attributes for revegetation areas: VS2, VS5, and WF11 for Years 5 – 20.

Biodiversity attribute	Plot Collection method

Indigenous Canopy cover (%)	Standard RECCE method
Indigenous subcanopy cover (%)	Standard RECCE method
Indigenous understorey cover (%)	Standard RECCE method
Indigenous ground cover (%)	Standard RECCE method
Total native vascular plant species richness	Standard RECCE method
Native ground cover species richness	Standard RECCE method
Basal area >10 cm diameter (m^2 /ha)	Standard RECCE method
Mean canopy height	Standard RECCE method
Tui abundance	Standard five-minute bird count
Kereru Abundance	Standard five-minute bird count
Forest bird species diversity	Standard five-minute bird count

5 OLDFIELD AND HELLYER ROAD STREAM AND WETLAND ENHANCEMENT RESTORATION PLANTING PLAN

5.1 Introduction

The expansion of Kings Quarry into the Stage 2 pit and fill areas will require the removal of 2,439 linear metres of stream length. Streams within the Stage 2 site are classified as intermittent, modified intermittent and permanent streams (Bioresearches, 2025b). The Assessment of Ecological Effects identified that the reclamation of the streams would represent a 'very high' level of effect (Bioresearches, 2023c), and these significant residual adverse effects would require biodiversity offset and compensation.

The loss of stream values from the Stage 2 Kings Quarry footprint will be partially offset through the restoration of streams at Oldfield Road and Hellyer Road. It is proposed to carry out a total of 2,893 linear metres of stream restoration through riparian planting (10 metres on each stream bank) and the removal of barriers to fish passage (Bioresearches, 2025c). Potential Stream Ecological Valuation (SEV) scores for the offset streams have been calculated (Bioresearches, 2025c) and provided in Table 19. As the loss of stream length cannot be fully offset, additional compensation via wetland planting and a 20 m buffer is proposed to be undertaken at Oldfield Road.

Table 19: Stream loss and offset and compensation actions across Oldfield Road and Hellyer Road

Stream Loss	**Length (m)**		
Kings Quarry Stage 2 Streams	2,439		
Stream Offset	**Length (m)**	**Potential SEV Scores**	**Planting (m^2)**
Stream Offset – Oldfield Road	629	0.74; 0.74	19,734
Stream Offset – Hellyer Road	2,264	0.74; 0.72; 0.70	43,497
Total Riparian:	**2,893**		**63,231**
Wetland Compensation – Oldfield Road	**Area (m^2)**		**Planting (m^2)**
Wetland 1	5,850		18,708
Wetland 2	570		20,822
Total Oldfield Road Wetlands:	6,420		**39,530**

Biodiversity gains at the offset site would be achieved through the enhancement of the existing habitat to improve its condition; by fencing the area from stock; and ongoing weed control of the restoration plantings. Culvert replacement at offset and restoration sites is to be in accordance with In accordance with NES-F requirements for fish passage.

The restoration planting provides aquatic ecological benefits provided by replacing pasture grass and/or weed species with native shrubs and trees in the riparian zone (providing temperature control and reduction of nuisance growth of aquatic vegetation through shading); woody debris in the stream (increasing habitat and refuges for invertebrates and fish); stabilisation of channel banks and channel shape; and reduction of nutrient and sediment inputs into the streams.

This plan has been written based on the framework provided in Appendix 16 of the Auckland Unitary Plan (AUP): Guideline for native revegetation plantings, and Auckland Council's Te Haumanu Taiao restoration guidance document.

The restoration planting outlined in this plan is required to be implemented within three (3) planting seasons following the commencement of stream works at the Stage 2 Kings Quarry impact site.

The following sections of this Plan address:

5. Weed removal and management;
6. Planting schedules;
7. Planting methodology; and
8. Maintenance requirements.

Planting is required to be protected in perpetuity via covenant.

5.2 Planting and Restoration Areas

The following descriptions of offset and compensation sites at Oldfield and Hellyer Road have been adapted from the Bioresearches (2025b) Freshwater Offset and Compensation Report.

Photo 5. Typical wetland habitat on Old Field Road to be restored under freshwater compensation

Photo 6. Typical riparian yard habitat on Old Field Road to be restored under freshwater offset.

Photo 7. Typical upstream (left) and downstream (right) riparian yard habitat at Hellyer Road to be restored under freshwater offset.

5.2.1 147 Oldfield Road

The 147 Oldfield Road site is located approximately 27 km North of Kings Quarry. The property is currently vegetated with a mosaic of grazed pasture, regenerating native broadleaved scrub (VS5) and kānuka scrub forest (VS2), as well as kauri, podocarp, broadleaved forest (WF11).

At present, stream habitats are located within active farmland and evidence of stock within freshwater habitats is present. The terrain is topographically similar to the Kings Quarry Stage 2 impact site, occurring 80-190 m above sea level (in comparison to 70-170m for Kings Quarry), and with steep and hilly terrain creating a greater proportion of intermittent headwater streams.

A total of 629 linear metres of stream length will be riparian planted at Oldfield Road. Potential SEV scores of the identified stream lengths, following restoration, are 0.74.

In addition, wetland habitat occurs within the property. Two wetlands are proposed to be planted with native species, as well as buffer planted with 20 metres of planting.

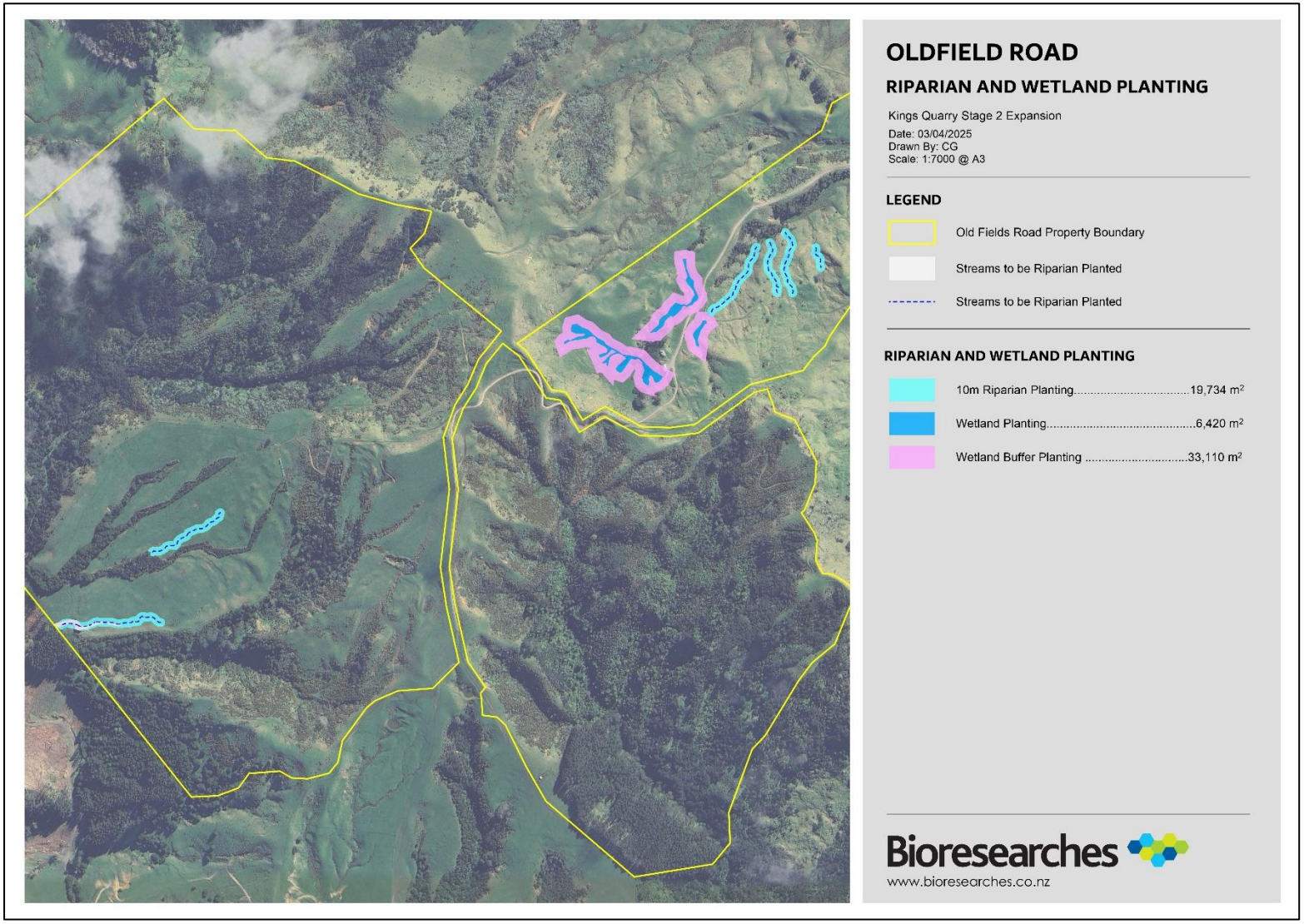


Figure 14: Map showing location of riparian and wetland planting at Oldfield Road

5.2.2 158 Hellyer Road

158 Hellyer Road is located 1.5 km north-west of the Stage 2 expansion area. The site is less topographically steep than the Kings Quarry site, and as such contains a greater proportion of permanent streams. The site also has a historic land use of pastoral farming.

2,264 linear metres on the Te Kuru Stream and its permanent tributaries will be riparian planted at Hellyer Road. Potential SEV scores of the streams following restoration at Hellyer Road are 0.74 for Tributary 1; 0.72 for the Central Upper Te Kuru Stream and 0.70 for the Central Lower Te Kuru Stream.

In addition, the removal and replacement of fish barriers, including the perched culverts will be undertaken, restoring fish passage through the reach.

