Meeting the requirements of the Biosecurity Act 1993 and National Policy Direction for Pest Management 2015: Qualitative analysis of costs and benefits for pests

Report prepared by Environment Southland
as part of the preparation of a Southland Regional Pest Management Plan

August 2018

Contents

Executive Summary

This report is the second part of the cost-benefit analysis work providing the information required for Environment Southland to determine whether options for management of pests in the region are likely to meet the requirements of the Biosecurity Act 1993 and the National Policy Direction for Pest Management (NPD). This report analyses suitable management options for each pest candidate against a do-nothing approach.

The costs, benefits and risks for each pest candidate in this report are largely based on qualitative assessment (intangible/descriptive costs and benefits – as permitted by the NPD), but are supplemented by basic economic assumptions where these are known.

Where significant risk with a pest candidate was identified as part of the pest evaluation process that analysis has been undertaken by an independent economist. The report is available as a separate attachment. Some findings from the independent report have general relevance to the qualitative analysis undertaken below. That is:

- *Exclusion pests* – these are considered likely to be of net benefit because of the small costs involved and the potential costs of establishment of the Exclusion pests, which are known to have had impacts elsewhere.

- *The Site led pests programme* - is considered likely to have a net benefit because of the requirement for land holder agreement, which suggests that the costs of control will be exceeded by the benefits to the parties involved.

The results of this analysis are reflected in the proposed management options for each pest candidate in the Proposal for the Southland Regional Pest Management Plan.

EXCLUSION ANIMALS

Rook

Description
Rooks are large, glossy, purplish-black birds and members of the crow family. The rook has a prominent, powerful bill and whitish patches of skin show around the base of its pale beak. Larger than a magpie, it weighs around 400 grams and is 45 centimetres long. Rooks announce their presence with a distinctive 'kaah', and as they fly they 'caw' to keep in contact with each other.

The rook is a highly gregarious bird species, foraging daily from either rookeries or communal winter roosts. During breeding (August-January), all birds live in rookeries, often the same sites used in previous breeding seasons. The males who forage for the family group make numerous individual forays, averaging less than one kilometre, to communal feeding grounds. At other times of the year, birds spend each night in communal roosts. Feeding forays at such times range up to 20 kilometres.

Rooks show a strong preference for foraging in fields of cereals at all stages of the crop, in recently cultivated land, and in stands of walnut trees. Feeding ranges are influenced by the occurrence of highly preferred foods, with extensive flights being made to walnut trees and to recently tilled fields. Large flocks of rooks can severely damage or destroy newly emerging crops or pasture.

Rooks can adversely impact production and economic well-being.

Proposed programme
Environment Southland is proposing an exclusion programme for rooks.

Level of analysis
Rooks are considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. Costs and benefits for exclusion programmes generally have also been considered in Section 12 of the cost benefit analysis undertaken by an independent economist.

NPD section 6 - assessment

Options for response
The analysis considers two options for rooks:
1. do nothing;
2. exclusion.

Benefits and costs of options for management of rooks

Benefits and costs of rook management options

Option	Costs	Benefits
Do nothing	Rooks will colonise and increase. Rooks will establish and cause economic impacts to occupiers and become a nuisance pest due to the noise they make. Occupiers may use ineffective control options.	None identified.
Exclusion	Currently low cost for staff time, inspections, communication and engagement.	No impacts on crops and pasture by excluding rooks from the region. Rookeries will not be able to establish.

Risks of rook exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Unable to control rook populations, i.e. control methods are limited in number and effectiveness and relatively expensive.	Low - given successful reduction of population since 2002.	High - if rook incursion from Otago increased dramatically.	Crop damage would be high. Control costs would be high.	Ensure that Otago controls rooks to low levels. Communications and engagement.
Extent to which the option will be implemented and complied with	Occupiers do not comply and attempt control unsuccessfully.	Low - given recent history of occupier cooperation.	Low.	Control costs would increase.	Awareness programmes to educate occupiers.
Risk that compliance with other legislation will adversely affect implementation	Animal welfare.	Low - given recent control history.	Low.	Inability to use current control tools.	Ensure that all animal welfare standards are observed.
Risk that public or political concerns will adversely affect implementation	Opposition to rook management.	Low - but animal welfare groups may object.	Low.	Inability to use current control tools.	Ensure that all animal welfare standards are observed.
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of rooks

The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - the Southland community by protection of biodiversity from rook impacts;
  - occupiers – economic impacts protected;
- active exacerbators: occupiers who knowingly see, harbour and disturb rooks;
- passive exacerbators: occupiers with crops, young grass, and other habitat favourable (tall trees).

Matters for consideration in allocation of costs of proposed rook programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed rook programme

Legislative rights and responsibilities	None known.
Management objectives	Exclusion.
Stage of infestation	Low - occasional cross regional boundary sightings.
Most effective control agents	Environment Southland staff and/or approved contractors using recognised and effective methods i.e. poisoning, shooting.
Urgency	High.
Efficiency and effectiveness	High - if undertaken in an effective and timely manner by Environment Southland there will be no need for occupier costs and agreements.
Practicality of targeting beneficiaries	Low - rooks are transient and may frequent several properties. Immediate, timely control is priority.
Practicality of targeting exacerbators	Low - rooks are transient and may frequent several properties which limits timeframes for control options.
Administrative efficiency	High - if resources are available to Environment Southland and were to include ongoing liaison with Otago Regional Council. Efficiency would be lost if responsibility was on occupiers who may choose less effective control methods (or none).
Security	High for Environment Southland with funding available for an exclusion pest.
Fairness	Timely control, effective results, wider community benefit.
Reasonable	Environment Southland has more resources available than occupiers, more effective outcomes.
Parties bearing indirect costs	Not applicable.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	Not applicable.

Proposed allocation of costs

It is proposed that costs of undertaking the Exclusion programme for rooks be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	-	-	-

Wallaby

(Bennett's, Dama, Parma, Brushtail Rock and Swamp)

Description

Wallaby is a kangaroo-like marsupial animal standing 0.5 (Dama) -1.5 (Bennett's) metres tall with tails as long as half their height. They range in weight from approximately five kilograms to in excess of twenty kilograms. Their fur colour varies from grey to reddish brown.

Wallabies are capable of causing significant adverse environmental effects. These include preventing the regeneration of native bush, depletion of forest under storey and possible impacts on water quality. They also damage tall tussock grasslands, including the inter-tussock vegetation which can become depleted with a consequent increase in bare ground and higher risk of soil erosion.

Adverse economic effects include damage to pasture with anecdotal evidence of complete clearance of cover in places. There is evidence of wallabies grazing on green feed crops particularly where these border suitable cover. Wallabies also damage exotic forests, particularly at the establishment stage, with damage being more serious in areas bordering native bush or scrub areas.

Proposed programme

Environment Southland is proposing an exclusion programme for wallaby.

Level of analysis

Wallaby are considered to require a medium level of analysis when assessed according to the NPD guidance document. Costs and benefits for exclusion programmes generally have also been considered in Section 12 of the cost benefit analysis undertaken by an independent economist.

Method

A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response

The analysis considers two options for wallaby:

1. do nothing;
2. exclusion.

Benefits and costs of options for management of wallaby

Benefits and costs of wallaby management options

Option	Costs	Benefits
Do nothing	Low costs unless wallabies are released in Southland, then high costs (If occupiers choose to control). Occupiers unlikely to use effective methods if populations establish. Many ideal habitat areas in Southland. Economic and environmental impacts would be high.	None identified.
Exclusion	Currently low costs in staff time, communications and engagement to meet exclusion objectives.	Environment Southland able to act immediately to any incursion at a relatively low cost preventing environmental and economic impacts from occurring.

Risks of wallaby exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Illegal releases.	Low.	Providing people can be informed, educated and understand impact consequences.	High - risk of environmental damage and impacts.	Communication and engagement. Inspections, encourage reports.
Extent to which the option will be implemented and complied with	Non-reporting of wallaby sightings.	Low.	Relies on community support and reporting sightings.	Population may become established or spread before control.	Communication and engagement. Use contractors to assist in sightings.
Risk that compliance with other legislation will adversely affect implementation	Need for poisoning operation.	Low.	Timeframe for VTA MOH approvals.	Population spread, impacts on habitat.	
Risk that public or political concerns will adversely affect implementation	Hunting fraternity pressure to change status.	Low.	Unlikely to gain traction or favour with the Southland community	Damage and environmental issues well documented.	High – Communication and engagement.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of wallaby
The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - the Southland community through protection of environmental impacts;
  - occupiers with potential habitat through protection of economic values;
- active exacerbators: illegal releases;
- passive exacerbators: occupiers who allow releases or harbour known populations or allow increases.

Matters for consideration in allocation of costs of proposed wallaby programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed wallaby programme

Legislative rights and responsibilities	None once unknown organism status removed.
Management objectives	Exclusion of wallaby from Southland, currently not present.
Stage of infestation	Nil.
Most effective control agents	Environment Southland approved contractors.
Urgency	High - to prevent releases, populations establishing.
Efficiency and effectiveness	Preventing introduction and establishment is the most cost effective form of management.
Practicality of targeting beneficiaries	Occupiers of land containing potential wallaby habitat will be the principal beneficiaries. The Southland community will indirectly benefit by not having wallaby present on either private or Crown land in Southland and the freedom from economic and environmental impacts.
Practicality of targeting exacerbators	The principal exacerbators are any person who would seek to illegally introduce wallaby. If caught they could be prosecuted and any fines collected could be used to fund the exclusion programme.
Administrative efficiency	High for Environment Southland, low for occupiers who may use ineffective control methods or fail to do timely control.
Security	High for Environment Southland with funding available for an exclusion pest.
Fairness	Timely control, effective results, community benefit.
Reasonable	Environment Southland has more resources available than occupiers, more effective outcomes.
Parties bearing indirect costs	Not applicable.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	Not applicable.

Proposed allocation of costs

It is proposed that costs for undertaking the exclusion programme for Wallaby be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	-	-	-

EXCLUSION PLANTS

Boneseed

Description
Boneseed is an evergreen shrub reaching up to three metres tall. The leaves are dull green, toothed and covered with a cottony down. Daisy-like flowers are produced in bright yellow clusters from late winter until late summer.

The plant gets its name from its hard, bone-coloured seed. They have a thin, fleshy cover, initially green but changing to black upon ripening. Up to 50,000 seeds per plant can be produced in one year and can remain viable for up to 10 years. Seed dispersal occurs locally by birds and by water.

A tolerance of dry, infertile soils allows boneseed to colonise and establish easily in coastal areas. While thought to be restricted to frost free areas, that may not be the case. Absence of grazing animals also aids its establishment.

Boneseed's vigorous growth will displace desirable plants, shade out native seedlings and reduce or prevent public access to coastal and beach areas. It is highly flammable and will regenerate prolifically after fire. It can cause adverse effects to environmental and recreational values.

Proposed programme
Environment Southland is proposing an exclusion programme for boneseed.

Level of analysis
Boneseed is considered to require a low level when assessed according to the NPD guidance document. Costs and benefits for exclusion programmes generally have also been considered in Section 12 of the cost benefit analysis undertaken by an independent economist.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for boneseed:
1. do nothing;
2. exclusion.

Benefits and costs of options for management of boneseed

Benefits and costs of boneseed management options

Option	Costs	Benefits
Do nothing	No costs associated with this option unless boneseed establishes. Costs incurred will be to ecosystems and biodiversity in coastal areas.	None identified.
Exclusion	Low costs for raising awareness and responding to reports of boneseed in the region.	Protection of environmental, economic and social values as described in impact assessment.

Risks of boneseed exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk of boneseed entering the region and not being reported. Potential to establish in isolated coastal locations.	Low – unwanted organism so prevented from human-assisted dispersal. Known distribution suggests low risk of entering region from dispersal by birds and animals.	Medium – due to uncertainty of achieving early detection of boneseed.	Prevention of loss of ecosystem function and reduction in biodiversity.	Raise awareness about boneseed. Investigate any potential reports of boneseed.
Extent to which the option will be implemented and complied with	Presence of boneseed not reported.	Medium.	High.	As above.	Encourage reports of boneseed.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of boneseed as being of community benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of boneseed
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: none as boneseed is not present in the region;
- passive exacerbators: any person who does not report the presence of boneseed.

Matters for consideration in allocation of costs of proposed boneseed programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed boneseed programme

Legislative rights and responsibilities	None known.
Management objectives	Exclusion.
Stage of infestation	Not present in region.
Most effective control agents	Not required.
Urgency	Low – boneseed is an unwanted organism. Knowingly spreading boneseed is prohibited. Dispersal into region by birds or animals unlikely based on known distribution.
Efficiency and effectiveness	Exclusion programme is efficient and effective given boneseed is not present in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended for exclusion pests.
Practicality of targeting exacerbators	None – there are no exacerbators as boneseed is not present in the region.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and monitoring costs.
Security	General rate will secure funding for inspections and monitoring for boneseed over five years.
Fairness	It is considered fair to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an exclusion plan. Transitional costs may be needed if boneseed does establish in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the exclusion programme for boneseed be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	-	-	-

Chilean needle grass

Description
Chilean needle grass is a tufted perennial plant growing to one metre in the absence of grazing. Its leaves are bright green and harsh to the touch. Identification within grazed pasture is difficult prior to flower emergence in October.