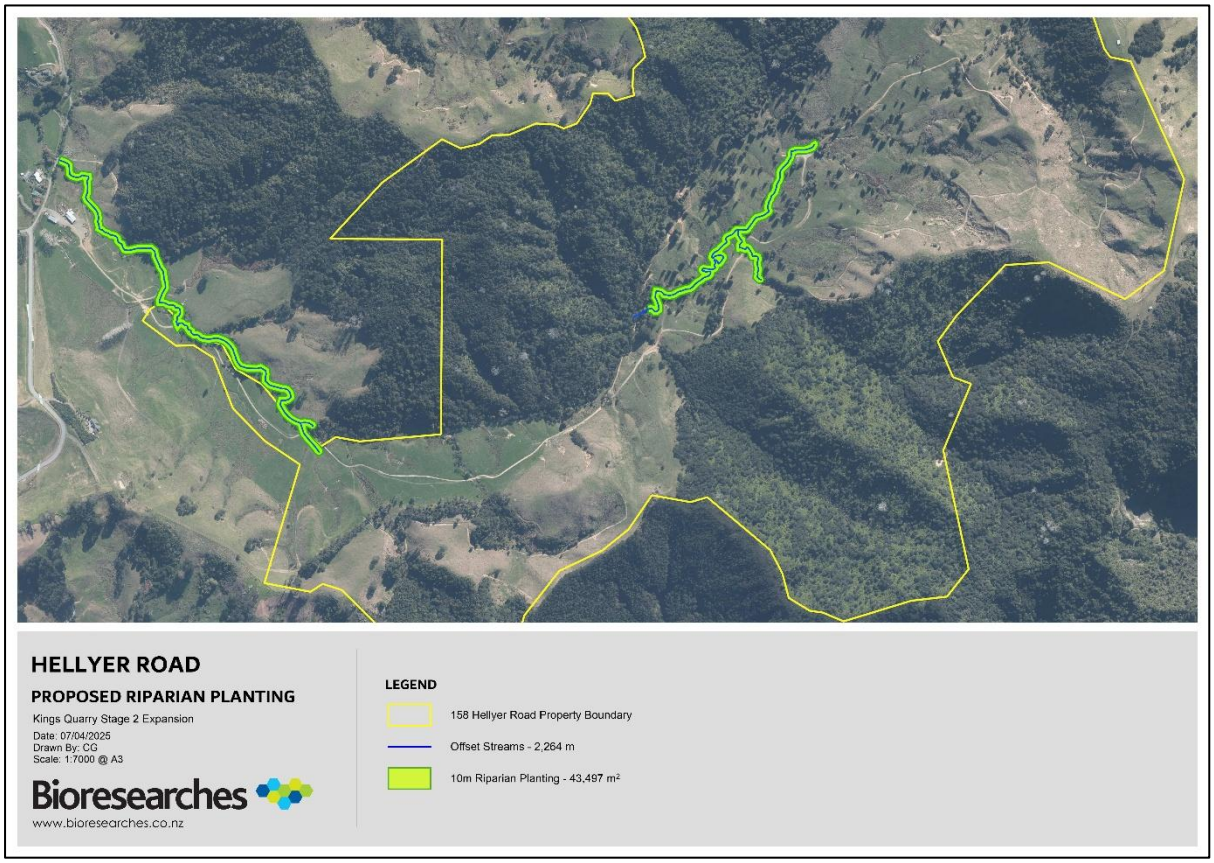


Figure 15: Map showing location of 10 metres of riparian planting at Hellyer Road

5.3 Planting Plan

A multi-staged approach is adopted by the following plan to ensure the survival and establishment of plantings and successful revegetation.

Stage 1 - Spring/summer: prior to the winter restoration planting, site preparation involves removal of any environmental weeds within the enhancement and revegetation sites.

Stage 2a – Additional weed control undertaken at revegetation site if necessary.

Stage 2b – Autumn/winter: Planting within the revegetation site.

5.3.1 Stage 1 – Weed Removal and Management

Weed removal is required within the revegetation site before planting. For the purposes of this plan, weeds are defined as plants that are either listed in Auckland Council's Regional Pest Management Plan 2020 – 2030 (RPMP 2020-2030), or The Ministry for Primary Industries National Pest Plant Accord (NPPA), including any updated versions of either list. Weeds can smother the existing indigenous flora and inhibit growth of any new plantings and ongoing weed control is vital to the success of restoration planting. Some weed species will need continued maintenance, as their seeds or rhizomes can persist in the ground.

At Oldfield Road, pasture including kikuyu grass is the dominant ground cover, and will require regular maintenance until canopy closure to prevent new plantings becoming smothered. Additional weed species include gorse, reed sweet grass, pampas and woolly nightshade.

At Hellyer Road, the primary vegetation coverage includes pasture, with some native species present within the canopy, as well as exotic macrocarpa.

Weed removal success is improved when carried out in the warmer months (October to March) and should be completed in the summer prior to planting activities commencing.

Weed control should be conducted for a minimum of five years post-planting and be done to a level where no mature weeds are present on the site and seedlings/saplings are removed within 6 months. A yearly audit in conjunction with maintenance activities should be conducted to ensure that weed control is of a high standard, is not causing unnecessary damage to native species and that full site coverage is being achieved.

5.3.1.1 Weed Removal Methods

Weed control methods should follow those outlined in Section 2.4.1 of this report. Additional exotic plant species to those listed in Section 2.4.1 include reed sweet grass (*Glyceria maxima*) and macrocarpa.

At Hellyer Road, a high number of bats have been recorded within the area. Therefore, it is recommended that pest plant exotic trees at both Oldfield Road and Hellyer Road are removed via drill and inject methodology and left standing (see section 2.4.1 of this report). Pine trees are known to self-seed within restoration areas and therefore should be controlled. Macrocarpa trees are not pest plants and therefore may be retained in restoration areas.

Reed sweet grass is present throughout aquatic restoration habitat at Oldfield Road. Reed sweet grass can be sprayed with glyphosate 100ml per 10L of water, avoiding the winter dormancy period. Spraying may be undertaken within 3 metres of waterways by a suitably qualified contractor. Follow-up spraying is required to fully remove reed sweet grass from restoration areas.

Additional spraying should be undertaken regularly at maintenance visits, and may be required additionally immediately prior to planting.

Exotic aquatic macrophytes (water pepper (*Persicaria hydropiper*), watercress (Nasturtium officinale), starwort (*Callitriche stagnalis*) and water forget- me-not (*Myosotis l*axa subsp. *caespitosa*) shall only be removed by hand within stream habitat. These species are expected to naturally decrease in abundance as shading increases from riparian plantings, but initial hand-removal may increase fish passage throughout stream reaches.

Herbicides should only be applied following a minimum of three (3) days without rainfall, and when rainfall is not forecast within 24 hours. This prevents run-off into watercourses, and the herbicide rapidly draining into groundwater. In addition, the following general guidelines apply when using herbicide control methods:

- Identify plants that will need to be retained prior to commencing weed removal activities;
- Keep a minimum of 1 m away from any native plants when applying glyphosate (and 3 m away when using herbicides with residual activity such as Metsulfuron); and
- Refrain from spraying directly next to watercourses – remain a minimum of 3 m distance from the wetted edge at all times.

The guidelines of the Auckland Regional Pest Management Plan (RPMP) should be strictly followed when new incursions of pest plants are recorded. New species should be noted on pest plant monitoring record sheets and controlled appropriately, in accordance with the RPMP.

It is recommended the use of the following chemical control substances is **avoided** due to their ability to accumulate in the environment:

- 2,4-D ester, MCPA and/or MCPB (often contained in herbicides marketed as ‘broadleaf killers’, e.g. ‘Pasture-Kleen’, ‘Ken-ester Relay’ or ‘Pasture Guard’);
- Picloram and/or triclopyr (often contained in herbicides marketed as ‘brushkillers’, e.g., ‘Eliminate Brushkiller’ or ‘Tordon Brushkiller’);
- Clopyralid (e.g. ‘Void’);
- Asulam (e.g., ‘Asulan’);
- Fluroxypyr (e.g., ‘Tandus XL’ or ‘Starane’); and
- Saflufencil (e.g., ‘Sharpen’).

Always follow the manufacturer’s instructions carefully and use the recommended safety precautions to protect the user and water health. A wetting agent, such as Boost, should be used to better adhere the spray adhere to the plant, allowing an increased efficacy of kill. Avoid spraying herbicide on windy days, when the droplets are likely to drift beyond the target area. The user should be suitably qualified in applying chemicals, such as being in possession of a GROWSAFE certificate.

Maintaining up-to-date records of agrichemical usage is a legal requirement for the management of agrichemicals as set under the Hazardous Substances and New Organisms (HSNO) Act and

specified in the New Zealand Standard for Management of Agrichemicals (NZS 8409:2021). Risks associated with the use of agrichemicals are required to be managed as indicated on the label and other product information so that adverse environmental effects are avoided.

A diary should be kept of all weed control, planting, and pest control work carried out.

5.4 Riparian Planting and Schedules

This section outlines a description of the planting zone, and a plant list including pioneer and enrichment species. The plants have been chosen based on information on indigenous Auckland vegetation (Singers *et al.,* 2017), Auckland Council's Te Haumanu Taiao guidance document, recorded species from nearby reference sites, and with respect to the vegetation at both the site of loss and the site of offset.

5.4.1 Planting Descriptions

The riparian plantings list for the Oldfield Road and Hellyer Road sites have been prepared with consideration to Auckland Council's Te Haumanu Taiao, with the aim of restoring the identified riparian margins to support aquatic health and functionality. Plant species have been chosen based on their tolerance of riparian conditions, fast growth and suitability to the local ecological region.

Riparian Planting

The terrestrial offset revegetation and infill planting at Oldfield Road is intended to restore kānuka scrub forest (VS2); broadleaved species scrub forest (VS5); and kauri, podocarp, broadleaved forest (WF11). Similarly, at Hellyer Road, the surrounding ecosystem extents, as identified by Auckland Council GeoMaps, to the riparian planting sites include kānuka scrub (VS2); broadleaved scrub forest (VS5) and kauri, podocarp, broadleaved forest (WF11).

These ecosystem types are reflected in the riparian planting lists to complement overall site restoration at Oldfield Road, as well as existing vegetation types at both Oldfield and Hellyer Road.

Wetland Planting

The wetlands within the site are not representative of Singers et *al.* (2017) classifications of wetland ecosystems within the Auckland region. Historical wetlands within proximity to the site are classified as bog and fen mosaic.

Both wetland 1 and 2 contain a range of species classified from obligate (Clarkson et *al.,* 2021[4]) to facultative, indicating that water levels within the wetlands are at least partially saturated throughout most of the year.

[4] Clarkson, B.R., Fitzgerald, N.B., Champion, P.D., Forester, L., Rance, B.D. 2021. New Zealand wetland plant list 2021. Manaaki Whenua - Landcare Research contract report LC3975 for Hawke's Bay Regional Council.

The wetland planting has been chosen to reflect a transition from saturated soils and obligate plants, to facultative plants on the wetland margins. Upland species have been planted within the wetland buffer planting zones. During planting, obligate (OBL) species should be planted within areas of highest saturation. Facultative (FAC) species are tolerant of both wet and dry periods.

5.4.2 Planting Lists

The planting will occur in a single stage, with no enrichment expected to be necessary, however infill planting may be required to replace any plants that do not survive.

The location of the planting and total area coverage can be found in Figure 14 and Figure 15.

The below tables provide species lists for the planting plan of each restoration site. The tables include total plant numbers, accounting for 10% die-off during the initial period following planting.

Table 20. Oldfield Road: Riparian planting mix (19,734 m2)

Scientific name	Common Name	Grade / size	Spacing (m)	% Plant mix	Number of plants	Number of plants + 10%
Shrubs						
Carpodetus serratus	Putaputawētā	1L / pb3	1	5	987	1085
Coprosma robusta	Karamū	1L / pb3	1	15	2960	3256
Cordyline australis	Tī kōuka	1L / pb3	1	5	987	1085
Hedycarya arborea	Porokaiwhiri	1L / pb3	1	5	705	776
Kunzea robusta	Kānuka	1L / pb3	1	10	1973	2171
Leptospermum scoparium	Mānuka	1L / pb3	1	20	3947	4341
Melicytus ramiflorus	Māhoe	1L / pb3	1	15	2960	3256
Phormium tenax	Harakeke	1L / pb3	1	10	1973	2171
*Plagianthus regius** closest to stream edge	Ribbonwood	1L / pb3	1	5	987	1085
Veronica stricta	Koromiko	1L / pb3	1	10	1973	2171
Trees				**100**	**19453**	**21398**
Pennantia corymbosa	Kaikōmako	1L / pb3	5	20	789	868
Dacrycarpus dacrydioides	Kahikatea	1L / pb3	5	10	395	434
*Laurelia novae-zelandiae**	Pukatea	1L / pb3	5	5	197	217
Podocarpus totara	Tōtara	1L / pb3	5	5	197	217
Sophora microphylla	Kōwhai	1L / pb3	5	5	705	776
Vitex lucens	Pūriri	1L / pb3	5	10	395	434
Totals				**55**	**2679**	**2947**

Table 21: Hellyer Road riparian planting mix (43,497 m2).

Scientific name	Common Name	Grade / size	Spacing (m)	% Plant mix	Number of plants	Number of plants + 10%
Shrubs						
Carpodetus serratus	Putaputawētā	1L / pb3	1	5	2175	2392
Coprosma robusta	Karamū	1L / pb3	1	15	6525	7177
Cordyline australis	Tī kōuka	1L / pb3	1	5	2175	2392
Hedycarya arborea	Porokaiwhiri	1L / pb3	1	5	2175	2392
Kunzea robusta	Kānuka	1L / pb3	1	10	4350	4785
Leptospermum scoparium	Mānuka	1L / pb3	1	20	8699	9569
Melicytus ramiflorus	Māhoe	1L / pb3	1	15	6525	7177
Phormium tenax	Harakeke	1L / pb3	1	10	4350	4785
*Plagianthus regius** closest to stream edge	Ribbonwood	1L / pb3	1	5	2175	2392
Veronica stricta	Koromiko	1L / pb3	1	10	4350	4785
				100	**43497**	**47847**
Trees						
Dacrycarpus dacrydioides	Kahikatea	1L / pb3	5	20	1740	1914
*Laurelia novae-zelandiae**	Pukatea	1L / pb3	5	10	870	957
Pennantia corymbosa	Kaikōmako	1L / pb3	5	5	435	478
Podocarpus totara	Tōtara	1L / pb3	5	5	435	478
Sophora microphylla	Kōwhai	1L / pb3	5	5	435	478
Vitex lucens	Pūriri	1L / pb3	5	10	870	957
Totals				**55**	**4785**	**5263**

Table 22: Oldfield Road: Wetland buffer riparian planting mix (33,110 m2).

Scientific name	Common Name	Grade / size	Spacing (m)	% Plant mix	Number of plants	Number of plants + 10%
Shrubs						
Coprosma robusta	Karamū	1L / pb3	1	15	4967	5463
Cordyline australis	Tī kōuka	1L / pb3	1	10	3311	3642
Kunzea robusta	Kānuka	1L / pb3	1	20	6622	7284
Leptospermum scoparium	Mānuka	1L / pb3	1	15	4967	5463
Melicytus ramiflorus	Māhoe	1L / pb3	1	15	4967	5463
Pennantia corymbosa	Kaikōmako	1L / pb3	1	10	3311	3642
Phormium tenax	Harakeke	1L / pb3	1	15	4967	5463
Trees				**100**	**33110**	**36421**
Dacrycarpus dacrydioides	Kahikatea	1L / pb3	5	20	6622	7284
Laurelia novae-zelandiae	Pukatea	1L / pb3	5	5	1656	1821
Sophora microphylla	Kōwhai	1L / pb3	5	10	3311	3642
Vitex lucens	Pūriri	1L / pb3	5	15	4967	5463
Totals				**50**	**16555**	**18211**

Table 23: Oldfield Road :Wetland planting mix (6,420 m2)

Scientific name	Common Name	Wetland Indicator Rating	Grade / size	Spacing (m)	% Plant mix	No. Plants	No. Plants + 10%
Austroderia fulvida	Toetoe	FAC	1L / pb3	1	5	321	353
Bolboschoenus fluviatilis	Purua grass	OBL	1L / pb3	1	8	514	565
Carex lessoniana	Rautahi	FACW	1L / pb3	1	10	642	706
Carex secta	Purei	OBL	1L / pb3	1	12.5	803	883
Carex virgata	Pūkio	FACW	1L / pb3	1	12.5	803	883
Cordyline australis	Tī kōuka	FAC	1L / pb3	1	5	321	353
Cyperus ustulatus	Giant umbrella sedge	FACW	1L / pb3	1	8	514	565
Dacrycarpus dacrydioides	Kahikatea	FAC	1L / pb3	5	5	64	71
Laurelia novae-zelandiae	Pukatea	FAC	1L / pb3	5	3	39	42
Leptospermum scoparium	Mānuka	FAC	1L / pb3	1	8.5	546	600
Machaerina rubiginosa	Baumea	OBL	1L / pb3	0.5	5	642	706
Parablechnum minus	Swamp kiokio	FACW	1L / pb3	0.5	5	642	706
Phormium tenax	Harakeke	FACW	1L / pb3	1	12.5	803	883
Totals					**100**	6651	7316

5.5 Planting Procedure

The planting season runs from May through to August for riparian and wetland buffer planting zones. Wetlands are to be planted in late March to early May, or from September to October, due to higher levels of ground saturation and avoidance of high water levels throughout winter.

During planting, the following procedures should be followed to ensure maximum survival of plants and optimal growth and health.

- Prior to planting, ensure all plants are thoroughly watered and have been allowed to drain out of direct sunlight.
- Set the plants out on site according to the recommended spacing. Aim to follow a randomised planting layout rather than straight lines, to achieve a "natural" rather than uniform look. Plant species should be mixed to avoid large single-species groupings.
- Dig a hole 1.5 – 2 times wider than the plants' root ball. Ensure the edges of the hole are roughened, especially in clay soil, to avoid a "pot effect" and the drowning of plants. Back-fill with a small amount of soil to cover the base.
- Carefully remove the plant from the bag and place within planting hole.
- Back-fill the hole with part new soil and part existing soil. Break up clumps of existing soil with a shovel as much as possible. As you fill, avoid stomping firmly on the soil, as this may over-compact the ground and restrict root growth. Some moderate firming with your foot or by hand once planted is adequate.
- Fill the planting hole until the top of the root ball sits exactly level with the ground surface. If the plant is planted too deep (plants sitting in indentations) water will pool and the plant may rot. If the plant is planted too high (plant is sitting in a mound) water will wick up through the soil and the plant will dry out.

5.5.1 Plant Sourcing

All plants must be eco-sourced from within the ecological district of the planting sites. This is the Rodney/Eastern Northland district (9.01) for both offset sites. Eco-sourcing protects the genetic lineage of plants in the area and ensures plants are adapted to their specific regional climatic conditions, making them more resilient to weather extremes. Examples of eco-source nurseries for this region include Scrub Nursery, Ngā Uri o Hau Native Nursery, Akerama Marae Nursery and South Kaipara Landcare Nursery.

Ideally plants should be ordered from an appropriate eco-source nursery as early in the project as possible to ensure that the appropriate species and numbers are grown on to be ready for planting. A minimum of one year's notice is recommended. In conjunction with the Threatened Plant Management Plan for the Kings Quarry site, seed may be collected directly from the Stage 2 impact area to be utilised within the planting areas.

All plantings from the Myrtaceae family (for example kānuka and mānuka) shall be sourced from a nursery that is a signatory to the Myrtle Rust Nursery Management Declaration V6, 11 October 2017, certifying that

the plant producer has implemented the New Zealand Plant Producers Imported Myrtle Rust Nursery Management Protocol (Myrtle Rust Nursery Management Protocol – V6, 11 October 2017).

Kauri must only be sourced from a nursery that has a Kauri plant production plan that meets the requirements of rule 3 of the National PA Pest Management Plan to prevent the spread of Kauri Dieback disease.

5.5.2 Physical Protection

New seedlings are susceptible to grazing by pests such as possums and rabbits, and adequate measures need to be taken to ensure plants are protected. As livestock are present on-site, fencing will be required to prevent the trampling of new and existing plants, both within the revegetation and enhancement areas. The use of plant guards is recommended.

5.5.2.1 Fencing

Fencing should be installed surrounding the planting areas, and is to be of a stock-proof standard – timber post and wire design:

- Consisting of a minimum 5 horizontal wires, preferably 7;
- To be built with timber round or half round posts, spaced at 3 to 5 m apart;
- On rolling hills (>7 °gradient), posts to be installed a maximum of 3 m apart; and
- Potentially with battens running vertically on the wires.

Fencing should be inspected annually and maintained to a stock-proof standard. Protection via fencing, in line with covenanting requirements, is required in perpetuity.

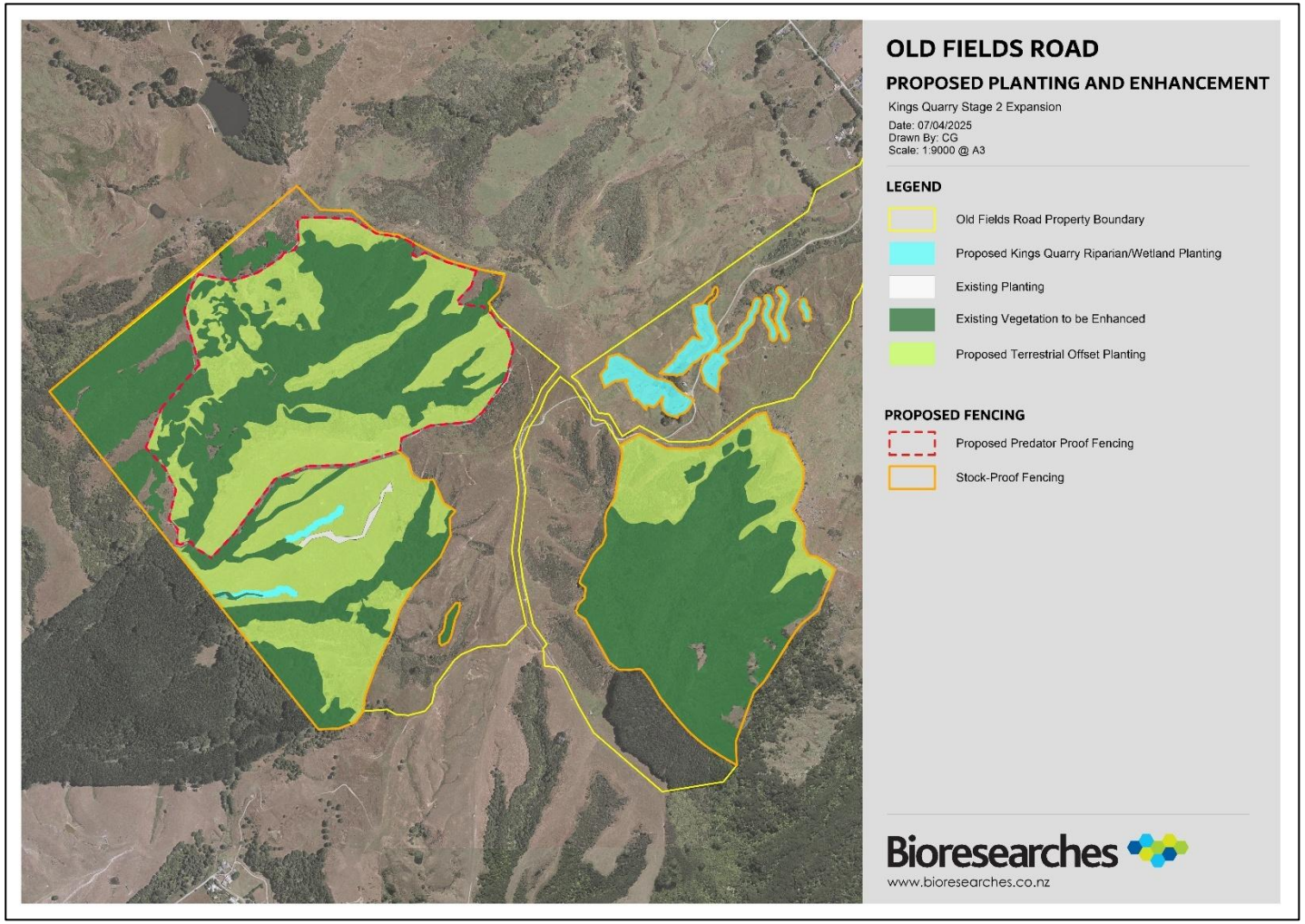


Figure 16: Map showing the location of fencing at Old Field Road.