The flowers have a purple tinge and ripen into hard, sharp seeds with long twisting tails. These aid the seed in the penetration of the animal's skin and the soil. It also produces viable seeds in its mid and basal stem regions (cleistogenes).

Plants will grow into dense stands and exclude other indigenous and exotic grassland species. Chilean needle grass reduces the livestock carrying capacity of pastures due to the production of masses of unpalatable flower stalks. The sharp penetrating seeds injure livestock and result in the downgrading of wool, skins and hides. The seed can move through an animal's skin into body muscles, causing abscesses and the downgrading of carcasses. Lambs are particularly vulnerable to seeds penetrating their eyes causing blindness.

The point of the seed is extremely sharp and hairy so catches onto passing animals, vehicles, and humans. As a result it can be transported considerable distances to new sites. Chilean needle grass can cause adverse effects to pastoral production and economic well-being.

Proposed programme
Environment Southland is proposing an exclusion programme for Chilean needle grass.

Level of analysis
Chilean needle grass is considered to require a medium level of analysis when assessed according to the NPD guidance document. Costs and benefits for exclusion programmes generally have also been considered in Section 12 of the cost benefit analysis undertaken by an independent economist.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for Chilean needle grass:
1. do nothing;
2. exclusion.

Benefits and costs of options for management of Chilean needle grass

Benefits and costs of Chilean needle grass management options

Option	Costs	Benefits
Do nothing	No costs associated with this option unless Chilean needle grass establishes. Costs to pastoral production and animal welfare will be incurred.	None identified.
Exclusion	Low costs for raising awareness and responding to reports of Chilean needle grass in the region.	Prevention of damage to pastoral production and animal welfare.

Risks of Chilean needle grass exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Major risk if Chilean needle grass is brought into region via animal or stock feed movements. Chilean needle grass can be difficult to identify.	Medium – stock from Chilean needle grass affected areas are moved into the region at times.	High – due to uncertainty of achieving early detection of Chilean needle grass.	Prevention of damage to pastoral production and animal welfare.	Raise awareness about Chilean needle grass. Investigate any potential reports of Chilean needle grass. Ensure stock and feed from affected areas are inspected prior to entering the region.
Extent to which the option will be implemented and complied with	Unknown movement of Chilean needle grass via animals or stock feed. Presence of Chilean needle grass not reported.	Medium.	High.	As above.	Encourage reports of Chilean needle grass.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Social stigma of being a Chilean needle grass-infested property may deter reporting.	Low.	Low.	As above.	Encourage reports of Chilean needle grass as being of personal and community benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Chilean needle grass
The beneficiaries and exacerbators of the programme are:

- beneficiaries: all pastoral farmers;
- active exacerbators: none as Chilean needle grass is not present in the region;
- passive exacerbators: any person who does not report the presence of Chilean needle grass.

Matters for consideration in allocation of costs of proposed Chilean needle grass programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Chilean needle grass programme

Legislative rights and responsibilities	None known.
Management objectives	Exclusion.
Stage of infestation	Not present in region.
Most effective control agents	Not required.
Urgency	Low – Chilean needle grass is an unwanted organism. Knowingly spreading Chilean needle grass is prohibited.
Efficiency and effectiveness	Exclusion programme is efficient and effective given Chilean needle grass is not present in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended for exclusion pests.
Practicality of targeting exacerbators	None – there are no exacerbators as Chilean needle grass is not present in the region.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and monitoring costs.
Security	General rate will secure funding for inspections and monitoring for Chilean needle grass over five years.
Fairness	It is considered fair to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an exclusion plan. Transitional costs may be needed if Chilean needle grass does establish in the region.
Mechanisms available	General rate, targeted rate on productive land and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the Exclusion programme for Chilean needle grass be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	-	-	-

Nasella tussock

Description
Nassella tussock is a tufted, perennial, tussock grass with fine, tightly rolled, light green or yellowish-green leaves. The plants are erect when young but slightly drooping with age and grow up to 70 centimetres tall and 80 centimetres wide. When fingers are run down the leaf, they feel needle-like and very tough. The stem is swollen just above ground level, like a shallot.

Flowering usually commences in October and is characterised by a purplish tinge that enhances the plant's visibility. Flower heads are open, with a branched seed head 25-95 centimetres long, and produced between November and January. Each mature plant can produce up to 100,000 seeds per year. Ripe seeds are purplish with a three centimetre long bristle.

Roots are deep, matted and fibrous. They have been found growing 1.7 metres below the soil surface.

Nassella tussock adversely affects production values due to reduced pasture quality and it also affects environmental values by displacing native species in tussock grassland.

Nassella tussock is not known to occur in Southland but it is known to occur in Otago near Roxburgh, Alexandra and in the Cardrona Valley.

Proposed programme
Environment Southland is proposing an exclusion programme for nassella tussock.

Level of analysis
Nassella tussock is considered to require a medium level of analysis when assessed according to the NPD guidance document. Costs and benefits for exclusion programmes generally have also been considered in Section 12 of the cost benefit analysis undertaken by an independent economist.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for nassella tussock:
1. do nothing;
2. exclusion.

Benefits and costs of options for management of nassella tussock

Benefits and costs of nassella tussock management options

Option	Costs	Benefits
Do nothing	No costs associated with this option unless nassella tussock establishes. Costs to pastoral production and loss of biodiversity in tussock grasslands will be incurred.	None identified.
Exclusion	Low costs for raising awareness and responding to reports of nassella tussock in the region.	Prevention of damage to pastoral production and loss of biodiversity values.

Risks of nassella tussock exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Potential risk of nassella tussock entering the region if it becomes more widespread in Otago, possibly as a contaminant in stock feed.	Low – control programme in Otago has ensured this is a low risk.	High - due to uncertainty of achieving early detection of nassella tussock.	Prevention of damage to pastoral production and loss of biodiversity.	Raise awareness about nassella tussock. Investigate any potential reports of nassella tussock.
Extent to which the option will be implemented and complied with	Presence of nassella tussock not reported.	Medium.	High.	As above.	Encourage reports of nassella tussock.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Social stigma of being a nassella tussock infested property may deter reporting.	Low.	Low.	As above.	Encourage reports of nassella tussock as being of personal and community benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of nassella tussock
The beneficiaries and exacerbators of the programme are:

- beneficiaries: all pastoral farmers and the Southland community;
- active exacerbators: none as nassella tussock is not present in the region;
- passive exacerbators: any person who does not report the presence of nassella tussock.

Matters for consideration in allocation of costs of proposed nassella tussock programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed nassella tussock programme

Legislative rights and responsibilities	None known.
Management objectives	Exclusion.
Stage of infestation	Not present in region.
Most effective control agents	Not required.
Urgency	Low – nassella tussock is an unwanted organism. Knowingly spreading nassella tussock is prohibited.
Efficiency and effectiveness	Exclusion programme is efficient and effective given nassella tussock is not present in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended for exclusion pests.
Practicality of targeting exacerbators	None – there are no exacerbators as nassella tussock is not present in the region.
Administrative efficiency	General rate considered most efficient method of cost allocation for inspection and monitoring costs.
Security	General rate will secure funding for inspections and monitoring for nassella tussock over five years.
Fairness	It is considered fair to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and monitoring costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an exclusion plan. Transitional costs may be needed if nassella tussock does establish in the region.
Mechanisms available	General rate, targeted rate on productive land and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the exclusion programme for nassella tussock be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	-	-	-

ERADICATION PLANTS

Boxthorn

Description
Boxthorn is a dense, spiny evergreen shrub with white flowers and scarlet berries growing up to six metres tall, with many stems emanating from ground level. The plant is particularly invasive in coastal areas on sand dunes, cliffs, and islands. It over-tops native plant species and can become the only woody plant species at a site. Seabirds can become entangled in its tough spiny thorns, often causing their deaths.

The Department of Conservation is working towards eradication of boxthorn in Southland.

Proposed programme
Environment Southland is proposing an eradication programme for boxthorn.

Level of analysis
Boxthorn is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for boxthorn:
1. do nothing;
2. eradication.

Benefits and costs of options for management of boxthorn

Benefits and costs of boxthorn management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing		Replacement of native plant species in coastal areas. Increase in death of seabirds. Increased injury to grazing animals from spines.	None identified.
Eradication	Six hours staff time and less than $50 for herbicide	Low costs for raising awareness and responding to report of boxthorn.	Prevention of replacement of native plants in coastal areas. Prevention of injury or death to seabirds and grazing animals.

Risks of boxthorn eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that search and control programme for boxthorn is discontinued by Department of Conservation.	Low.	Medium.	Prevention of replacement of native plants in coastal areas. Prevention of injury or death to seabirds and grazing animals.	Ensure continuity of the programme remains a priority for Department of Conservation.
Extent to which the option will be implemented and complied with	Presence of boxthorn not reported.	Low.	Medium.	As above.	Encourage reports of boxthorn.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Not considered to be a risk factor if boxthorn is specified as a pest.				
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of boxthorn
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community through prevention of loss of public good benefits;
- active exacerbators: any person who knowingly does not report the presence of boxthorn;
- passive exacerbators: any person who unknowingly does not report the presence of boxthorn.

Matters for consideration in allocation of costs of proposed boxthorn programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed boxthorn programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag.
Most effective control agents	Department of Conservation.
Urgency	High.
Efficiency and effectiveness	An eradication programme is efficient and effective given boxthorn is only known at one site in the region.
Practicality of targeting beneficiaries	It is considered more practical for the Department of Conservation to fund the programme as there is only one site.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	It is considered more efficient for the Department of Conservation to administer the programme as there is only one site.
Security	Funding is considered secure as long as it remains a priority for the Department of Conservation.
Fairness	It is considered fair for the Department of Conservation to fund programme costs due to public good benefits.
Reasonable	It is considered reasonable for the Department of Conservation to fund programme costs due to public good benefits.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if boxthorn is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the eradication programme for boxthorn be covered by the Department of Conservation.

Field horsetail

Description
Field horsetail is an herbaceous perennial plant with deep growing rhizomes and tends to grow in damp places. Fertile (reproductive) stems are produced in early spring and are non-photosynthetic. They are whitish to light brown, hollow, cylindrical, jointed, unbranched, leafless, about eight millimetres in diameter and 15-20 centimetres long. Tips of fertile stems end in a yellowish to brownish cone (strobilus) about 12-30 millimetres long, which produces spores. Once spores have been produced, fertile stems wither and die, usually in early summer.

Sterile (vegetative) stems start to grow after the fertile stems have wilted, and persist through summer until the first autumn frosts. These stems are green, either erect or somewhat prostrate, 15-60 centimetres tall and composed of slender, grooved, hollow joints, which are 1-1.5 millimetres in diameter. Sterile stems look like miniature pine trees with their plume-like branches. Their appearance also explains the plant's common name of 'horsetail'.

The plant is toxic to horses, sheep and cattle, according to overseas reports, and its high silica content can adversely affect teeth and gums of grazing stock. It can cause milk taint in dairy pastures. While it can reduce crop yields drastically, if present in sufficient quantity, it will not compete well with healthy pasture.

Invasive in wet places, it forms dense stands which can prevent the regeneration of other species, block waterways, contributing to flooding and siltation.

Proposed programme
Environment Southland is proposing an eradication programme for field horsetail.

Level of analysis
Field horsetail is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for field horsetail:
1. do nothing;
2. eradication.

Benefits and costs of options for management of field horsetail

Benefits and costs of field horsetail management options

Option	Costs	Benefits
Do nothing	Costs to the economy and environment will be incurred if field horsetail is allowed to spread further in the region.	None identified.
Eradication	Low costs for monitoring and control at one known site in the region. Additional costs expected for raising awareness and responding to reports of field horsetail in the region.	Protection of economic and environmental values.

Risks of field horsetail eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that control measures for field horsetail are not completely effective. Risk that field horsetail is already established at other unknown locations.	Medium - field horsetail has proven difficult to control once established.	Medium – due to uncertainty that only one site is present in the region.	Prevention of loss of ecosystem function and reduction in biodiversity. Prevention of loss of production and blockage of waterways.	Investigate control options for field horsetail. Raise awareness about field horsetail. Investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of field horsetail not reported.	Medium – difficulty with identification may prevent reports.	High.	As above.	Encourage reports of field horsetail.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of field horsetail as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of field horsetail
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of field horsetail through their actions;
- passive exacerbators: any person who does not report the presence of field horsetail.

Matters for consideration in allocation of costs of proposed field horsetail programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed field horsetail programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag.
Most effective control agents	Environment Southland.
Urgency	High.
Efficiency and effectiveness	An eradication programme is efficient and effective given field horsetail is only known at one site in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for field horsetail over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if field horsetail is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs
It is proposed that costs for undertaking the eradication programme for field horsetail be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

German ivy

Description
German ivy is a scrambling perennial vine growing up to more than three metres high. It has thin, broad leaves and produces yellow flowers in dense clusters, from May to October.

The plant is invasive in a wide range of habitats, including coastal areas and lowland forest margins, shrubland, roadsides, quarries, swamps and other damp areas. It smothers small trees and lower vegetation. Once present at a site it often leads to the invasion of more aggressive plant species.

Proposed programme
Environment Southland is proposing an eradication programme for German ivy.