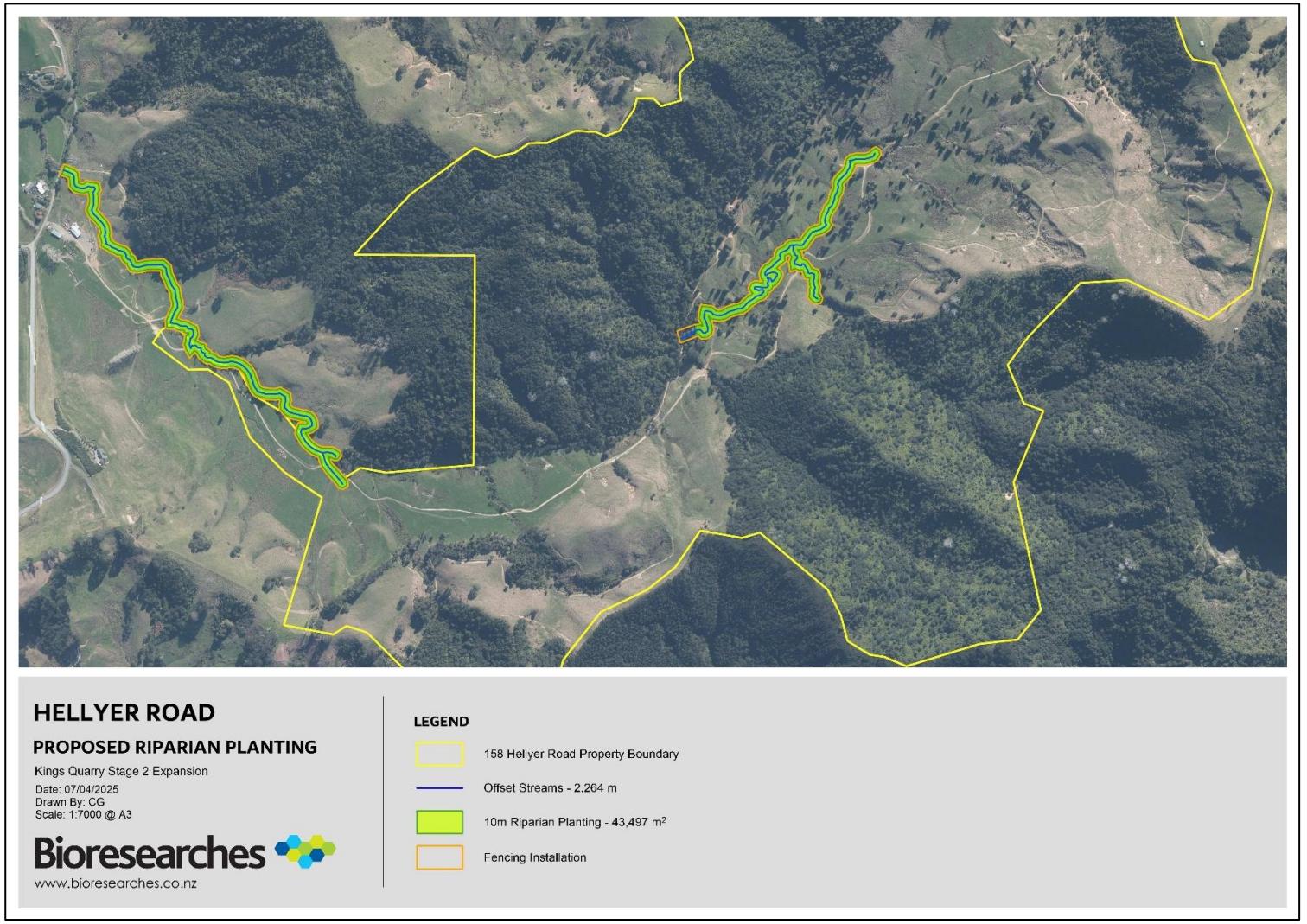


Figure 17: Map showing the location of fencing at Hellyer Road

5.6 Pest Animal Management

Pest animal management at Oldfield Road has been detailed within Section 2.8.1.3 of this report. Within the riparian and wetland planting areas, pest animal control will include stock proof fencing, as well as control for rats and possums on 100m grid lines at 100m trap/bait station spacing (see section 3.7). Mustelids will also be controlled at 200m trap intervals.

Similarly, pest animal control at Hellyer Road will incorporate stock proof fencing, as well as control for rats, possums and mustelids. Traps and/or bait stations should be utilised should follow the guidelines outlined in Section 3.7 of this report. A map showing the location of traps at Hellyer Road can be found in Figure 18.

Table 24. Pest animal control methods for rats, possums, mustelids and rabbits at Hellyer Road

Target species	Suitable approved traps	Suitable approved toxins	Recommended spacing
Rats (ship and Norway)	DOC200 Double-set DOC200 DOC250 Re:wild F-Bomb D-rat pro CSL Multi-trap* AT220* (NAWAC approved for ship rats only)	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Trap & bait station set at 100 m intervals
Possums	SA2 Kat trap Flipping Timmy AT220 CSL Multi-trap	DoubleTap (diphacinone and cholecalciferol) or cholecalciferol.	Trap & bait station set at 100 m intervals along these lines (excluding pasture areas).
Mustelids	DOC200 Double-set DOC200 DOC250 CSL Multi-trap* Re:Wild F-bomb	n/a	Mustelid-capable traps at 200 m intervals
Rabbits	n/a	Pindone	n/a – based on locating areas where rabbit damage, fresh scratching and faecal pellet heaps are evident

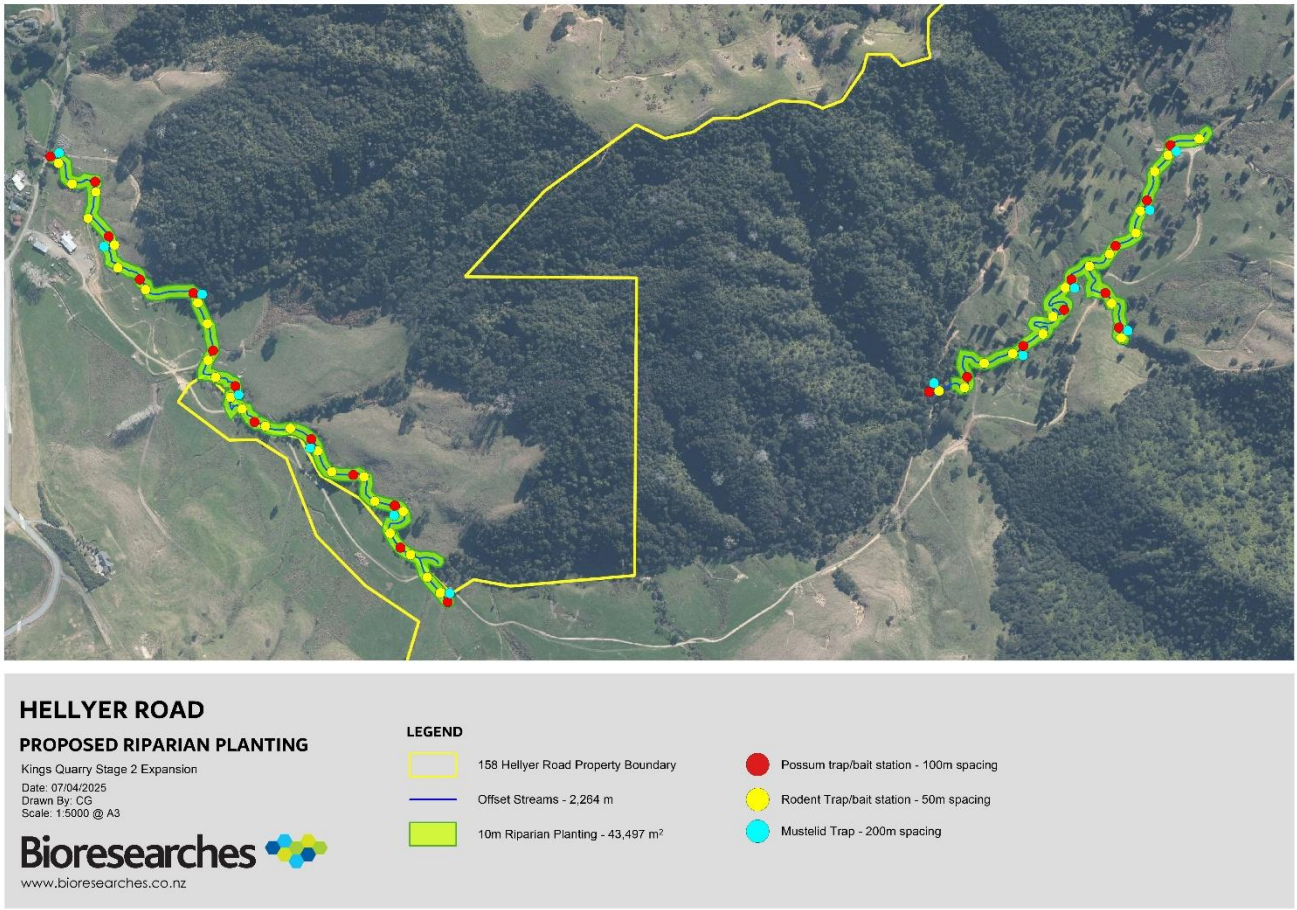


Figure 18. Location of pest control stations and traps within riparian planting at Hellyer Road.

5.7 Maintenance Plan

The maintenance plan of this report details the required plant aftercare, including replacement plants and weed control. It includes activities which should be undertaken for a minimum of 5 years following planting, with successful planting indicators including 80% canopy closure and a minimum survival density of 90% of the original planted density.

In the instance that planting targets are not being met (i.e., plants continue to fail despite replacement planting), a substitute species may be used subject to the approval of a consulting ecologist. Replacement plants should be at least of the same size (relative to surrounding plants).

5.7.1 General Activities

Maintenance should occur for a minimum period of 5 years.

Maintenance of revegetation planting will include:

- Manually removing weed species should they re-establish;
- Replacing any plants that do not survive during the 5-year period.

Revegetation planting maintenance will occur bi-monthly for the first year (or for 12 months after planting/initial weed control). Thereafter, the planting areas shall be maintained quarterly for at least 3 years after initial planting, and biannually in years 4-5 if planting targets are being met. The maintenance frequency adopted in this report is in line with the restoration planting guidelines outlined in Auckland Council (2023[5])

Successful planting targets include at least a 90% canopy closure, and a minimum of 90% of the original density of plants specified has survived.

Weed control of the enhancement areas should be undertaken twice per year.

A sample schedule of the plant maintenance and management activities required at the revegetation planting and enhancement areas are presented in the tables below.