Level of analysis
German ivy is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for German ivy:
1. do nothing;
2. eradication.

Benefits and costs of options for management of German ivy

Benefits and costs of German ivy management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No costs associated with this option.	Costs to environmental values will be incurred if German ivy is allowed to spread further. Impacts upon ecological processes and biological diversity.	None identified.
Eradication	Eradication programme has cost on average $3200/year over the last three years (excludes Department of Conservation funded programme on Stewart Island/Rakiura).	No qualitative costs associated with an eradication programme.	Protection of environmental values – scrubland and forest edges in coastal areas in particular.

Risks of German ivy eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that control measures for German ivy are not completely effective. Risk that German ivy is already established at other unknown locations.	Low – control measures have proven effective. Awareness over recent years has not generated new sites.	Low.	Prevention of loss of ecosystem processes and reduction in biodiversity.	Continue to raise awareness about German ivy, and investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of German ivy is not reported.	Medium – difficulty identifying German ivy may prevent reports.	High.	As above.	Encourage reports of German ivy.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of German ivy as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of German ivy
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of German ivy through their actions;
- passive exacerbators: any person who does not report the presence of German ivy.

Matters for consideration in allocation of costs of proposed German ivy programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed German ivy programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag – largely due to control programme.
Most effective control agents	Environment Southland (mainland Southland) and the Department of Conservation (Stewart Island/Rakiura).
Urgency	Medium.
Efficiency and effectiveness	An eradication programme is efficient and effective given German ivy is only known at 22 sites in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for German ivy over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if German ivy is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the eradication programme for German ivy be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Parrots feather

Description
Parrots feather is a bottom-rooted, perennial floating and emergent plant with stolons, fibrous roots, and stems (five millimetres diameter) that grow to two metres long (three to four metres in flowing water) emerging 10 centimetres above water and rooting at lower nodes, with submerged parts become bare. Feather-like blue-green leaves (25-45 x 7-15 millimetres) are in whorls of five or six, and are each divided into 25-30 leaflets (seven millimetres long). From September to February, minute female flowers are produced, but no seed is set in New Zealand.

It is spread by flowing water, and new water bodies are infested by fragments spread by boats and trailers, eel nets, diggers, and people 'liberating' fish.

The plant forms dense mats, shading out existing native species and preventing new seedlings of native species from establishing, and replaces species that usually grow on the margins of waterbodies. Large clumps dislodge, causing flooding, and rotting vegetation stagnates water, killing fauna and flora.

Proposed programme
Environment Southland is proposing an eradication programme for parrots feather.

Level of analysis
Parrots feather is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for parrots feather:
1. do nothing;
2. eradication.

Benefits and costs of options for management of parrots feather

Benefits and costs of parrots feather management options

Option	Costs	Benefits
Do nothing	Costs to the economy and environment will be incurred if parrots feather is allowed to spread further in the region.	None identified.
Eradication	Low costs for monitoring and control at one known site in the region. Additional costs expected for raising awareness and responding to reports of parrots feather in the region.	Protection of economic and environmental values, as well as social and cultural wellbeing.

Risks of parrots feather eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that control measures for parrots feather are not completely effective. Risk that parrots feather is already established at other unknown locations.	Medium – control options for aquatic plants are limited.	Medium – due to uncertainty that only one site is present in the region.	Prevention of loss of ecosystem function and reduction in biodiversity. Prevention of loss of recreational activities and blockage of waterways.	Investigate control options for parrots feather. Raise awareness about parrots feather, and investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of parrots feather not reported.	Medium	Medium	As above.	Encourage reports of parrots feather.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of parrots feather as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of parrots feather
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community
- active exacerbators: any person who contributes towards the spread of parrots feather through their actions
- passive exacerbators: any person who does not report the presence of parrots feather

Matters for consideration in allocation of costs of proposed parrots feather programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed parrots feather programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag.
Most effective control agents	Environment Southland.
Urgency	High.
Efficiency and effectiveness	An eradication programme is efficient and effective given parrots feather is only known at one site in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for parrots feather over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if parrots feather is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for parrots feather be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Purple loosestrife

Description
Purple loosestrife is an erect, hairy summer-green perennial herb. It has many-branched stems that grow to one to two metres tall, are pink at the base and die off in winter. The leaves occur opposite each other along the stems. Its flower head is a terminal spike 20 to 25 centimetres long with many purple-magenta flowers found from December to February. Mature plants are capable of producing more than two million seeds in one growing season.

The plant is invasive along the margins of wetlands, lakesides, streams, ditches and other damp areas. It can form large impenetrable stands that exclude all other species. It destroys wetland habitat for fish and bird species and can cause blockages to waterways which can contribute to flooding.

Global Invasive Species Database lists purple loosestrife in the worse 100 most invasive species worldwide. Climex models for purple loosestrife in Southland show the climate is suitable for the spread of this plant here. Purple loosestrife invades a variety of wetland habitats, including marshes, river and stream riparian, pond edges, lakes, roadside ditches, and reservoirs. This plant forms dense thickets, outcompetes and replaces native grasses, sedges and other flowering plants that provide a higher quality food source and habitat for wildlife. It destroys wetland habitat for fish and bird species and can cause blockages, which can contribute to flooding. It is only known at a few low incidence sites known, mainly in domestic gardens.

Proposed programme
Environment Southland is proposing an eradication programme for purple loosestrife.

Level of analysis
Purple loosestrife is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers four options for purple loosestrife:
1. do nothing;
2. eradication;
3. progressive containment;
4. site-led.

Benefits and costs of options for management of purple loosestrife

Benefits and costs of purple Loosestrife management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing		Low.	Low - because of the potential to spread into and dominate sensitive wetland environments.
Eradication	$5000/year.	Low.	High - if eradication at few known low incidence sites is achieved.

Option	Basic economic assumptions	Costs	Benefits
Progressive containment		Low.	Medium – leaving any plants will lead to further spread.
Site-led		Low.	Not applicable.

Risks of purple loosestrife eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Low – eradication should be possible at a few low incidence sites mainly in gardens.	Medium.	High.	Infestation of sensitive areas, mainly wetland, by a highly invasive exotic weed and loss of biodiversity values. Restriction of waterways.	
Extent to which the option will be implemented and complied with	If designated as an eradication pest – surveillance, control and compliance measures will achieve the goal.	Low.	Low.	As above.	
Risk that compliance with other legislation will adversely affect implementation	Purple loosestrife is on the National Pest Plant Accord which bans sale of the plant. This reinforces the eradication goal.	Low.	Low.	As above.	
Risk that public or political concerns will adversely affect implementation	Unlikely although some occupiers may object to removal.	Low.	Low.	As above.	
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of purple loosestrife
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who propagates and transports purple loosestrife;
- passive exacerbators: occupiers who have purple loosestrife on their land.

Matters for consideration in allocation of costs of proposed purple loosestrife programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed purple loosestrife programme

Legislative rights and responsibilities	Purple loosestrife is designated as an unwanted organism under the Pest Plant Accord which bans sale, propagation and distribution but does require control of plants that have already established.
Management objectives	To eradicate purple loosestrife from Southland.
Stage of infestation	A small number of low incidence sites known.
Most effective control agents	A regional pest management plan with an eradication objective for purple loosestrife under which a programme of surveillance, control and compliance can be delivered.
Urgency	Medium - experience from other countries has shown that purple loosestrife can spread quickly when conditions are favourable.
Efficiency and effectiveness	A funded work programme under the proposed Regional Pest Management Plan is the most cost effective approach.
Practicality of targeting beneficiaries	Occupiers are the beneficiaries who could contribute to a regional work programme via a targeted council rate.
Practicality of targeting exacerbators	Those who cultivate or spread purple loosestrife may be targeted by the compliance provisions of the Plan.
Administrative efficiency	As above.
Security	As above.
Fairness	A regionally funded programme under the proposed Regional Pest Management Plan is considered the fairest approach.
Reasonable	As above.
Parties bearing indirect costs	Southland ratepayers.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	Regional rating under the Local Government Act.

Proposed allocation of costs
It is proposed that costs for undertaking the eradication programme for purple loosestrife be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
-	100%	-	100%	-

Smilax

Description
Smilax is a scrambling, slightly woody perennial vine. It has slender wiry stems that can climb up to three metres high. The leaves are an ovalish, flat shape, with a pointed tip and have approximately seven veins, evident on the upper surface. Small greenish-white flowers appear in July and August, followed by round red berries. The plant produces tubers near the surface that allow it to survive and re-sprout after stems have been cut or the foliage sprayed with herbicide.

Smilax smothers low growing plants and seedlings, usually in low canopy habitats such as coastal and estuarine areas, roadsides, hedgerows and bare sites.

Proposed programme
Environment Southland is proposing an eradication programme for smilax.

Level of analysis
Smilax is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for smilax:
1. do nothing;
2. eradication.

Benefits and costs of options for management of smilax

Benefits and costs of smilax management options

Option	Costs	Benefits
Do nothing	Loss of biodiversity will be incurred if smilax is allowed to spread further in the region.	None identified.
Eradication	Low costs for monitoring at five known sites in the region. Additional costs expected for raising awareness and responding to reports of smilax in the region.	Protection of environmental values in the region.

Risks of smilax eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that control measures for smilax are not completely effective. Risk that smilax is already established at other unknown locations.	Medium - due to uncertainty that smilax is only known at five sites in the region.	Medium.	Protection of environmental values in the region.	Raise awareness about smilax, and investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of smilax not reported.	Medium.	Medium.	As above.	Encourage reports of smilax.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of smilax as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of smilax
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who propagates and transports smilax;
- passive exacerbators: occupiers who have smilax on their land.

Matters for consideration in allocation of costs of proposed smilax programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed smilax programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag.
Most effective control agents	Environment Southland.
Urgency	High.
Efficiency and effectiveness	An eradication programme is efficient and effective given smilax is only known at five sites in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for smilax over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the Southland region.
Reasonable	As above.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if field horsetail is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the Eradication programme for smilax be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Spartina

Description
Spartina is a perennial estuarine sward grass, commonly one metre tall and growing in shallow saltwater. It has stiff, upright stems, originating from thick rhizomes. The stems have broad, pointed leaves from their base to the top, where several long fingers contain the seed. New growth occurs from either root pieces or seed. Shoots rapidly sprout from underground rhizomes, while the seed falls into the water and floats away.

Colonies of spartina form dense grassy clumps, and these can spread laterally from underground rhizomes, or by overground side shoots (tillers). Within the estuarine area, vast meadows can form causing a build-up of sediment. This can increase the risk of flooding and also alter the habitat for wading bird species and other estuarine flora and fauna.

The Department of Conservation is working towards the eradication of spartina in Southland.

Proposed programme
Environment Southland is proposing an eradication programme for spartina.

Level of analysis
The assessment of spartina is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. The qualitative assessment is supplemented by inputting basic economic assumptions.

NPD section 6 - assessment

Options for response
The analysis considers three options for spartina:
1. do nothing;
2. eradication;
3. progressive containment.

Benefits and costs of options for management of spartina

Benefits and costs of spartina management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No costs associated with this option.	Increased risk of flooding due to build-up of sediment in estuaries. Reduced habitat for wading birds and reduced diversity of estuarine flora and fauna.	None identified.
Eradication	Current budget is $20,000 for eradication.	Low costs for raising awareness and responding to reports of spartina.	Reduced risk of flooding. Protection of habitat for wading birds, and estuarine flora and fauna.
Progressive containment	Estimate of $20,000 based on current budget.	Low costs for raising awareness and responding to	Reduced risk of flooding. Protection of habitat for wading birds, and estuarine

Option	Basic economic assumptions	Costs	Benefits
		reports of spartina.	flora and fauna.

Risks of spartina eradication programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Lack of experienced personnel to complete search and control. Risk that all plants are not found.	Medium - currently using detection dog.	High.		Ensure there are sufficient personnel trained to search. Ensure dog and handler are trained and available for detection.
Extent to which the option will be implemented and complied with	Presence of spartina not reported.	Low.	High.		Encourage reports of spartina.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Not considered to be a risk factor if spartina is specified as a pest.				
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of spartina
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community through prevention of loss of community benefits;
- active exacerbators: any person who knowingly does not report the presence of spartina;
- passive exacerbators: any person who unknowingly does not report the presence of spartina.

Matters for consideration in allocation of costs of proposed spartina programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed spartina programme

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Lag.
Most effective control agents	Department of Conservation.
Urgency	High.
Efficiency and effectiveness	An eradication plan is effective and efficient given spartina is at low levels due to the success of the long-term control programme.
Practicality of targeting beneficiaries	It is considered more practical for the Department of Conservation to fund the programme rather than target beneficiaries as the Department of Conservation have managed the spartina programme over a long-term.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	It is considered more efficient for the Department of Conservation to administer the programme.
Security	Funding is considered secure as long as it remains a priority for the Department of Conservation.
Fairness	It is considered fair for the Department of Conservation to fund programme costs due to public good benefits.
Reasonable	It is considered reasonable for the Department of Conservation to fund programme costs due to public good benefits.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for an eradication plan. Transitional costs may be needed if spartina is found at other locations in the region.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the eradication programme for spartina be covered by the Department of Conservation.

PROGRESSIVE CONTAINMENT PLANTS

Bengal cat

Description
Bengal cats are an artificially created hybrid (F5) between the Asian leopard cat and the domestic cat. It was first introduced into New Zealand before 1998 when import restrictions were put in place.

The hybrid is a relatively large (4 to 9 kilograms), strong, agile animal with distinctive spotted markings which has, in recent times, made it a popular cat breed. It is well documented that some Bengal cats have behaviours which make them unattractive as pets and increases the risk of owners wishing to get rid of them at worst by release into the wild. There has been wide concern expressed internationally and in New Zealand the 'wild genetic' traits in the hybrid will make it a very successful and dangerous predator if it became established in the wild and interbred with the feral cat population. The wild ancestor Leopard cats are carnivorous, feeding on a variety of small prey including mammals, lizards, amphibians, birds and insects. In most parts of their range, small rodents such as rats and mice form the major part of their diet, which is often supplemented with grass, eggs, poultry, and aquatic prey. Bengal cats may predate on a wider range of native species than feral cats because of their larger size. For example, adult kiwi and weka would be at risk from a cat of this size.

They are active hunters, dispatching their prey with a rapid pounce and bite. Unlike many other small cats, they do not "play" with their food, maintaining a tight grip with their claws until the animal is dead. This may be related to the relatively high proportion of birds in their diet, which are more likely to escape when released than are rodents. While there is no direct evidence that Bengal cats or other hybrid cats have become wildlife predators in New Zealand or elsewhere their strong hunting traits, their size and intelligence suggests that they could become so if allowed.

In the last 150 years there have been numerous biosecurity mistakes made in New Zealand through introduction of exotic animals which established in the wild and have devastated native wild life, e.g. mustelids, rodents, possums, cats. On this basis there is a strong rationale for continuing to maintain a precautionary approach here in Southland. Bengal cats may predate on a wider range of native species than feral cats because of their larger size, e.g. adult kiwi and weka. It is also possible that Bengal cats could also predate small farmed livestock such as lambs and chickens. Accordingly there would be at significant risk from a cat of this size and its adverse effects on matters mentioned in s54a Biosecurity Act.

Proposed programme
Environment Southland is proposing a progressive containment programme for Bengal cats.

Level of analysis
The assessment of Bengal cat is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. The qualitative assessment is supplemented by inputting basic economic assumptions.

NPD section 6 - assessment

Options for response

The analysis considers three options for Bengal cats:

1. do nothing;
2. exclusion - currently in the Regional Pest Management Strategy, now with exemptions issued for 20 owned Bengal cats;
3. progressive containment.

Benefits and costs of options for management of Bengal cat

Benefits and costs of Bengal cat management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing	There is only a small potential regional trade in Bengal cat breeding.	High, determinably effect native biodiversity.	Low. Some benefits to people whole like to keep domestic cats as companion animals.
Progressive containment		Low: costs associated with maintaining a database of registered animals.	High, prevents the establishment of wild Bengal cat populations and the interbreeding of Bengal cats with other feral cat population, reducing the impacts on indigenous biodiversity values.

Risks of Bengal cat progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Some cat owners choose not to neuter, microchip or register their Bengal cats and these escape into the wild.	Low.	High.	Native birds and reptiles and potentially small livestock e.g. lambs, hens.	Low.
Extent to which the option will be implemented and complied with	It is expected that most Bengal cat owners will comply.	Low.	Low.	Native birds and reptiles and potentially small livestock e.g. lambs, hens.	
Risk that compliance with other legislation will adversely affect implementation	None known.				
Risk that public or political concerns will adversely affect	Possible push back from cat fanciers. Breeders outside	Medium.	Medium.	Native birds and reptiles and potentially small livestock e.g.	Medium – through effective communication.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
implementation	of Southland likely to support to eliminate possible competition from breeders in Southland.			lambs, hens.	
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Bengal cats
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: owners of Bengal cats;
- passive exacerbators: breeders and sellers of Bengal cats outside of Southland.

Matters for consideration in allocation of costs of proposed Bengal cat programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Bengal cat programme

Legislative rights and responsibilities	Able to own, keep and sell Bengal cats in New Zealand.
Management objectives	To contain owned Bengal cats to prevent their establishment in the wild and interbreeding with the feral cat population to produce a more effective predator.
Stage of infestation	Low – currently no record of escapes or interbreeding in Southland.
Most effective control agents	Retain in captivity and prevent breeding by neutering.
Urgency	Medium – current controls under the Regional Pest Management Strategy need to be maintained.
Efficiency and effectiveness	The costs of owners neutering, micro-chipping and registering their Bengal cats will significantly reduce the risks to native wildlife and small farmed animals.
Practicality of targeting beneficiaries	The Southland community will benefit from the reduced risk of another threat to native wildlife and livestock.
Practicality of targeting exacerbators	Owners of Bengal cats will be required to comply with the proposed Regional Pest Management Plan rules at the risk compliance action if they do not.
Administrative efficiency	The management of a register, undertaking inspections and checks can be done at a low cost.
Security	Environment Southland will be responsible for compliance with the proposed Regional Pest Management Plan rules.
Fairness	The owners of Bengal cats will bear the costs of managing the risks

	associated with their animals.
Reasonable	As above.
Parties bearing indirect costs	None.
Transitional cost allocation arrangements	Not applicable – existing regime will continue.
Mechanisms available	Not applicable.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Bengal cats be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Bomarea

Description
Bomarea is a shade tolerant, multi-stemmed vine that arises from short underground rhizomes, which bear numerous tubers. The flowers are clumped in a dense pendulous bunch of 15 to 20. The flowers are reddish on the outside and yellow with red spots on the inside, they develop into capsules about two centimetres in diameter. When these are ripe they split open to reveal bright fleshy orange seeds, which can be dispersed over long distances by birds.

An ornamental garden escapee, it invades alongside streams and river banks, shrublands, forest edges, forest remnants and intact low canopy forest. The vines grow into the forest canopy, forming large masses, which overtop and smother supporting trees. Large infestations can alter light levels in forests, kill mature trees and prevent seedlings from establishing.

Proposed programme
Environment Southland is proposing a progressive containment programme for bomarea.

Level of analysis
Bomarea is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for bomarea:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of bomarea

Benefits and costs of bomarea management options

Option	Costs	Benefits
Do nothing	Costs to environmental values described in impact assessment for bomarea.	None identified.
Progressive containment	No qualitative costs associated with a progressive containment programme.	Protection of environmental values described in impact assessment.

Risks of bomarea progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that bomarea is already established at other unknown locations.	High – reports from Stewart Island/Rakiura indicate bomarea is more widespread previously thought. Only one	High.	Prevention of loss of ecosystem processes and reduction in biodiversity.	Raise awareness about bomarea and investigate any potential reports.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
		site identified in mainland Southland but awareness of bomarea is low.			
Extent to which the option will be implemented and complied with	Presence of bomarea is not reported.	Medium.	High.	As above.	Encourage reports of bomarea.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of bomarea as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD Section 7 - Allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of bomarea
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of bomarea through their actions;
- passive exacerbators: any person who does not report the presence of bomarea.

Matters for consideration in allocation of costs of proposed bomarea programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed bomarea programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag phase on mainland Southland. Later lag phase – explosion phase on Stewart Island/Rakiura.
Most effective control agents	Environment Southland for mainland Southland, potential for the Department of Conservation on Stewart Island/Rakiura.
Urgency	High.
Efficiency and effectiveness	A progressive containment programme is efficient and effective for bomarea on mainland Southland given there is only one known site. The full extent on Stewart Island/Rakiura is yet to be determined.
Practicality of targeting beneficiaries	Funding from general rate recommended for bomarea on mainland Southland.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for bomarea over five years.
Fairness	It is considered fair to fund inspection and control costs for mainland Southland through a general rate as there is benefit to the Southland region.
Reasonable	As above.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for bomarea on mainland Southland be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Buddleja

Description
Buddleja is a multi-stemmed shrub growing up to three metres tall. It has willow-shaped leaves that are white or grey on the underside. The flower head is a distinctive, dense, cone-shaped panicle with small fragrant purple or white flowers found from December to February.

It forms dense, self-replacing thickets along forest margins, areas of revegetation, riverbeds and plantation forests (especially following disturbance) and waste ground. In riverbeds, buddleja can cause a build-up of material and increase the risk of flooding.

Proposed programme
Environment Southland is proposing a progressive containment programme for buddleja.

Level of analysis
Buddleja is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD Section 6 - assessment

Options for response
The analysis considers two options for buddleja:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of buddleja

Benefits and costs of buddleja management options

Option	Costs	Benefits
Do nothing	Costs to environmental values, forestry and water quality will be incurred if buddleja is spread further outside of cultivation and spread.	None identified.
Progressive containment	No qualitative costs associated with a progressive containment programme.	Protection of environmental, economic and social values described in impact assessment.

Risks of buddleja progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that buddleja establishes outside cultivation.	High – new sites outside cultivation have been found in recent years.	High.	Prevention of loss of environmental, economic and social values.	Raise awareness about buddleja and investigate any potential reports of buddleja establishing outside of cultivation.
Extent to which the option will be implemented and complied with	Presence of buddleja not reported.	Medium.	High.	As above.	Encourage reports of buddleja.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Buddleja is regarded as desirable by some people. This may prevent reporting of locations.	Low.	Low.	As above.	Encourage reports of buddleja outside cultivation as being of public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of buddleja
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of buddleja through their actions;
- passive exacerbators: any person who does not report the presence of buddleja outside of cultivation.

Matters for consideration in allocation of costs of proposed buddleja programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed buddleja programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag.
Most effective control agents	Environment Southland. Central government agencies (for Crown managed land).
Urgency	High.
Efficiency and effectiveness	A progressive containment programme is efficient and effective given buddleja is only known at a few sites outside cultivation.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs where buddleja is found outside cultivation.
Security	General rate will secure funding for inspections and control costs for buddleja over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	As above.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for buddleja be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Contorta pine and mountain pine

Description
Contorta pine is a small to medium sized pine tree, usually with twisted branches and paired needles. It is monoecious (both female and male parts on the same tree). Trees mature at approximately five years of age, though peak seed production occurs after eight to ten years. The seed cones take 15 months to mature and can contain up to 300,000 seeds/kilogram.

Mountain pine is a small-to-medium sized, multi-stemmed tree with dark brownish-grey bark, which peels in small thin flakes. The foliage is often dense with needle-like leaves occurring in bundles of two. The needles are dark green, rigid and curved.

The seeds are very small and light and are capable of spreading long distances with the wind. As a result, wilding offspring are capable of rapid invasion of land with low grazing intensity. This leads to significant impacts on native ecosystems, particularly those with low-stature vegetation[1]. Existing plantings act as seed sources for ongoing wilding spread.

It can be difficult to successfully control or manage the spread of these species over the long-term if the seed source is not removed or appropriately managed and contained.

These two conifers have very limited commercial value. It is therefore appropriate to specify these organisms as pests in their own right.

Proposed programme
Environment Southland is proposing a progressive containment plan for contorta and mountain pine to reduce wilding tree spread from Mid Dome and surrounding land. This will allow ES and other agencies to continue to support the Mid Dome Wilding Trees Charitable Trust's programme to remove seed sources from Mid Dome and surrounding lands.

Level of analysis
Contorta pine is considered to require a medium level of analysis when assessed according to the NPD guidance document. The qualitative assessment is supplemented by inputting basic economic assumptions.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers six options for contorta pine:
1. do nothing;
2. eradication;
3. progressive containment.

[1] Indigenous ecosystems at particular risk from wilding conifer invasion include: tussock and other indigenous grasslands, alpine ecosystems, subalpine and dryland scrub and shrublands, frost-flats, wetlands, turf communities, geothermal areas, dunelands, ultramafic/serpentine areas, rockfields and herbfields, riparian areas, coastal margins, bluffs and cliffs.

Benefits and costs of options for management of contorta and mountain pine

Benefits and costs of contorta and mountain pine management options

Option	Basic economic assumptions	Costs	Benefits
Do nothing		High ecological and social impacts on the Mid Dome Wilding Tree Programme Area	Low – because of high impacts of wilding tree spread onto vulnerable land in terms of pastoral production, water yield, biodiversity, social and cultural values.
Eradication	High, control methods to achieve eradication are expensive.	Low, some short term by-kill caused by control methods	High if eradication can be achieved.
Progressive containment	Environment Southland contribution of $100,000/year to the $700,000-$1,000,000/year Mid Dome Trust programme.	Medium continued re-invasion, re-establishment	Medium – by protecting the most vulnerable land from unwanted spread.

Risks of contorta and mountain pine progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks.	Inability to complete the Mid Dome programme due to lack of funds.	Medium.	High.	Severe impacts on pastoral production, water yield, biodiversity over 100,000 hectares of vulnerable land as well as social and cultural values.	High if funding can be maintained.
Extent to which the option will be implemented and complied with.	Wilding contorta and mountain pine can be contained if not eradicated through the Mid Dome programme.	Medium.	Medium.	As above.	High.
	Occupiers will assume responsibility for ongoing maintenance under the proposed Regional Pest Management Plan once the control programme objectives are	Low.	Low.	As above.	High.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
	achieved.				
Risk that compliance with other legislation will adversely affect implementation.	None known.			As above.	
Risk that public or political concerns will adversely affect implementation.	Government support for continued national funding is critical.	Medium.	High.	As above.	Medium.
Any other material risk.	Loss of social licence to use herbicides or other key tools.	Low.	High.	As above.	High.