Table 25. Planting and Maintenance Activity Schedule

Time	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year One	Initial weed control												
	Initial planting (Riparian and Wetland Buffer)												
	Initial Planting (Wetland)												
	Fence and pest control installation												
	Plant maintenance												
Year two	Plant maintenance												
Year three	Plant maintenance												
Year four	Plant maintenance												
Year five +	Plant maintenance												
All Years	Enhancement Area Weed control and plant maintenance												

5.7.1.1 Summer Activities

Summer (late November - late March) activities will include pest plant and animal control, as well as watering plants during periods of drought.

[5] Auckland Council. (2023). Te Haumanu Taiao: Restoring the natural environment in Tāmaki Makaurau.

5.7.1.2 Autumn and Winter Activities

Autumn and Winter (April – September) activities will include continued weeding (spraying may become inappropriate due to rain and wind), and the replacement of any dead plants. Plant replacement should be of the same species in the same grade as specified in the planting list. Should a particular species continue to fail, a substitute species may be used subject to the approval of a consulting ecologist.

5.8 Ongoing Monitoring

Monitoring of the riparian and wetland planting zones is required in accordance with consent conditions 10-15 below. Wetland monitoring should be in accordance with the Clarkson et *al.* (2004) guidelines. Monitoring should include measures to ensure the expected rate of uplift is occurring, including notes of any plant species failing to establish, and recommended substitutions or replanting actions.

Measures of success include reaching 80% native canopy coverage (riparian and wetland buffer planting) or native coverage (wetland planting) at five years following planting. Additional measures include a 90% survival rate of plantings for five years following planting.

10. *The consent holder must monitor the SEV of the offset streams at five years and ten years after completion of the riparian planting of the stream, or until the monitoring shows that the streams have achieved the predicted SEV values of the stream reaches in the SWERPP, which ever time is lesser.*

11. *The consent holder must monitor the compensation wetlands on an annual basis for five years after the completion of the enhancement planting of the wetland. Wetland monitoring should be undertaken in accordance with the "Handbook for Monitoring Wetland Condition" (Clarkson et al., 2004).*

12. *Within two months of each round of stream monitoring being completed, the consent holder must provide the SEV assessments and associated calculations used for monitoring the sites required by Condition 10 to the Council.*

13. *Within two months of each round of wetland monitoring being completed, the consent holder must provide a Wetland Restoration Monitoring Report which includes the Wetland Condition Scores and Condition Index and associated calculations used for monitoring the sites required by Condition 11 to the Council.*

14. *Where the monitoring concludes that the SEV value of the offset stream reaches has not reached the predicted SEV values in the SWERPP referenced in Condition 1 of the 'general conditions for all consents' within ten years of completion, a Further Enhancement Works Plan must be prepared and submitted to the Council for approval. The Further Enhancement Works Plan must include, but not be limited to the improvement of planting along the existing stream reach to meet the predicted SEV value and further monitoring until such time that the requirements of the Further Enhancement Works Plan are achieved.*

15. *Where required by Condition 14, the consent holder must provide the Further Enhancement Works Plan within six months of monitoring and must implement the Further*

Enhancement Works Plan within six months of certification of the plan by the Council or during the next planting season (whichever is appropriate to the measures adopted).

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APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Kings Quarry Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

Maps and Images

All maps, plans, and figures included in this report are indicative only and are not to be used or interpreted as engineering drafts. Do not scale any of the maps, plans or figures in this report. Any information shown here on maps, plans and figures should be independently verified on site before taking any action. Sources for map and plan compositions include LINZ Data and Map Services and local council GIS services. For further details regarding any maps, plans or figures in this report, please contact Bioresearches.

Appendix A Disease Management

Myrtle Rust

Myrtle rust threatens native species such as kānuka, mānuka, pōhutukawa, swamp maire, and other common exotic species within the Myrtaceae family, such as lilly pily (*Syzygium smithii*), gumtrees (*Eucalyptus* spp.) and bottlebrush (*Callistemon* spp.). Some of the most common symptoms to look out for are:

- Bright yellow powdery eruptions appearing on the underside of the leaf (young infection);
- Bright yellow powdery eruptions on both sides of the leaf (mature infection);
- Brown/grey rust pustules (older spores) on older lesions;
- Grey, 'fuzzy' spore growth on undersides of leaves; and
- Some leaves may become buckled or twisted and die off.

If myrtle rust is found, Ministry for Primary Industries (MPI) guidelines should be strictly followed.

Figure 19: Left: Myrtle rust visible on leaves, with rust coloured, powdery eruptions

Disease Management: Auckland Council Standards

In relation to an existing fence with conventional post, wire and batten, a fence that is:

a. a minimum overall fence height of 1175 mm; and
b. a maximum of 5 m spacing between posts; and
c. a minimum of 7 wires with maximum spacing of 200 mm between top wires; and
d. spaces between wires gradually decreasing to 100 mm between bottom two wires; and, e. the bottom wire is a maximum of 100 mm above the ground; and
e. a minimum of 1m spacing between battens; and
f. all wires must be strained to a minimum 150 kgs of tension; and
g. all materials are structurally sound; and
h. swing or driven footing in all dips or hollows; and
i. which has been topped up with a top up netting fence that is:
j. minimum overall fence height 1550 mm; and
    i. any new wires are minimum gauge of 2.5 mm high tensile galvanised; and
    ii. any existing, end and angle strainers must have at minimum a 2.1 m long round with minimum diameter 150 mm dug in and wired on to attach netting to; and
    iii. a batten of dimensions 1500 x 50 x 50 mm must be installed beside any existing posts to attach netting to; and
    iv. minimum top up netting specifications of height 600 mm, stay wire width 300 mm and 5 line wires; and
    v. an overlap may be created onto existing fence if required.

1. In relation to a new conventional post wire and batten fence, a fence that has:
    a. minimum overall fence height 1550 mm; and
    b. any wires are minimum gauge of 2.5 mm high tensile galvanised; and
    c. the bottom wire is a maximum of 70 mm above the ground along a bulldozed line or equivalent; and
    d. any end strainers are 3 m long rounds with minimum 200 mm diameter; and
    e. any angle strainers are 2.7 m long rounds with minimum 200 mm diameter; and f. no internal stays; and
    f. any posts are 2.4 m long rounds with minimum diameter 120 mm; and
    g. a maximum spacing between posts of
        i. 5 metres on land with less than 30 degree ground slope; or
        ii. 4 metres on land with ground slope between 30 degrees to less than 45 degrees; or
        iii. 3 metres on land with ground slope of 45 degrees or more; and
        iv. swing or driven footing in all dips or hollows; and
        v. is constructed alongside any water body with an appropriate setback sufficient to avoid any slumping which may cause a breach of the fencing standard; and
        vi. two electrified outriggers at 300mm and 1200mm spacing; and
        vii. a minimum of 1 m spacing between battens; and
        viii. minimum batten dimensions are 1500 x 50 x 40 mm; and
        ix. n. 11 wires with a maximum spacing from bottom to top of 114mm, 114mm, 127mm, 139mm, 165mm, 178mm, 178mm, 178mm, 178mm, 178mm; and
        x. all wires must be strained to a minimum 150 kilograms of tension.
2. In relation to a new netting fence, a fence that has:
    a. minimum overall fence height 1550 mm; and
    b. been constructed of tight lock deer netting; and

c. no internal stays; and
d. any stay wires are 300mm wide; and
e. a minimum of 11 line wires; and
f. the bottom of the netting is a maximum of 70 mm above the ground; and
g. any end strainers are 3 m long rounds with minimum 200 mm diameter; and
h. any angle strainers are 2.7 m long rounds with minimum 200 mm diameter; and
i. swing or driven footing in all dips or hollows; and
j. any posts are 2.4 m long rounds with minimum diameter 120 mm; and
k. a maximum spacing between posts of
    i. 5 metres on land with less than 30 degree ground slope; or
    ii. 4 metres on land with ground slope between 30 degrees to less than 45 degrees; or
    iii. 3 metres on land with ground slope of 45 degrees or more.

3. In relation to any gate, whether new or top-up, a gate that is:
    a. the same height as the adjoining fence; and
    b. the bottom of the gate is a maximum of 100 mm above the ground at all points including over any ditches or hollows; and
    c. all components are structurally sound.
4. In relation to any fence across any water body, that fence must have a flood gate that:
    a. is constructed of H3 treated 100mm x 50mm timber; and
    b. is suspended from an overhead wire or rail in such a way that the spacings will allow the passage of water but will not allow stock including goats to pass through; and
    c. swings freely; and
    d. is panelled in partitions; and
    e. has a cross-bar positioned in the top third of the floodgate; and
        i. is on the downstream side of any culvert.

Wire netting may not be used in floodgate construction.

Flood gates may not be a single solid panel. Electric type fences do not comply, as shortages and vegetation growth may lead to non-compliance.

Appendix B Planting Schedule

Table 26. Proposed planting schedule and monitoring timetable for revegetation at the Oldfield Road site. The cumulative planted area is also provided in relation to the quantity of vegatation loss and remediation planting occurring concurrently at Kings Quarry.

	Oldfield Road Site													Kings Quarry		
	Planting Block (5.15 ha each)												Cumulative Area Planted (ha)	Cumulative Vegetation Cleared (ha)	Remediation Planting (ha)	Net Vegetation Area Cleared (ha)
Year	1	2	3	4	5	6	7	8	9	10	11	12				
1	Planted												5.15	5.72	0.11	5.61
2	Ann. Mon.	Planted											10.3	8.45	0.56	7.88
3	Ann. Mon.	Ann. Mon.	Planted										15.45	9.36	0.56	8.8
4	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted									20.6			
5	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted								25.75	9.97	0.56	9.4
6	5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted							30.9	18.15	1.83	16.3
7		5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted						36.05			
8			5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted					41.2			
9				5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted				46.35			
10					5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted			51.5			
11	5yr Report					5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted		56.65	19.36	5.55	13.82
12		5yr Report					5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.	Planted	61.8			
13			5yr Report					5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.	Ann. Mon.				
14				5yr Report					5yr Report	Ann. Mon.	Ann. Mon.	Ann. Mon.				
15					5yr Report					5yr Report	Ann. Mon.	Ann. Mon.				
16	5yr Report					5yr Report					5yr Report	Ann. Mon.		21.26	6.52	14.73
17		5yr Report					5yr Report					5yr Report				
18			5yr Report					5yr Report								
19				5yr Report					5yr Report							
20					5yr Report					5yr Report						
21	5yr Report					5yr Report					5yr Report			23.35	7.87	15.48
22		5yr Report					5yr Report					5yr Report				
23			5yr Report					5yr Report								
24				5yr Report					5yr Report							

25					5yr Report					5yr Report						
26						5yr Report					5yr Report			24.99	9.14	15.85
27							5yr Report					5yr Report				
28								5yr Report								
29									5yr Report							
30										5yr Report						
31											5yr Report			26.18	12.37	13.81
32												5yr Report				
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36														27.28	13.42	13.85
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41														27.83	24.69	3.13
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Appendix C Predator-proof Fence report

Pest exclusion fencing feasibility report

Oldfields Road

Wellsford

The proposed fence encircles the partially vegetated catchment to the right of Dr Helen Blackie, Alliance Ecology

Prepared for Alliance Ecology, Auckland

pestproof fences

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Contents

Assessment undertaken by:

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Director, Pestproof Fences Ltd, Havelock North

March, 2025

Summary

The feasibility and practicality of creating a fenced wildlife sanctuary near Oldfields Road, Wellsford, was assessed during a visit to the site in mid February, 2025. The proposed fence, about 3450 m long, would encircle a small partially vegetated catchment of about 60 ha. The fence would cross four small inflow waterways at the top of catchment and a stream at the bottom. A causeway already exists over the stream, which with minor modification, could support a fence and be made completely pest-proof. For its entire length, the proposed fence follows existing farm tracks or ridge lines with gentle gradients. The soil - heavy clay - provides firm footing for posts but is probably 'workable' only during summer when soil moisture levels are at a seasonal minimum.