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of contorta and mountain pine
The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - pastoral farmers with affected land;
  - downstream water users;
  - public users of the affected conservation estate;
  - private land for recreational and other social and cultural purposes.
- active exacerbators: occupiers whose land is infested which provides a seed source for fringe and distant spread. Note that the original contorta and mountain pine was introduced by the Crown for soil conservation purposes.
- passive exacerbators: occupiers of land vulnerable to wilding spread.

Matters for consideration in allocation of costs of proposed contorta and mountain pine programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed contorta pine programme

Legislative rights and responsibilities	There is no legislative responsibility or requirement to control contorta and mountain pine.
Management objectives	To prevent the further spread of P contorta/mugo from existing sites by progressively containing it at its major source at Mid Dome. This is currently being achieved through the Mid Dome Trust's programme. The management objective will be met by maintaining and completing this programme.
Stage of infestation	Advanced and potentially deteriorating.
Most effective control agents	Given the scale of the infestation, after 50 years of spread from the original sources, effective control is beyond the means of individually affected occupiers. Therefore a collaboration/ consortium of affected parties including occupiers, agencies and stakeholders is needed.
Urgency	Low - but important to continue the Mid Dome programme to protect expenditure to date and to minimise the total cost of achieving effective management.
Efficiency and effectiveness	The costs of the principal management tool, the Mid Dome programme, are currently shared between agencies with land management responsibilities by mutual agreement under a Memorandum of Understanding.
Practicality of targeting beneficiaries	The funding method above has worked very successfully since 2008. Occupiers contribute in kind.
Practicality of targeting exacerbators	As above. The Crown is making the largest contribution to the Mid Dome programme.
Administrative efficiency	A collective approach led by a community based trust with strong support from central and local government agencies has worked well over the last decade.
Security	The programme and its intended outcomes are secure as long as the parties continue to support the Memorandum of Understanding.
Fairness	The programme at Mid Dome is considered to be fair at this stage by the affected parties.
Reasonable	As above.
Parties bearing indirect costs	The taxpayer and Southland ratepayers are bearing the indirect costs.
Transitional cost allocation arrangements	Respective occupiers will take over responsibility for ongoing wilding maintenance control once seed sources are eliminated.
Mechanisms available	The proposed Regional Pest Management Plan will provide the regulatory framework for long-term management of Contorta and Mountain pine.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for contorta and mountain pine be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
-	100%	-	5%	95%

Cotoneaster

Description
Cotoneasters are long-lived shrubs that grow to three to four metres high, producing clusters of small flowers over summer that are white or pinkish in colour. These are followed by clusters of fruit that vary in colour from scarlet to orange-red.

They invade a wide range of habitats including forest margins and gaps, coastal areas and roadsides. The plants will out-compete native shrub species, form dense understorey stands and completely prevent other species from growing.

Proposed programme
Environment Southland is proposing a progressive containment programme for cotoneaster.

Level of analysis
Cotoneaster is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for cotoneaster:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of cotoneaster

Benefits and costs of cotoneaster management options

Option	Costs	Benefits
Do nothing	Costs to environmental and social values will be incurred if cotoneaster is allowed to spread further.	None identified.
Progressive containment	Cotoneaster is regarded as a desirable garden plant by some. A progressive containment programme may impact on amenity values associated with cotoneaster.	Protection of environmental, and social values described in impact assessment.

Risks of cotoneaster progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Cotoneaster can be difficult and costly to control. Given it is well-established in the proposed containment area, a Progressive containment programme could fail due to cost and practicality.	High.	High.	Protection of environmental and social values.	Within the proposed containment area, target high risk areas where Cotoneaster could impact on values at risk.
Extent to which the option will be implemented and complied with	High – costs of achieving initial control and achieving compliance of follow up control in proposed containment area may be impractical.	High.	High.	Protection of environmental and social values.	As above.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Cotoneaster is regarded as desirable by some people. This may affect implementation and compliance with a progressive containment programme.	Medium.	High.	Protection of environmental and social values.	As above.
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of cotoneaster
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: occupiers who contribute towards the spread of cotoneaster;
- passive exacerbators: occupiers who allow cotoneaster to grow on their property.

Matters for consideration in allocation of costs of proposed cotoneaster programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed cotoneaster programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Explosion.
Most effective control agents	Environment Southland (rateable land only) for initial control. Central government agencies (for Crown managed land).
Urgency	Low.
Efficiency and effectiveness	A progressive containment programme throughout the proposed containment area may not be efficient or effective.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	Passive exacerbators can be targeted. It is not practical to target active exacerbators.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and initial control costs.
Security	General rate will secure funding for inspections and control costs for cotoneaster over five years.
Fairness	It is considered fair to fund inspection and initial control costs through a general rate as there is benefit to the entire region
Reasonable	It is considered reasonable to fund inspection and initial control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for cotoneaster be covered in the following way.

Funding of inspection and monitoring costs – initial control		**Funding of control costs – initial control**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-
Funding of follow up inspection and monitoring costs		**Funding of follow up control costs**		
100%	-	-	-	100%

Darwin's barberry

Description
Darwin's barberry is an evergreen, spiny, yellow-wooded shrub (less than four metres tall) with woody and densely hairy stems that have tough, five-pronged, needle-sharp spines. Hairless, glossy, dark green leaves (10-30 by 5-15 millimetres) are usually spiny-serrated along edges. Hanging clusters (seven centimetres long) of deep orange-yellow flowers (five to seven millimetres diameter) appear from July to February followed by oval purplish-black berries (five to seven millimetres diameter) with a bluish-white surface.

This long-lived plant tolerates moderate to cold temperatures, damp to dry conditions, high wind, salt, shade, damage, grazing (not browsed), and a range of soils. Birds and possibly possums eat the berries and subsequently spread the seeds. Berries are also occasionally spread by soil and water movement.

It is capable of invading pasture, disturbed forest, shrubland, tussockland, along roadsides and other sparsely vegetated sites. The plant form dense colonies that replace existing vegetation and prevent the establishment of desirable plants. Darwin's barberry will also establish under canopy in forest and shrubland. It can grow more rapidly than native species when suitable conditions arise, allowing it to dominate sites where it establishes.

Proposed programme
Environment Southland is proposing a progressive containment programme for Darwin's barberry.

Level of analysis
Darwin's barberry is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for Darwin's barberry:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of Darwin's barberry

Benefits and Costs of Darwin's barberry management options

Option	Costs	Benefits
Do nothing	Costs to economic, environmental and social values will be incurred if Darwin's barberry is allowed to spread further.	None identified.
Progressive containment	No qualitative costs associated with a progressive containment programme.	Protection of economic, environmental, and social values described in impact assessment.

Risks of Darwin's barberry progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Darwin's barberry can be difficult and costly to control. Given it is well-established in the proposed containment area, a progressive containment programme could fail due to cost and practicality.	High.	High.	Protection of economic, environmental and social values.	Within the proposed containment area, target high risk areas where Darwin's barberry could impact on values at risk.
Extent to which the option will be implemented and complied with	High – costs of achieving initial control and achieving compliance of follow up control in proposed containment area may be impractical.	High.	High.	As above.	
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	There may be some public concern about requiring occupiers to control Darwin's barberry once initial control is completed. This may affect implementation and levels of compliance with a progressive containment programme.	Medium.	High.	As above.	
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Darwin's barberry
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: occupiers who contribute towards the spread of Darwin's barberry;
- passive exacerbators: occupiers who allow Darwin's barberry to grow on their property.

Matters for consideration in allocation of costs of proposed Darwin's barberry programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Darwin's barberry programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Explosion.
Most effective control agents	Environment Southland (rateable land only) for initial control. Central government agencies (for Crown managed land).
Urgency	Low.
Efficiency and effectiveness	A progressive containment programme throughout the proposed containment area may not be efficient or effective.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	Passive exacerbators can be targeted. It is not practical to target active exacerbators.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and initial control costs.
Security	General rate will secure funding for inspections and control costs for Darwin's barberry over five years.
Fairness	It is considered fair to fund inspection and initial control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and initial control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Darwin's barberry be covered in the following way.

Funding of inspection and monitoring costs – initial control		**Funding of control costs – initial control**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-
Funding of follow up inspection and monitoring costs		**Funding of follow up control costs**		
100%	-	-	-	100%

Giant buttercup

Description
Giant buttercup is a perennial plant up to a metre tall with multiple branches. Its leaves are highly variable in size (can be as big as an outstretched hand), hairy and the three primary lobes are highly dissected. Yellow glossy flowers (15 to 25 millimetres across) with five petals appearing, mainly between November and April.

The plant has a short rhizome (horizontal underground stem up to about 100 millimetres long) with fibrous remains of old leaves, axillary buds and fleshy roots. Genetically, it is a highly diverse with up to six different chloroplast cytotypes from Europe coexisting in swamp and wasteland areas, river flats and dairy pastures.

Giant buttercup is very free seeding, with the seeds being spread by water, animals and in silage and hay. Sheep will eat it, however the plant is seasonably unpalatable to cattle. It therefore has the potential to quickly overwhelm other pasture species in dairying areas thereby reducing pasture and dairy production. Once well established in pasture, the plant is costly and difficult to control.

In dairy farming in New Zealand it is estimated to reduce milk solid revenue by $150 million annually. It can also outcompete desirable pasture species.

Giant buttercup is known to be established on farms and roadside verges in four localised areas of Southland. It has probably been present there for several decades but has the potential to spread onto dairy farms throughout the region if allowed.

Proposed programme
Environment Southland is proposing a progressive containment programme for giant buttercup.

Level of analysis
Giant buttercup is considered to require a medium level analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers six options for giant buttercup:
1. do nothing;
2. eradication;
3. progressive containment.

Benefits and costs of options for management of giant buttercup

Benefits and costs of giant buttercup management options

Option	Costs	Benefits
Do nothing	Low.	Low – increasing production losses due to increasing spread of giant buttercup in dairy pastures.
Eradication	High.	High – if eradication can be achieved.
Progressive containment	Low – medium.	Medium to high if spread can be contained and incidence and distribution decreased.

Risks of giant buttercup progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Occupiers do not recognise/report/ control/prevent spread of giant buttercup. Control tools are limited and not fully effective (i.e., herbicide resistance).	High.	High.	Dairy production due to loss of grazeable pasture.	High – through a regional pest management plan with regulatory back up. New tools may be found.
Extent to which the option will be implemented and complied with	Medium - Environment Southland will create awareness and liaise with occupiers. Occupiers will be encouraged to self-help and prevent spread.	Medium.	High.	As above.	
Risk that compliance with other legislation will adversely affect implementation	None known.				
Risk that public or political concerns will adversely affect implementation	occupiers should welcome encouragement and assistance to control giant buttercup.	Low.			
Any other material risk	Further spread from within and outside of Southland – imported stock food i.e.				

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
	hay/baleage.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of giant buttercup
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: occupiers who do not control or contribute to the spread giant buttercup;
- passive exacerbators: occupiers whose land is suitable for giant buttercup to grow.

Matters for consideration in allocation of costs of proposed giant buttercup programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed giant buttercup programme

Legislative rights and responsibilities	There are no statutory requirements to manage giant buttercup.
Management objectives	Progressive containment.
Stage of infestation	Low - but has the potential to spread to all dairy land in Southland.
Most effective control agents	A pest management programme to raise awareness and encourage occupiers to control and prevent the spread of giant buttercup.
Urgency	Medium.
Efficiency and effectiveness	A programme to encourage occupier responsibility/self-help to manage the impacts of giant buttercup is considered the most cost effective option.
Practicality of targeting beneficiaries	Affected dairy farming occupiers will bear the control costs and targeted ratepayers the costs of awareness, advice and regulatory.
Practicality of targeting exacerbators	This will be more difficult and may rely on reports of bad practice or use of stock or stock food imported from risk areas.
Administrative efficiency	A ratepayer funded programme to encourage occupier self-help is considered the most efficient approach.
Security	As above.
Fairness	As above.
Reasonable	As above.
Parties bearing indirect costs	Ratepayers.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	Not applicable

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for giant buttercup be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General Rate	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Occupier control or contribution**
-	100%	-	-	100%

Heather

Description
Heather is a bushy, evergreen tough shrub (less than 90 centimetres tall) with woody, wiry stems and densely hairy young shoots becoming hairless as they mature. Its long, dark green to brown leaves (1.5-3.5 millimetres long) are in opposite pairs on the stem, overlapping in four vertical rows. Bell-shaped, pink to pale purple flowers (two to four millimetres long) on narrow, leafy, elongated, upright clusters (two to nine centimetres long) appear from December to March and are followed by tiny, round, hairy seed capsules.

The plant forms dense stands and suckers and seeds profusely, and is faster growing than its subalpine competitors. It tolerates cold, high to low rainfall, semi-shade, and poor soils, but is intolerant of heavy shade. Suckers are spread in soil and seed is spread by wind, water and soil movement.

Heather is capable of rapidly forming dense stands in low-growing habitats in shrubland, short tussockland, herbfield, bare land, montane wetlands, and riverbeds. As a result, heather can prevent the establishment of native species.

Proposed programme
Environment Southland is proposing a progressive containment programme for heather. This programme will not apply to the Stewart Island/Rakiura site-led area as heather is managed differently at that site.

Level of analysis
Heather is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for heather:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of heather

Benefits and costs of options for management of heather

Option	Costs	Benefits
Do nothing	Costs to environmental values, forestry and water quality will be incurred if heather is allowed to spread further outside of cultivation.	No benefits associated with this option.
Progressive containment	No costs associated with a progressive containment programme.	Protection of environmental and social values described in impact assessment.

Risks of heather progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that heather establishes outside cultivation.	High – number of sites outside cultivation known in Te Anau area, and one on Stewart Island/Rakiura in recent times.	High.	Prevention of loss of environmental and social values.	Raise awareness about heather and investigate any potential reports of it establishing outside of cultivation.
Extent to which the option will be implemented and complied with	Presence of heather not reported.	Medium.	High.	As above.	Encourage reports of heather.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Heather is regarded as desirable by some people. This may prevent reporting of locations.	Low.	Low.	As above.	Encourage reports of heather outside cultivation as being of public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of heather
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of heather through their actions;
- passive exacerbators: any person who does not report the presence of heather outside of cultivation.

Matters for consideration in allocation of costs of proposed heather programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocating costs of proposed heather programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag.
Most effective control agents	Environment Southland (rateable land only). Central government agencies (for Crown managed land).
Urgency	High.
Efficiency and effectiveness	A progressive containment programme is efficient and effective given heather is only known at a few sites outside cultivation.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs where heather is found outside cultivation.
Security	General rate will secure funding for inspections and control costs for heather over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for heather be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Japanese honeysuckle

Description
Japanese honeysuckle is an evergreen or semi-evergreen climber with a smothering growth habit. Its leaves occur in opposite pairs with tubular, sweetly scented white-yellow flowers. The plant was originally introduced as an ornamental hedging plant and is found in many gardens in Southland.

The plant invades disturbed forest and forest margins, shrubland, coastal areas and river margins. Japanese honeysuckle grows rapidly smothering shrub and small tree species. It blocks light, breaks branches and its presence can lead to other pest plant species invading an area.

Proposed programme
Environment Southland is proposing a progressive containment programme for Japanese honeysuckle.

Level of analysis
Japanese honeysuckle is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for Japanese honeysuckle:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of Japanese honeysuckle

Benefits and costs of options for management of Japanese honeysuckle

Option	Costs	Benefits
Do nothing	Costs to environmental values will be incurred if Japanese honeysuckle is allowed to spread further outside of cultivation.	No benefits associated with this option.
Progressive containment	No costs associated with a progressive containment programme.	Protection of environmental and social values described in impact assessment.

Risks of Japanese honeysuckle progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that Japanese honeysuckle establishes outside cultivation.	Medium – some reports of Japanese honeysuckle establishing outside cultivation.	High.	Prevention of loss of environmental and social values.	Raise awareness about Japanese honeysuckle and investigate any potential reports of it establishing outside of cultivation.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Extent to which the option will be implemented and complied with	Presence of Japanese honeysuckle not reported.	Medium.	High.	As above.	Encourage reports of Japanese honeysuckle.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Japanese honeysuckle is regarded as desirable by some people. This may prevent reporting of locations.	Low.	Low.	As above.	Encourage reports of Japanese honeysuckle outside cultivation as being of public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Japanese honeysuckle
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of Japanese honeysuckle through their actions;
- passive exacerbators: any person who does not report the presence of Japanese honeysuckle outside of cultivation.

Matters for consideration in allocation of costs of proposed Japanese honeysuckle programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Japanese honeysuckle programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag.
Most effective control agents	Environment Southland (rateable land only). Central government agencies (for Crown managed land).

Urgency	High
Efficiency and effectiveness	A progressive containment programme is efficient and effective given Japanese honeysuckle is only known from a few sites outside cultivation.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs where Japanese honeysuckle is found outside cultivation.
Security	General rate will secure funding for inspections and control costs for Japanese honeysuckle over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Japanese honeysuckle be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Lagarosiphon

Description
Lagarosiphon is a rhizomatous perennial freshwater herb. The plant has spiralled leaves on a much-branched stem. The stems can be up to five metres long and form large interwoven mats below the water surface in depths to six and a half metres. It was introduced from southern Africa as an aquarium plant and grows wholly submerged in fresh water ponds, lakes and slow moving streams, with silty or sandy bottom mud.

Lagarosiphon forms vast, deep meadows in still and slow moving water that shade out other species. Large clumps can dislodge, causing blockages and flooding. It can restrict recreational activities such as boating and fishing on affected water bodies.

Lagarosiphon is known in a small number of small waterways in the lower plains. Initial infestations are thought to have resulted from releasing pet fish into waterways including 'oxygen weed'. A localised infestation in ponds and oxbows in the Ōreti River eel fishing may be related to eel fishing activities there.

Proposed programme
Environment Southland is proposing a progressive containment programme for lagarosiphon.

Level of analysis
Lagarosiphon is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers three options for lagarosiphon:
1. do nothing;
2. eradication;
3. progressive containment.

Benefits and costs of options for management of lagarosiphon

Benefits and costs of options for management of lagarosiphon

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	High if lagarosiphon spreads and infests all suitable waterways.	Low.
Eradication	No quantitative costs.	High – control techniques to achieve eradication are expensive to implement and may not be technically feasible.	High – if eradication could be achieved.
Progressive containment	$5000/year Cost of existing programme.	Medium, lagrosphison continues to negatively impact in areas with an established population.	High – prevent further spread and reduce distribution where possible.

Risks of lagarosiphon progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Lack of effective control tools. Lagarosiphon may be spread accidently on machinery, water activities.	Medium.	High.	Freshwater biodiversity and natural function of waterways.	Medium – develop new tools.
Extent to which the option will be implemented and complied with	Lagarosiphon has not spread significantly in the last decade under a containment approach.	Low.	High.	As above.	
	Difficult to identify any person who may accidently be spreading it.	Medium.	High.	As above.	
Risk that compliance with other legislation will adversely affect implementation	None known – lagarosiphon is banned from sale, propagation distribution under the National Pest Plant Accord which complements the RPMP.				
Risk that public or political concerns will adversely affect implementation	None known.				
Any other material risk	None known.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of lagarosiphon

The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community and users of waterways;
- active exacerbators: any person who actively causes lagarosiphon to spread either accidentally or deliberately;
- passive exacerbators: owners of the beds of waterways (generally the Crown).

Matters for consideration in allocation of costs of proposed lagarosiphon programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed lagarosiphon programme

Legislative rights and responsibilities	The only legislative provision is lagarosiphon's status as an unwanted organism under the National Pest Plant Accord.
Management objectives	To prevent the further spread of lagarosiphon.
Stage of infestation	Early – established in a few small streams on the lower plains and in the mid reaches of one large river.
Most effective control agents	A work programme of surveillance, control and compliance delivered under a Regional Pest Management Plan.
Urgency	Low – as there is little evidence of rapid spread over the last decade.
Efficiency and effectiveness	A regional work programme is considered the most effective and efficient approach to contain lagarosiphon.
Practicality of targeting beneficiaries	The Southland community as beneficiaries can contribute via a regional targeted rate.
Practicality of targeting exacerbators	Difficult to monitor those inadvertently spreading lagarosiphon, e.g. machinery operators, eel fishers.
Administrative efficiency	As above.
Security	As above.
Fairness	As above.
Reasonable	As above.
Parties bearing indirect costs	Regional ratepayers.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	As above.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Lagarosiphon be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
-	100%	-	100%	-

Old man's beard

Description
Old man's beard is a deciduous, woody, perennial climber that can grow up to 25 metres in height. It has conspicuous small fragrant flowers from December to May, followed by silky seed balls. Individual plants reach maturity in four to five years and have a life span of more than 30 years.

Old man's beard invades forest margins, disturbed bush, shrubland, riverbeds, cliffs, hedgerows and gardens. It grows quickly and produces heavy permanent tangled masses of vines that kill host plants and prevent the regeneration of other species. Each plant produces a prolific amount of viable seed, estimated to be more than 10,000 seeds per square metre, which are dispersed primarily by wind and water.

Proposed programme
Environment Southland is proposing a progressive containment programme for Old man's beard.

Level of analysis
Old man's beard is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - Assessment

Options for response
The analysis considers three options for Old man's beard:
1. do nothing;
2. eradication;
3. progressive containment.

Benefits and costs of options for management of Old man's beard

Benefits and costs of options for management of Old man's beard

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Costs to environmental values will be incurred if Old man's beard is allowed to spread further – i.e. sustainability of ecological processes and biological diversity.	No benefits associated with this option.
Eradication	Eradication programme has cost on average $17,000/year over the last three years (excludes Department of Conservation-funded programme on Stewart Island/Rakiura).	No qualitative costs associated with an eradication programme.	Protection of environmental values described in impact assessment.
Progressive containment	Progressive containment programme is expected to incur similar costs to the eradication programme over	No qualitative costs associated with a progressive containment programme.	Protection of environmental values described in impact assessment.

Option	Basic economic assumptions	Costs	Benefits
	the past three years.		

Risks of Old man's beard progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risk	Risk that Old man's beard is already established at other unknown locations.	High – new sites are usually found each year.	High.	Prevention of loss of ecosystem processes and reduction in biodiversity.	Continue to raise awareness about Old man's beard, and investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of Old man's beard is not reported.	Medium – difficulty with identification may prevent reports.	High.	As above.	Encourage reports of Old man's beard.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	As above.	Encourage reports of Old man's beard as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Old man's beard
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland communityl
- active exacerbators: any person who contributes towards the spread of Old man's beard through their actionsl
- passive exacerbators: any person who does not report the presence of Old man's beard,

Matters for consideration in allocation of costs of proposed Old man's beard programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in below.

Matters for consideration in allocation of costs of proposed Old man's beard programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag phase – due to control programme over last 17 years.
Most effective control agents	Environment Southland (mainland Southland) and Department of Conservation (Stewart Island/Rakiura).
Urgency	High.
Efficiency and effectiveness	A progressive containment programme is efficient and effective given Old man's beard is known from over 150 sites in the region.
Practicality of targeting beneficiaries	Funding from general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs.
Security	General rate will secure funding for inspections and control costs for Old man's beard over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Old man's beard be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Reed sweet grass

Description
Reed sweet grass is an aggressive perennial mat-forming grass that grows to almost two metres tall. It has fibrous roots, rhizomes and an erect or lax stem. Soft, light green leaves (30-60 x 2 centimetres) have a membranous ligule. Its much-branched flowerhead has numerous spikelets containing many seeds.

The plant grass establishes along the margins of lakes, streams, ditches, and other waterways. It can also form dense mats on top of the water as well as survive and persist in damp pasture areas. Reed sweet grass replaces nearly all other species where it establishes and degrades the habitat for aquatic fauna and flora. The grass can cause a build-up of silt and other material leading to an increase in flooding. In wetland areas, cattle are attracted to it for grazing, causing further degradation in such areas.

Proposed programme
Environment Southland is proposing a progressive containment programme for reed sweet grass.

Level of analysis
Reed sweet grass is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. The qualitative assessment is supplemented by inputting basic economic assumptions.

NPD section 6 - assessment

Options for response
The analysis considers two options for reed sweet grass:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of reed sweet grass

Benefits and costs of options for management of reed sweet grass

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Costs to economic, environmental and social values will be incurred if reed sweet grass is allowed to spread further.	Reed sweet grass is used as stock feed.
Progressive containment	Containment programme has cost on average $7,700/year over the last three years. Costs have increased due to more reed sweet grass being found.	Loss of grazing due to control of reed sweet grass.	Protection of economic, environmental and social values.

Risks of reed sweet grass progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that reed sweet grass is already established at other unknown locations.	High – new sites have been found in the past two years outside of the known distribution.	High.	Prevention of loss of economic, environmental and social benefits.	Raise awareness about reed sweet grass and investigate any potential reports.
Extent to which the option will be implemented and complied with	Presence of reed sweet grass is not reported.	Medium – difficulty with identification may prevent reports.	High.	As above.	Encourage reports of reed sweet grass.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely.	Low.	Low.	Low.	Encourage reports of reed sweet grass as being of personal and public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of reed sweet grass
The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - any person outside the reed sweet grass containment area with the pest on their property;
  - the wider Southland community;
- active exacerbators: any person who contributes towards the spread of reed sweet grass through their actions;
- passive exacerbators: any person who does not report the presence of reed sweet grass.