The visit indicated that it would be entirely feasible to build a predator-proof along the proposed route. Minimal earthworks and vegetation removal would be required to establish the building platform. The technical specifications of the fence, gates, and culvert systems are described in the report. The indicative cost of the fence is listed in Appendix 1.

1 Introduction

This brief report documents the findings of a visit to a private property (hereafter called Oldfields Road) near Wellsford, Auckland district (Fig. 1) aimed at assessing whether it would be feasible and practical to create a pest-free fenced wildlife sanctuary on part of it. The inspection was arranged by Dr Helen Blackie of Alliance Ecology and was undertaken on February 19, 2025, in the company of a landowner representative (Alexander Semenoff) and his farm manager (Ryan). The entire route of the proposed fence was examined over the course of 4 hours, mainly be driving along it in a side x side.

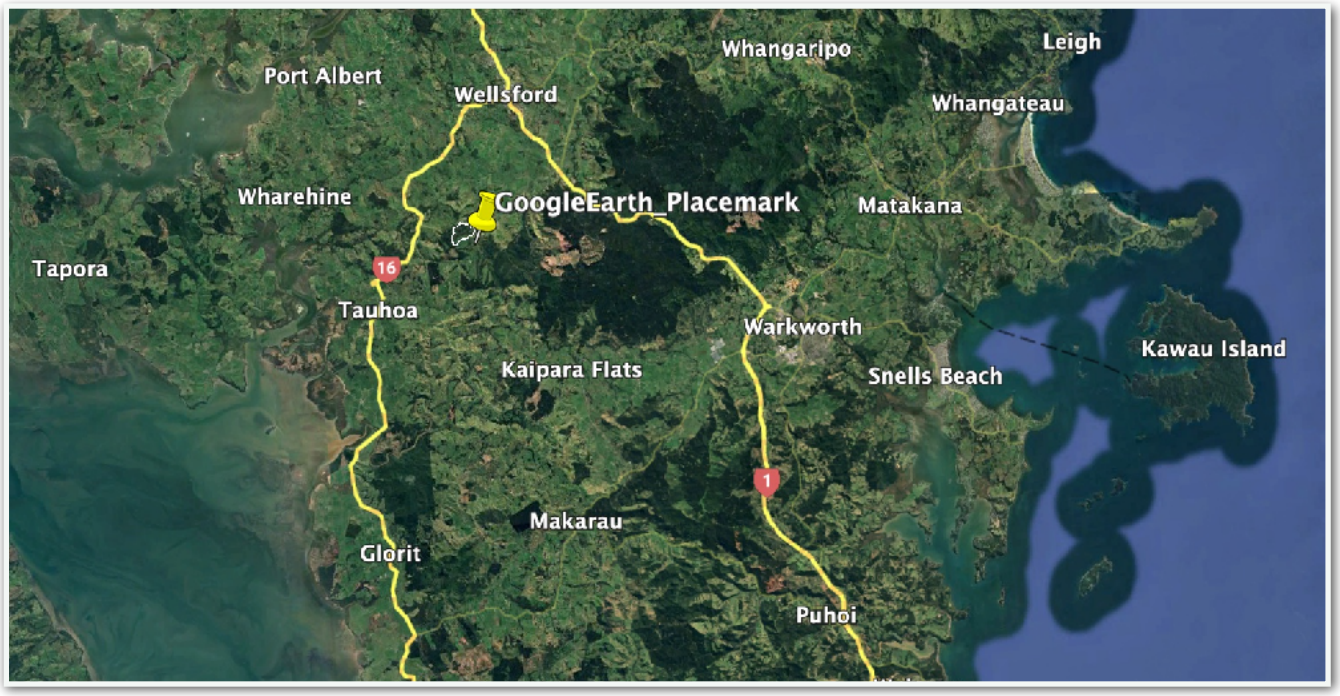

Fig. 1. *Location of the property (Yellow Pin) on the Northland Peninsula, between Warkworth and Wellsford.*

2 Site description and proposed fence route

The proposed fence is about 3490 m long (Fig. 2). It encircles about 60 ha of partially vegetated farmland - the majority of a small catchment with a south-western aspect and a north to south fall. The catchment contains a small ephemeral stream that may stop flowing altogether in dry summers.

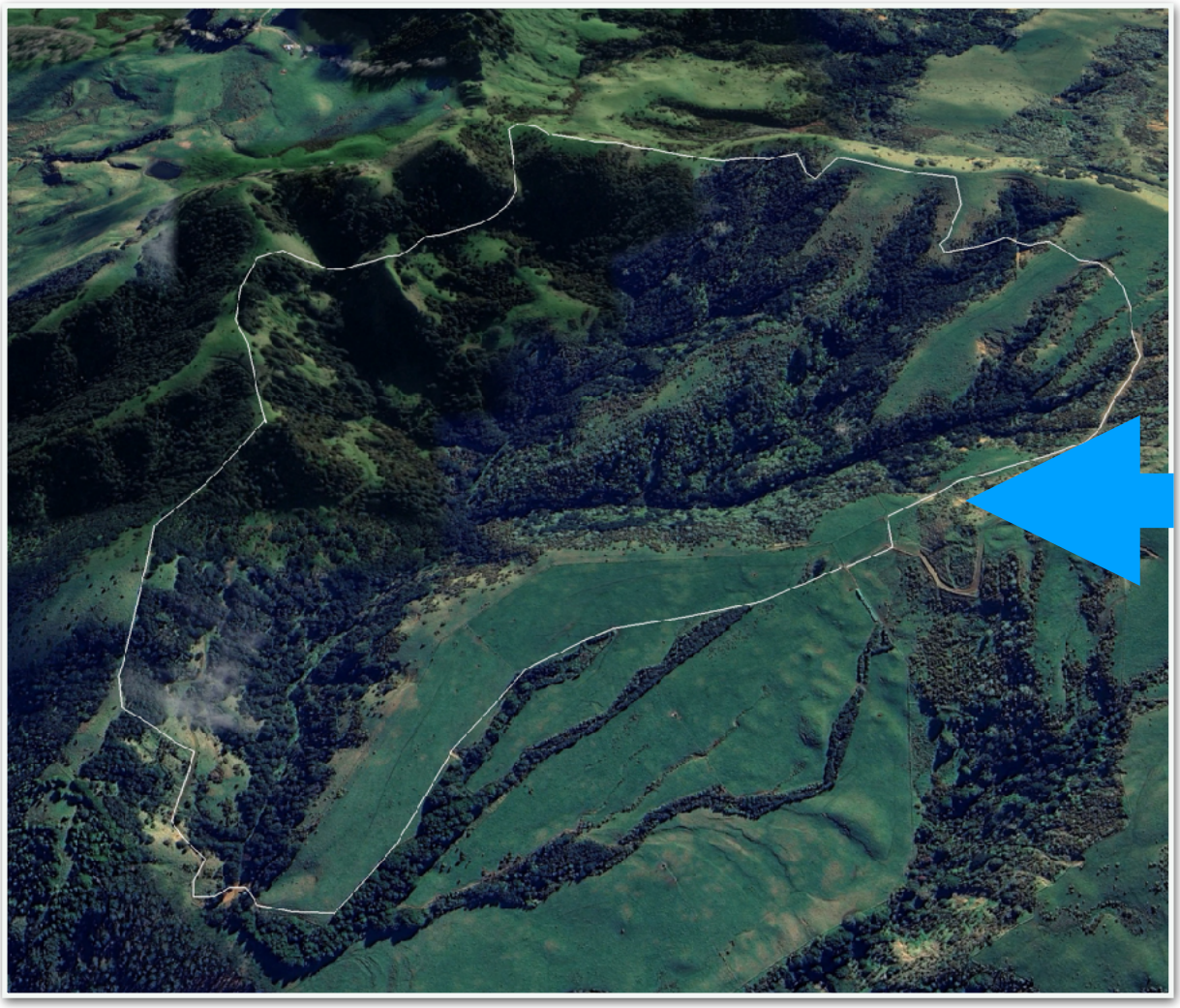

Fig. 2. *Proposed indicative route (white line) of the pest exclusion fence at Oldfields Road, Wellsford. The blue arrow approximates the location of the photo point on the cover of this report.*

2.1 Terrain

For the most part, the route of the proposed fence follows ridge-lines or existing farm tracks with gentle gradients. There is a 105 m difference in altitude between the highest and lowest points on the proposed route, with an average gradient of 1:18 around the circuit. A farm tractor (with post driver) can access the entire route, making material layout, post-driving and overall fence construction both routine and straight forward.

2.2 Soil type and stability

The soil along the fence route is heavy clay, overlaying large rocks in some places. It is winter wet and summer dry, prone to both pugging and cracking. Nonetheless, it provides firm footing for posts - as evidenced by the general absence of post displacement on the existing stock fences.

The slopes along the proposed route are stable, with little evidence of recent erosion. A short section of the proposed route near the stream outflow at the bottom of the catchment crosses the toe of a small recent slip, but it presents no difficulties for fence platform establishment, and is unlikely to slump again in the future.

2.3 Vegetation

For much of its length, the route of the fence traverses open farmland with no significant vegetation within 5 m of either side. No specimen trees, such as large totara or nikau, require removal to establish the fence or provide access for machinery. Some vegetation (mainly gorse and young kanuka) would require removal in the top end of the catchment, where the proposed fence traverses the headwaters of four small gullies. Most of this vegetation is on the uphill side of the fence, and - if not removed - could enable pests to jump over the fence into the protected area.

2.2 Water inflows and outflows

The proposed fence crosses at least four small gullies in the top of the catchment where, during significant rainfall events, water would flow under the fence into the protected area. At all other times, the gullies would be completely dry. Their catchment areas above the fence are tiny (< 1.0 ha). It is completely possible to make these “inflow” waterways pest proof, by channelling the flows into screened culverts, depicted below.

The stream at the bottom of the catchment is the most significant water crossing - but, as mentioned previously, it is small and ephemeral, perhaps shrinking to isolated pools in dry summers (Fig. 3). There is already a road crossing over the stream, with an embedded culvert pipe approximately 300 mm in diameter (Fig. 4). With minor modifications, the existing causeway could be made completely pest-proof.

Fig. 3: *The 'outflow' stream at the bottom end of the catchment.*

Fig. 4. *The existing causeway over the 'outflow' stream at the bottom end of the catchment.*

3 Technical specifications of the proposed fence

3.1 Fence and capping

The height and technical specifications of a typical PPF fence are shown in Fig. 5. The components in Fig. 5 are shown as 316L stainless steel, but at Oldfields Road they would be galvanised steel, appropriate for a low corrosion environment in an inland setting. Galvanised steel fences are substantially cheaper than those made from stainless steel.