Matters for consideration in allocation of costs of proposed reed sweet grass programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed reed sweet grass programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Explosion.
Most effective control agents	Environment Southland for initial control to achieve zero density. Occupiers should then carry out any further control required.
Urgency	Moderate.
Efficiency and effectiveness	A progressive containment programme is efficient and effective to prevent further spread of reed sweet grass.
Practicality of targeting beneficiaries	Funding from general rate is recommended for initial control to achieve zero density of reed sweet grass. Beyond this stage, beneficiaries should fund any further control required.
Practicality of targeting exacerbators	Not considered reasonable to target exacerbators as may result in behaviour that causes the spread or non-reporting of reed sweet grass.
Administrative efficiency	General rate is considered the most efficient method for inspection and initial control costs.
Security	General rate will secure funding for inspections and initial control costs over five years.
Fairness	It is considered fair to fund initial control costs and inspection costs from the general rate.
Reasonable	It is considered reasonable to fund initial control costs and inspection costs from the general rate.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for reed sweet grass be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Rough horsetail

Description
Rough horsetail is an erect, colony-forming, summer-green perennial, growing to two metres tall with extensive, deep, freely branching rhizomes. It has ridged, hollow stems that occasionally branch and feel hard and rough. The stems are jointed and break easily at this point. Leaves are reduced to toothed sheaths that encircle the joints along the stems, with a black ring at the base. The stems have a distinctive black collar at the joints. It has extensive underground rhizomes (underground stems). Spores are produced in cone-like structures on fertile stems (rather than flowers and seed heads) giving it a look of a strange asparagus spear. It is sometimes kept as an ornamental plant due to its unusual appearance.

This plant prefers moist areas such as gravel areas and pond/lake margins but once it is well established it will adapt to a wide range of conditions. It can even be found growing through the cracks in concrete.

Rough horsetail spreads rapidly, re-sprouting from underground stems, and displacing desirable plant species once established in an area. It is resistant to most herbicides and underground rhizomes make it hard to control.

The plant is capable of forming pure stands in a wide range of damp habitats, preventing the seedlings of native species from establishing. It blocks and alters watercourses, causing flooding.

Underground rhizomes are spread by movement of soil or through deliberate planting.

Proposed programme
Environment Southland is proposing a progressive containment programme for rough horsetail.

Level of analysis
Rough horsetail is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for rough horsetail:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of rough horsetail

Benefits and costs of options for management of rough horsetail

Option	Costs	Benefits
Do nothing	Costs to environmental values will be incurred if rough horsetail is allowed to spread further outside of cultivation.	No benefits associated with this option.
Progressive containment	No qualitative costs associated with a progressive containment programme.	Protection of environmental and social values described in impact assessment.

Risks of rough horsetail progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that rough horsetail establishes outside cultivation.	Low.	High.	Prevention of loss of environmental, and social values.	Raise awareness about rough horsetail and investigate any potential reports of it establishing outside of cultivation.
Extent to which the option will be implemented and complied with	Presence of rough horsetail not reported.	Medium.	High.	As above.	Encourage reports of rough horsetail.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Rough horsetail is used in floral displays. This may discourage reporting of locations outside cultivation.	Medium.	High.	As above.	Encourage reports of rough horsetail outside cultivation as being of public benefit.
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of rough horsetail
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of rough horsetail through their actions;
- passive exacerbators: any person who does not report the presence of rough horsetail outside of cultivation.

Matters for consideration in allocation of costs of proposed rough horsetail programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed rough horsetail programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag.
Most effective control agents	Environment Southland (rateable land only). Central government agencies (for Crown managed land).
Urgency	Low.
Efficiency and effectiveness	A progressive containment programme is efficient and effective given rough horsetail is not known to occur outside cultivation.
Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs where rough horsetail is found outside cultivation.
Security	General rate will secure funding for inspections and control costs for rough horsetail over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for rough horsetail be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

Siberian lyme grass

Description
Siberian lyme grass is a perennial grass with stout rhizomes and very robust tufts, growing up to 1.5 metres tall. The leaves are strongly ribbed and are almost entirely without hairs. It was introduced into New Zealand for agriculture and was first reported growing outside cultivation in 1895.

The plant invades coastal dunes, foreshore areas and other sandy places forming a dense monoculture, completely replacing desirable species in these areas.

Proposed programme
Environment Southland is proposing a progressive containment programme for Siberian lyme grass.

Level of analysis
Siberian lyme grass is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers two options for Siberian lyme grass:
1. do nothing;
2. progressive containment.

Benefits and costs of options for management of Siberian lyme grass

Benefits and costs of options for management of Siberian lyme grass

Option	Costs	Benefits
Do nothing	Costs to environmental values will be incurred if Siberian lyme grass is allowed to spread further.	No qualitative benefits associated with this option.
Progressive containment	No qualitative costs associated with a progressive containment programme.	Protection of environmental values described in impact assessment.

Risks of Siberian lyme grass progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Risk that Siberian lyme grass establishes beyond the two known locations given difficulty of identification and therefore reporting of it.	High.	High.	Prevention of loss of environmental, values.	Raise awareness about Siberian lyme grass and investigate any potential reports of it establishing outside of known locations.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Extent to which the option will be implemented and complied with	Presence of Siberian lyme grass not reported.	Medium.	High.	As above.	Encourage reports of Siberian lyme grass.
Risk that compliance with other legislation will adversely affect implementation	None identified.				
Risk that public or political concerns will adversely affect implementation	Unlikely – Siberian lyme grass was introduced for agriculture prior to 1985, but not aware it is still valued as a pasture species.	Low.	Low.	As above.	Encourage reports of Siberian lyme grass outside cultivation as being of public benefit.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Siberian lyme grass
The beneficiaries and exacerbators of the programme are:

- beneficiaries: the Southland community;
- active exacerbators: any person who contributes towards the spread of Siberian lyme through their actions;
- passive exacerbators: any person who does not report the presence of Siberian lyme outside of cultivation.

Matters for consideration in allocation of costs of proposed Siberian lyme grass programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Siberian lyme grass programme

Legislative rights and responsibilities	None known.
Management objectives	Progressive containment.
Stage of infestation	Lag.
Most effective control agents	Environment Southland.
Urgency	Medium.
Efficiency and effectiveness	A progressive containment programme is efficient and effective given Siberian lyme grass is not known to occur outside cultivation.

Practicality of targeting beneficiaries	Funding from the general rate recommended.
Practicality of targeting exacerbators	There are currently no known exacerbators to target.
Administrative efficiency	General rate is considered the most efficient method of cost allocation for inspection and control costs where Siberian lyme grass is found outside cultivation.
Security	General rate will secure funding for inspections and control costs for Siberian lyme grass over five years.
Fairness	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Reasonable	It is considered reasonable to fund inspection and control costs through a general rate as there is benefit to the entire region.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	None for the proposed progressive containment programme.
Mechanisms available	General rate and occupier contributions are the most readily available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the progressive containment programme for Siberian lyme grass be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Occupier control or contribution**
100%	-	100%	-	-

MARINE EXCLUSION

Marine pests not yet present in Southland

Description

Asian paddle crab is a large crab with six prominent spines on each side of the carapace, which is up to 12 centimetres across, and five prominent spines on the upper surface of each claw. The swimming paddles on the back legs are flattened. Colour ranges from off-white and pale green, through olive-green to a deep chestnut brown with purplish markings.

They inhabit the sand and mud of coastal estuaries and harbours from the low tide mark out to 15 metres depth.

It is highly detrimental to shellfish aquaculture, is an aggressive predator and displaces native and fisheries species. Also, it can carry diseases that affect crab, lobster, shrimp and prawn fisheries.

Sabella (Mediterannean fanworm) is a large tube worm that prefers sheltered, shallow subtidal areas (1-30 metres deep). It attaches to hard substrates such as shells, jetty pylons, wrecks and rocks, but can also be found in sand.

Sabella secretes a tough, flexible tube up to 40 centimetres long. Tentacles at the top form a spiralled fan, up to 15 centimetres across. Fans vary in colour, from dull white, to brightly banded with stripes of orange, purple and white.

These fast-growing worms can form vast, dense meadows and are likely to compete with native suspension feeders for food and interfere with their lifecycle. It is known to be present in New Zealand marine waters and in a number of ports outside of Southland.

Sea squirts are marine invertebrates.

Styela (clubbed tunicate) has a long, club-shaped body on a tough stalk. Its surface is leathery, rumpled, and knobbly. They can be brownish-white, yellowish-brown, or reddish-brown and ugly in appearance. Styela is sometimes referred to as a ’solitary' sea squirt because each individual has its own stalk and adheres separately to a substrate.

Styela is known to grow rapidly overseas, reaching densities of up to 500-1500 individuals per square metre. They can live for up to two years and grow up to 160 millimetres long.

In October 2005 styela was discovered in Auckland’s Viaduct Basin, and in Lyttelton Harbour. It was found soon after on the hull of a vessel that had sailed from Auckland to Picton, and in the Hauraki Gulf and Northland.

Styela multiplies rapidly in suitable sites, spawning every 24 hours in water temperatures above 15°C. It competes with other filter feeders for food and space. As a result it disrupts native ecosystems and aquaculture.

The eudistoma sea squirt is also known as the Australian droplet tunicate. It forms large colonies that attach to hard surfaces and look like clusters of white or cream-coloured cylindrical tubes. Each colony

contains numerous small individuals and they can appear orange flecked due to the colour of the larvae within them. The species is firm and gelatinous to the touch and the cylindrical colonies are generally 5-30 centimetres long, but can occasionally reach 1.5 metres in length. Colonies are generally 5-20 millimetres in diameter and regress and over-winter as small (approx. 10 millimetres) cream buds, re-growing the following spring to larger colonies.

This species is generally found in soft-bottomed tidal habitats and on hard structures such as wharf piles, aquaculture equipment and mangrove roots. It prefers submerged habitats just below the waterline, but can be found out of the water for periods during low tide.

Eudistoma competes with native species for both space and food. Due to its rapid growth rate, it can inhabit a wide range of habitats, and can reach high abundances. It is also possible that it can ingest and kill the eggs and larvae of native species. However, some of the competitive ability of this species is minimised by the fact that it is only present in large numbers during summer months and dies down during rain events and winter months.

Pyura is a large, solitary, stumpy, chalice-shaped sea squirt with two large mounds representing siphons set in the depressed upper surface of the body. When the pyura is inflated, cruciform or cross-shaped siphons are visible by the bright reddish orange body wall visible from the exterior. Individuals can be very large and often form dense aggregates on intertidal platforms, sometimes occupying 100 percent cover. Pyura may be found sub-tidally down to 12 metres. It is capable of displacing important native New Zealand species, including green shell mussels. At present pyura are restricted to the Far North.

Didemnum colonies form extensive sheets on vertical surfaces. Cylindrical or frond-like outgrowths can often arise off the main colony. These can form extremely long dripping tendrils, sometimes metres long. Outgrowths of the colony encrust algae, hydrozoans, tube worms and mussels. The colonies are pale yellow to cream coloured and firm yet gelatinous to the touch. Common exhalent openings are obvious at the end of lobes and a fine open network of canals can be seen below the surface.

Dense colonies of didemnum displace native and fisheries species and smother beaches, rocks and tidepools. They also foul boat hulls, the undersides of floating structures, marine farm lines and sea cages.

Proposed programme
Environment Southland is proposing an exclusion programme for the Asian paddle crab, Mediterranean fanworm and four sea squirt species.

Level of analysis
Exclusion marine pest species are considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. The qualitative assessment is supplemented by inputting basic economic assumptions.

NPD section 6 - assessment

Options for response

The analysis considers two options for marine pests (not yet present in Southland):

1. do nothing
2. exclusion

Benefits and costs of options for management of marine pests not yet present in Southland

Benefits and costs of options for management of marine pests not yet present in Southland

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Low cost until pests establish and compete with natives, which could impact fisheries or foul aquaculture equipment.	Economic and environmental impacts would be high if any of the exclusion marine pests established in Southland. Would be harmful to High Value Areas such as Fiordland and Stewart Island/Rakiura, but also aquaculture and other coastal areas could be modified.
Exclusion	Difficult to quantify – however there are clear benefits to commercial ventures such as aquaculture by preventing or delaying the arrival of a pest such as Mediterranean fanworm. Additionally, the practice of excluding these marine pests e.g. clean vessel hull and gear may prevent the establishment of a pest that could have catastrophic consequences.	Currently low cost in staff time. Some costs for surveillance and compliance.	Council and supporting agencies able to act immediately to any incursion at a moderate cost which could prevent significant environmental and economic damages.

Risks of marine pests not yet present in Southland exclusion programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Accidental release and natural spread.	Medium.	High.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Also, risks to aquaculture industry – fouling of equipment or outcompeting value species for food/space.	Education. Pathway Management Plan. Surveillance for early detection.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Extent to which the option will be implemented and complied with	Vessel owners generally comply with biofouling maintenance best practice. Additionally regulations regarding marine biosecurity are increasing e.g. the Craft Risk Management Standard. Top of North Pathway Plan, Fiordland Pathway Plan.	Low-medium.	High.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Also, risks to aquaculture industry – fouling of equipment or outcompeting value species for food/space.	Education. Pathway. Management Plan. Surveillance for early detection.
Risk that compliance with other legislation will adversely affect implementation	Marine pollution regulations regarding antifoul paint. In-water cleaning regulations etc. making it difficult for vessel owners to mitigate biosecurity risk.	Low.	Medium-high.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Also, risks to aquaculture industry – fouling of equipment or outcompeting value species for food/space.	Regional councils have similar rules for marine pests. CRMS also promoting high hull fouling standards to meet making it unlikely marine pollution regulations would move towards less effective paints. Additionally in-water cleaning restrictions likely to change due to push for better marine biosecurity.
Risk that public or political concerns will adversely affect implementation	New to region pest arrives and 'horse has bolted' attitude takes place.	Medium.	High.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Also, risks to aquaculture	Education. Surveillance for early detection and response.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
				industry – fouling of equipment or outcompeting value species for food/space.	
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of Marine Pests not yet present in Southland
The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - Southland community;
  - commercial fishing sector;
  - recreational fishing sector;
  - tourism sector;
  - aquaculture sector;
- active exacerbators:
  - all vessel owners and aquaculture farm operators not following marine biosecurity best practice when moving from one location to another e.g. poor antifoul condition, not inspecting hull, equipment, stock transfers etc;
- passive exacerbators:
  - all vessel owners and aquaculture farm operators adhering to marine biosecurity best practice. Best practice may still promote the transport of marine pest species from one region to another;
  - aquaculture farms, marinas, ports not controlling marine pests on structures and equipment.