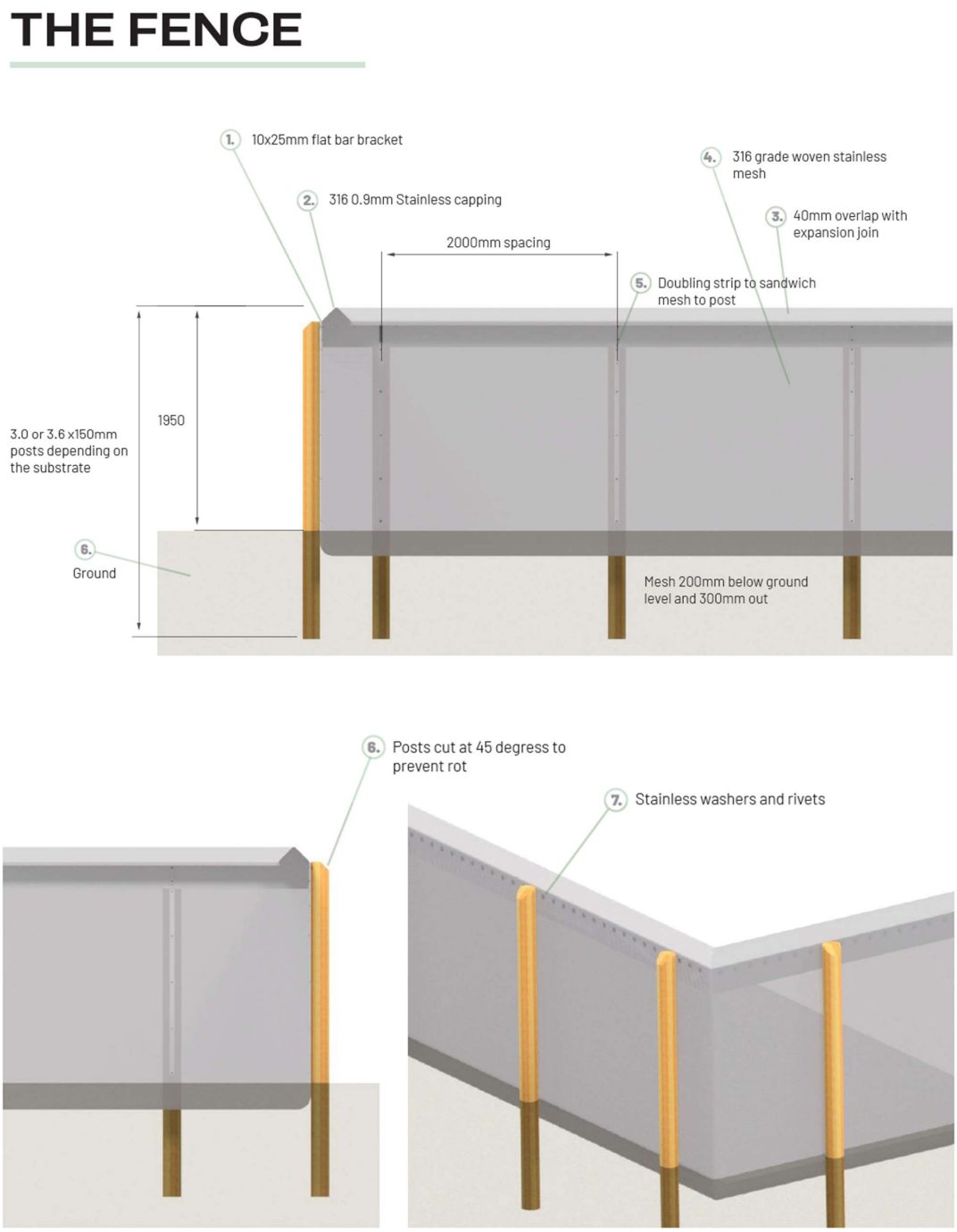

Fig. 5. *The general specifications of the proposed fence.*

In the Oldfields Road environment, a fence with galvanised components would have an expected life of 35-50 years. Failure resulting from electrolysis is not a risk, because the metals in the fence (galvanised steel and aluminium) have low galvanic potential when in contact with each other. Toppling is also highly unlikely given the post spacing (2 m), the

bracing provided by the steel capping, and the characteristics of the clay soils at Oldfields Road.

Four fences in Hawkes Bay with the same specifications withstood cyclone Gabrielle in 2023, with no failures at all.

Fig. 6 depicts a galvanised full-height fence that is nearing completion.

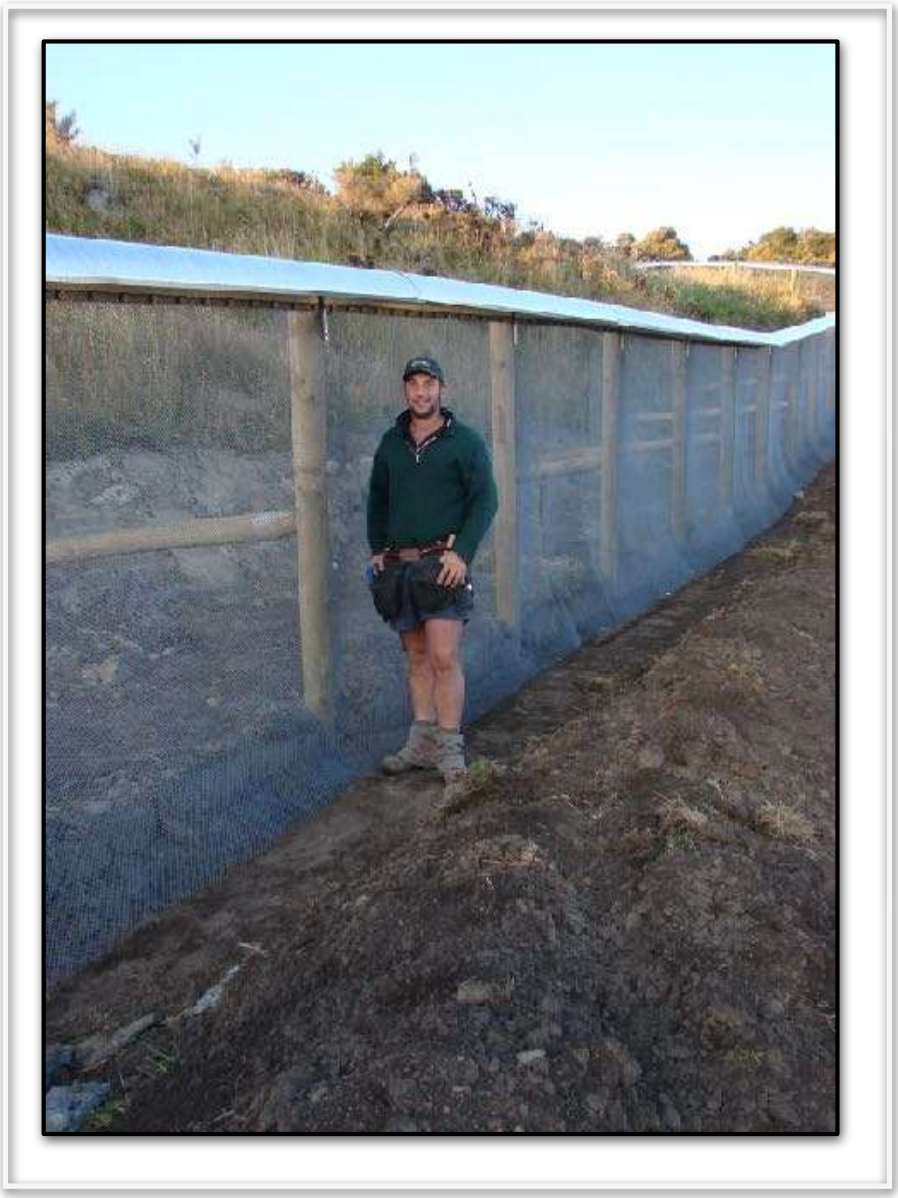

Fig. 6.: *A galvanised Pestproof Ltd exclusion fence that is nearing completion. The trench containing the buried skirt is about to be back filled - the last job in the construction process. This type of fence is as simple as a pest-proof fence can get. It is essentially a continuous wall of woven mesh, supported by capping and posts. It has no stapled mesh overlaps, above or below ground, which can potentially open up and become entry points for pests over time. This feature is essential for the long-term exclusion of mice.*

The fence at Oldfield's Road would be clad in woven mesh, manufactured from 1.4 mm diameter wire. The aperture size is 8mm x 6mm (Fig. 7), small enough to exclude mice at all stages of life.

Fig. 7: *Example of woven mouse-proof mesh. This particular product has a black coating to reduce its visibility in the landscape. The mesh is extremely resilient with natural springing, greatly reducing the chances of deformation when struck by objects.*

3.2 Vehicle and pedestrian gates

The standard Pestproof vehicle gate is 3.6 m wide (Fig. 8) sufficient to allow farm tractors and excavators to pass through. Vehicle gates are set in concrete to provide rigidity and stability. The gate itself is supported by four hinges to prevent sagging. They can be supplied with locks, if required. The brief for the Oldfields Road fence calls for one vehicle gate.

Pedestrian gates come in a number of forms but the simplest one, appropriate for the proposed Oldfields Road fence, is a step through gate set within the fence itself (Fig. 9). If required, 'closed cell' double-door gates can be provided, which eliminate the possibility of pest incursions, should a gate be left open.

Fig. 8: *The PPF vehicle gate. The gate is clad in two punched metal panels. Motifs can be incorporated, if desired.*

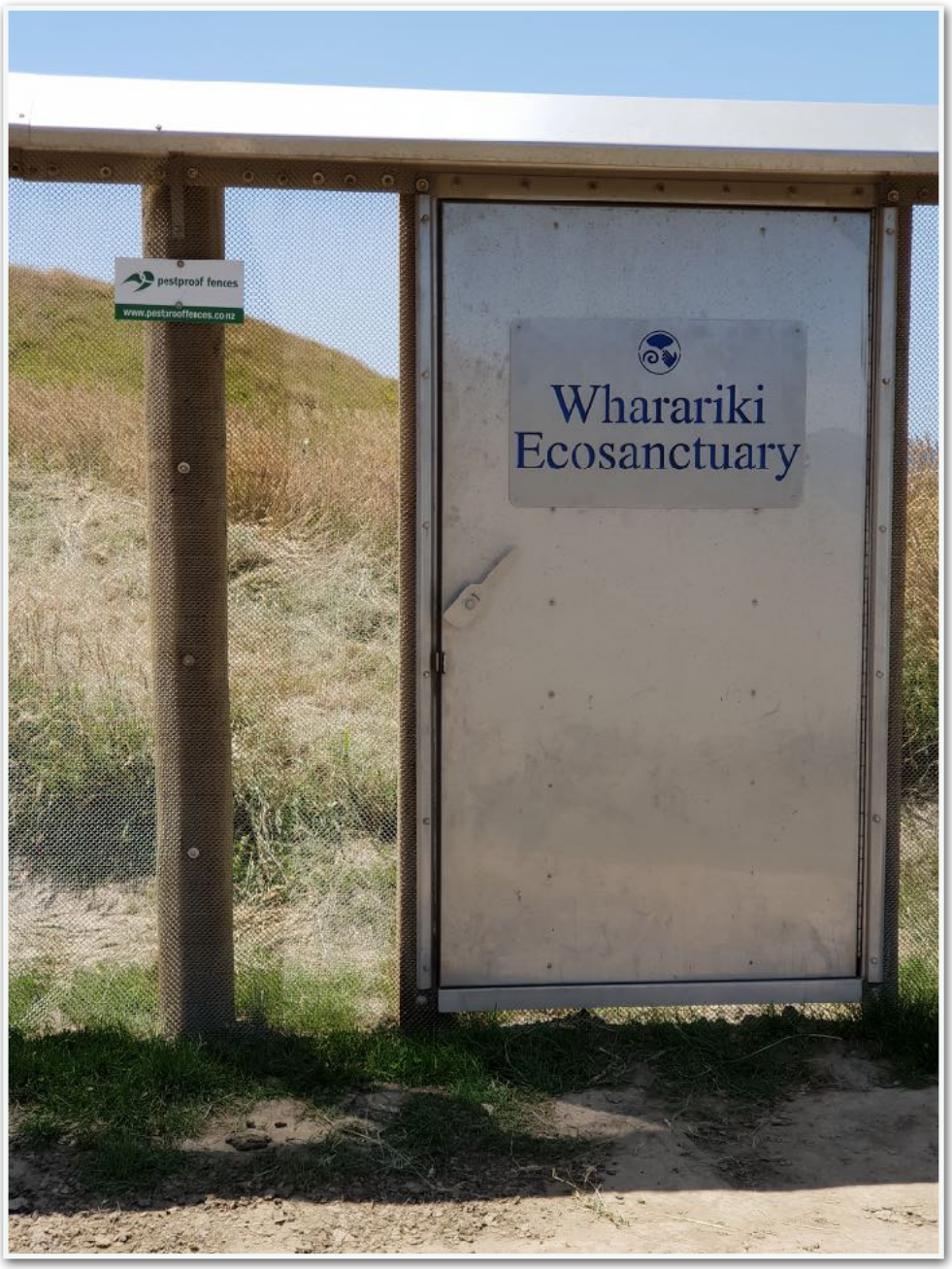

Fig. 8: *A simple pedestrian gate, set within the fence itself. An alternative version is a 'half gate, beginning 50 cm up from ground level. In 'half-gates', the mesh section between the bottom of the gate and the ground helps to keep pests out, should the gate be inadvertently left open.*

3.3 Inflow and outflow culverts

The proposed fence requires at least four inflow culverts at the top end of the catchment, similar to those depicted in Fig. 9. The culverts come in a range of sizes to cater for a range of flows, but they are all comprise a buried culvert pipe (to take the water under the fence), and a concrete wingwall at the inflow end with pest-proof screens attached to the wingwall. The simplest version of an inflow culvert, appropriate for the Oldfields Road site, is shown in Fig. 10.

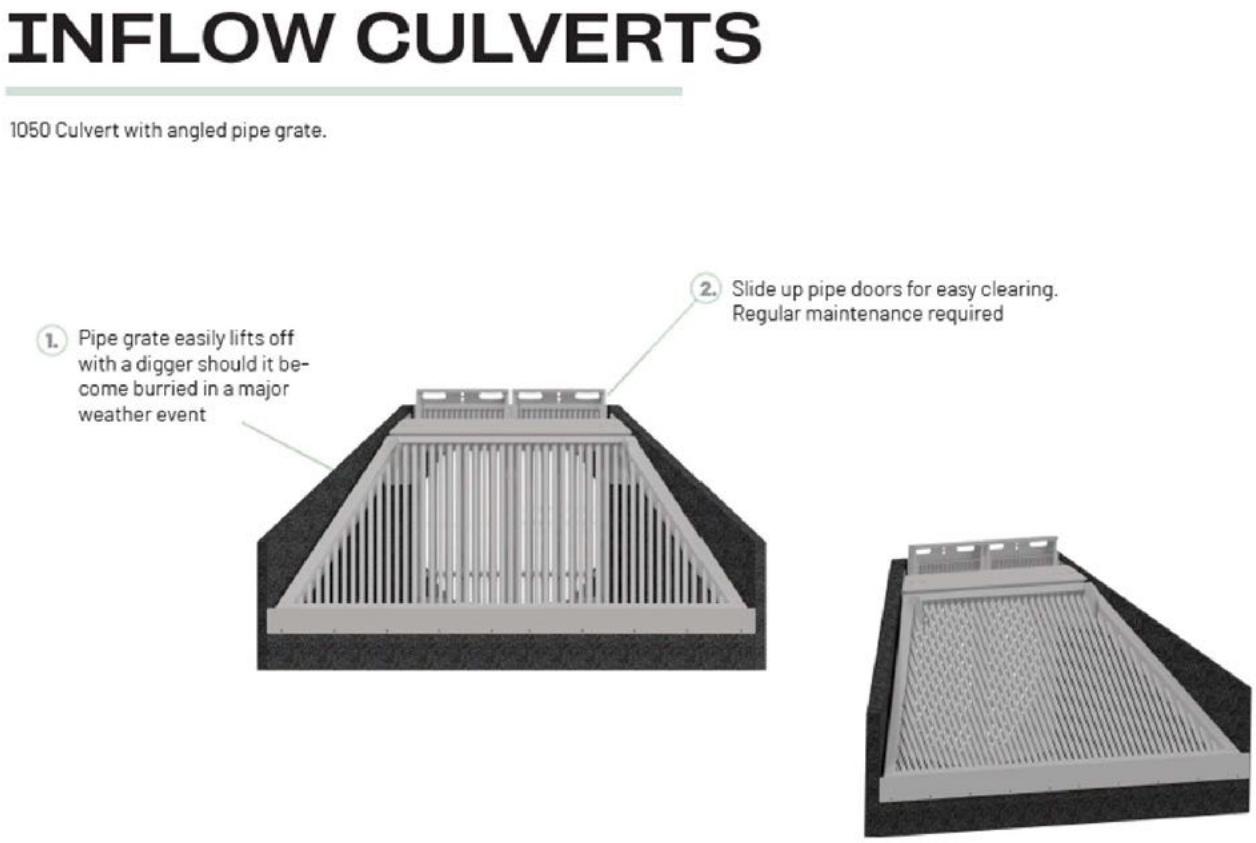

Fig. 9: *A typical inflow culvert, involving a pipe with a screened wingwall at the inflow end. The wingwall is positioned on the 'outer' side of the fence, and prevents pests moving through the drainage pipe into the protected area.*

Fig. 10: *A small inflow culvert, suitable for waterways with infrequent and small flows. The grate at the front of the pest-proof screen can be removed for easy cleaning.*

The proposed outflow culvert for the causeway at the bottom of the catchment incorporates a flap gate that opens during periods of high flow but otherwise remains closed (Fig. 11). During normal flows, water trickles through the fingers at the bottom of the hinged flap gate but the gate itself remains shut. The flap gate culvert system is designed to bolt directly onto the 'outflow' end of the culvert pipe in the causeway. An additional screen (not shown) is attached to the inflow end to stop sticks and other large items blocking the entrance or wedging in the pipe itself.

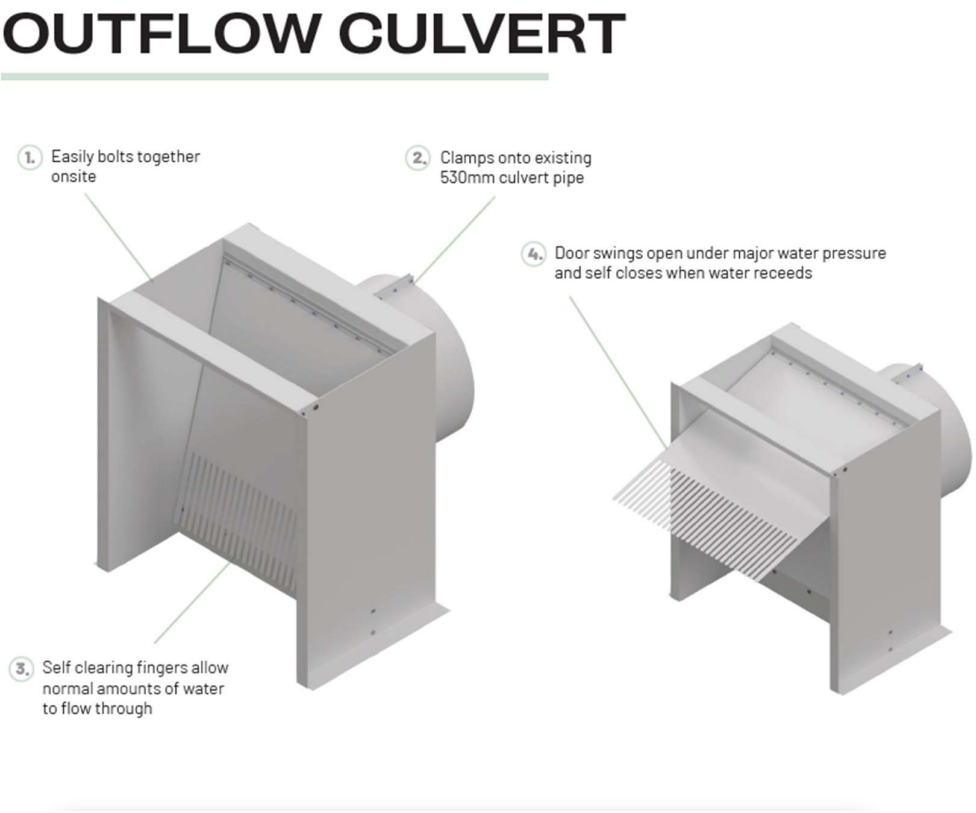

Fig. 11: *An outflow culvert suitable for the small stream at Oldfields Road. The unit bolts directly on to the end of the culvert pipe.*

4 Build sequence

4.1 Order of operations

The build sequence is :

1) Earthworks for fence platform establishment (where required),
2) Culvert and gate installation,
3) Post driving
4) Mesh trench excavation
5) Mesh attachment
6) Capping and bracket attachment
7) Capping corner attachment
8) Mesh trench backfill and seeding.

4.2 Earthworks and sedimentation

At Oldfields Road, the proposed fence would be built almost entirely on existing farm tracks and and ridge crests. Little is required in the way of additional earthworks to create a stable building platform. Construction (if it proceeds) would be undertaken in summer to minimise runoff. Following fence completion, all areas of exposed soil are seeded to re-establish pasture cover as soon as possible.

4.3 Probable build duration

Full-height pest exclusion fences of the type proposed for Oldfields Road typically take 1.75 man-hours per metre to build, once all materials are delivered to site. The most efficient size and operating schedule of the construction team is six people, working 10 days on and four off.

The probable build duration of the proposed fence is therefore 3490 x 1.75 = 6108 hours = 102 (10-hour) days for a team of six. Total build time, including days off, is therefore approximately 142 days. The build, if it proceeds, would start in early November and finish at the end of March, with the inclusion of a small allowance for a Xmas break.

5 Conclusions and overall assessment

It is completely feasible and practical to build a full-height pest exclusion fence at Oldfields Road along the route depicted in Fig. 2. There are no significant technical difficulties of any kind to overcome - and for most of the proposed route, minimal earthworks are required to establish a suitable building platform. The clay soils restrict construction to the summer/early autumn period but (cyclones aside) the whole fence could be completed over a 5-month period with a team of 6 people.

Appendix 1

Indicative cost

The indicative cost of a mouse-proof fence with: wooden posts; galvanised mesh, capping, brackets and fittings; one galvanised vehicle gate, one pedestrian gate, 4 inflow culverts and one outflow culvert is $520/m + GST = $1,814,800 + GST in total.

This indicative price is based on the current exchange rate of $US 1.0 = $NZ 1.75, the assumption that free accommodation will be available for the construction team on site for the duration of the build, and that there are no significant weather-related disruptions during the build period.

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March, 2025

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