Grouping of subjects
These organisms fall within the exclusion marine pests group of subjects. These exclusion pests satisfy the criteria under paragraph 119 of the National Policy Direction guidance document.

Matters for consideration in allocation of costs of proposed marine pests not yet present in Southland programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed marine pests not yet present in Southland programme

Legislative rights and responsibilities	None.
Management objectives	Exclusion from Southland coastal marine area.
Stage of infestation	Not present in Southland.
Most effective control agents	Surveillance, early detection, and manual removal, chemical, freshwater or heat treatment.
Urgency	Medium – there is a high level of domestic vessel traffic including from regions infested with the identified 'exclusion' marine pests.
Efficiency and effectiveness	Preventing establishment of these species is the most efficient and effective form of management.
Practicality of targeting beneficiaries	Can target some of the beneficiaries, however, recreational sector is difficult to target.
Practicality of targeting exacerbators	Potential to target through cost-recovery, prosecution, instant fines (when adopted) if fouled with one or more of the exclusion marine pests. Many of the beneficiaries are also the exacerbators.
Administrative efficiency	Generally low cost and efficient, but will rely on support from Department of Conservation and Ministry for Primary Industries.
Security	High – funding available. Continuing exclusion programme is low cost, high reward.
Fairness	Cost allocation is fair, i.e. targeting the marine fee reserve.
Reasonable	Costs of exclusion programme fairly low and Environment Southland contributes towards this.
Parties bearing indirect costs	None.
Transitional cost allocation arrangements	Not applicable.
Mechanisms available	General biosecurity rate and marine fee.

Proposed allocation of costs

It is proposed that costs for undertaking the exclusion programme for the exclusion marine pests be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**	
General rate	**Marine fee reserve**	**General rate**	**Marine fee reserve**
-	100%	-	100%

MARINE PROGRESSIVE CONTAINMENT

Undaria

Description
Undaria is a golden brown seaweed with a central midrib, divided frond and a fleshy, frilly reproductive structure at the base of the seaweed. These characteristics help differentiate *Undaria* from native seaweed species. *Undaria* was accidentally introduced into New Zealand in the early 1980s, and has now spread to many parts of the coastline, including Southland. It is known to occur in parts of Stewart Island/Rakiura, Waikawa, in Bluff harbour, and has recently established in Breaksea Sound where it is closely monitored.

Undaria is a winter annual laminarian kelp that first appears in early spring in its native home range. *Undaria* has a high growth rate with sporophytes reaching maturity in 40 to 50 days with the potential to release up to 700 million zoospores. With its high growth and reproductive output, and the ability to tolerate wide ranging temperatures, substrates and sheltered to exposed conditions, *Undaria* is a hardy invasive species.

Undaria can substantially modify natural habitats impacting on the native ecology of those areas. Invasion can result in an addition to canopy cover, or it can result in dense mono-specific stands of *Undaria*. These dense stands can reduce the presence and diversity of smaller understorey algal species and out-compete marine macro algae canopy species.

Proposed programme
Environment Southland is proposing a progressive containment programme for *Undaria*.

Level of analysis
Undaria is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken.

NPD section 6 - assessment

Options for response
The analysis considers three options for *Undaria*:
1. do nothing;
2. progressive containment;
3. site-led.

Benefits and costs of options for management of *Undaria*

Benefits and costs of options for management of Undaria

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Low cost until pests establish and compete with natives which could impact fisheries and natural environment. Most aquaculture is on Stewart Island/Rakiura or in Bluff and already heavily infested as are the port areas.	Economic, environmental and political impacts would be high if *Undaria* was to establish throughout Fiordland. Would be harmful to High Value Areas such as Fiordland and parts of Stewart Island/Rakiura, but also aquaculture and other coastal areas could be modified.
Progressive Containment	Difficult to quantify biodiversity benefits – the practice of excluding this marine species e.g. clean vessel hull and gear may prevent the establishment of *Undaria* in other High Value Areas.	High cost to control un *Undaria* in Fiordland and contain it to Bluff, Stewart Island/Rakiura areas.	Would reduce ecological and potential fisheries impacts in Fiordland and would help to prevent its spread from Breaksea to other Fiords.
Site-led	Difficult to quantify biodiversity benefits – the practice of excluding this marine species e.g. clean vessel hull and gear may prevent the establishment of *Undaria* in other High Value Areas.	High cost to control *Undaria* in Fiordland.	Would reduce ecological and potential fisheries impacts in Fiordland and would help to prevent its spread from Breaksea to other Fiords.

Risks of *Undaria* progressive containment programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Accidental release and natural spread.	Medium.	High.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Competition with native species for light and space.	Education. Pathway Management Plan. Surveillance for early detection. Direct control in Breaksea Sound and other infested sites. Could reduce population in port areas to prevent spread to other High Value Areas.
Extent to which the option will be implemented and complied with	Vessel owners generally comply with biofouling maintenance best practice.	Low-medium.	High.	High ecological values in many coastal areas of Southland e.g. Stewart	Education. Pathway Management Plan. Surveillance for early

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
	Additionally regulations regarding marine biosecurity are increasing e.g. Craft Risk Management Standard (CRMS), Top of North Pathway Plan, Fiordland Pathway Plan.			Island/Rakiura and Fiordland. Competition with native species for light and space.	detection. Direct control in Breaksea Sound and other infested sites. Could reduce population in port areas to prevent spread to other High Value Areas.
Risk that compliance with other legislation will adversely affect implementation	Marine pollution regulations regarding antifoul paint. In-water cleaning regulations etc. making it difficult for vessel owners to mitigate biosecurity risk.	Low.	Medium-high.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Competition with native species for light and space.	Regional councils have similar rules for marine pests. CRMS also promoting high hull fouling standards to meet making it unlikely marine pollution regulations would move towards less effective paints. Additionally in-water cleaning restrictions likely to change due to push for better marine biosecurity.
Risk that public or political concerns will adversely affect implementation	'Horse has bolted' attitude. It's everywhere, why worry about it. However, if nothing is done there will be further public and political pressure from the other side of the argument.	Low.	High.	High ecological values in many coastal areas of Southland e.g. Stewart Island/Rakiura and Fiordland. Competition with native species for light and space.	Education. Surveillance. Direct control.
Any other material risk	None identified.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of *Undaria*

The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - Southland community;
  - commercial fishing sector;
  - recreational sector;
  - tourism industry;
  - tourists;
- active exacerbators:
  - all vessel owners and aquaculture farm operators not following marine biosecurity best practice when moving from one location to another e.g. poor antifoul condition, not inspecting hull, equipment, stock transfers etc;
- passive exacerbators:
  - all vessel owners and aquaculture farm operators adhering to marine biosecurity best practice. Best practice may still promote the transport of marine pest species from one region to another;
  - aquaculture farms, marinas, ports not controlling marine pests on structures and equipment.

Matters for consideration in allocation of costs of proposed *Undaria* programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Undaria programme

Legislative rights and responsibilities	Fiordland Marine Regional Pathway Management Plan, Fiordland Marine Reserve (Marine Reserves Act 1971).
Management objectives	Contain *Undaria* current populations and reduce its density in Fiordland.
Stage of infestation	Widespread.
Most effective control agents	Environment Southland/Department of Conservation/Ministry for Primary Industries/Contractors manual removal, heat or chemical treatment.
Urgency	High.
Efficiency and effectiveness	Protecting High Value Areas is the most efficient and effective.
Practicality of targeting beneficiaries	Can target some of the beneficiaries, however, recreational sector is difficult to target.
Practicality of targeting exacerbators	Potential to target through cost-recovery, prosecution, instant fines (when adopted) if fouled with one or more of the exclusion marine pests. Many of the beneficiaries are also the exacerbators.
Administrative efficiency	Generally low cost and efficient, but will rely on support from Department of Conservation and Ministry for Primary Industries.
Security	High – funding available.
Fairness	Cost allocation is fair i.e. targeting the marine fee reserve.
Reasonable	Cost likely to be high however, Fiordland has very high biodiversity values and stakeholders (through Fiordland Marine Guardians) deemed very important.
Parties bearing indirect costs	None.
Transitional cost allocation arrangements	Not applicable.

Mechanisms available	General biosecurity rate and marine fee.

Proposed allocation of costs

It is proposed that costs for undertaking the containment programme for *Undaria* be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**	
General rate	**Marine fee reserve**	**General rate**	**Marine fee reserve**
-	100%	-	100%

SUSTAINED CONTROL ANIMALS

Possum

Description
Possums are marsupials and the males and females are similar in size; between 650 and 930 millimetres, including a tail of 250 to 405 millimetres. They are about the size of a cat. Adults weigh between 1.4 and 6.4 kilograms and have a furry body, with a long prehensile bushy tail for climbing. These animals have a pointed snout with a pink nose and long dark whiskers and brown eyes. The large pointed ears are furless on the inside. Fur is fluffy grey or dark brown on the head, back and tail and white or dirty yellow on the belly and there are several colour forms. Mature possums have a brown stain (the sternal gland) between their front legs. The front legs are shorter than the hind legs. Front paws are rather hand-like, and rear paws rather longer with a pair of fused digits.

Possums begin breeding at one to two years of age, and populations are capable of increasing at a rate of 22-30 percent per year, indicating that a population at 20 percent of its carrying capacity is capable of recovering to its full carrying capacity within ten years. Juvenile possums disperse an average of six kilometres from their home range into suitable adjacent habitat, but can move up to 30 kilometres per year.

Primarily herbivores, possums feed on a variety of leaves, flower buds, fruit, ferns, and fungi. They feed also on invertebrates and opportunistically on the eggs and nestlings of birds. As a result a very large range of both indigenous and introduced flora and fauna are affected. Despite this wide range, possums are strongly selective browsers and the majority of the diet in any one location consists of only a few species. The species most common in a habitat are not necessarily those most frequently eaten, therefore, possums cause extensive defoliation of favoured plant species and progressive change in forest composition to less favoured species occurs. Damage is not however uniform across habitats.

Possum damage appears to be variable within and between plant populations, communities and ecosystems, and is influenced by a range of biotic and abiotic (living and non-living) factors. These factors may predispose plant communities to possum damage, trigger damage episodes, or accelerate the rate of vegetation change. Within forest communities, possum browsing is frequently concentrated on a few trees that may be defoliated or killed, while neighbouring trees may be unaffected. At a regional scale plant species such as mistletoe or fuchsia can coexist with long-established possum populations, while other populations of the same species can be threatened with extinction. Possums can also impact native animals by predation of insect species, snails, and birds.

Possums cause economic effects by damaging exotic forests, eating pasture, and through the spread of bovine TB. However, the possum browsing on pasture is likely to be a minor problem apart from pasture/bush margins. Possums can also damage winter feed and other crops especially on bush/pasture margins. The damage to exotic forests tends to be limited but they are known to damage tree crops and domestic gardens.

Possums are included in the programme to address adverse effects to conservation values and to protect the past economic investment in Bovine Tb control. There is evidence to support the link between possums and TB in farmed animals. Recent studies show that cattle and deer may lick and nuzzle TB infected possums in the terminal stages of the disease as the possums wander around open ground in daylight. Sheep do not appear to exhibit this level of curiosity, and to date have remained relatively free of the disease.

Proposed programme
Environment Southland is proposing a sustained control programme for possum. This programme will also apply to the Stewart Island/Rakiura site-led area; however additional rules for possums will apply at that site.

Level of analysis
Possum is considered to require a medium level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken for possums.

NPD section 6 - assessment

Options for response
The analysis considers three options for possum:
1. do nothing;
2. eradication;
3. sustained control.

Benefits and costs of options for management of possum

Benefits and costs of options for management of possum

Option	Costs	Benefits
Do nothing	Low cost – only what occupiers would spend voluntarily to reduce losses to production.	Nil or negative with respect to the economy and environment. Some benefits for possum fur harvesting.
Eradication	Very high costs and probably not economically and technically feasible with existing tools and reinvasion from adjacent uncontrolled land.	High benefits to economy and environment. Loss of the possum fur industry.
Sustained control	The cost of delivering a sustained control programme for possums to reduce impacts and cross boundary effects (based on the current Possum Control Area) is $813,000/year.	Moderate to high with reduction of TB risk and production loss and to the improved protection of biodiversity values. A fur recovery industry could be retained.

Risks of sustained control programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Control techniques are not applied or maintained to a standard that achieves the required RTC.	Low	Medium	Disease vector management (TB) Biodiversity values Agricultural values	Possum Control Programme provides support to occupiers carrying out possum control.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
	Reduction in funding to support occupiers	Low	High	As above	Provisions of adequate funding through the Long Term Plan and Annual Plan processes.
Extent to which the option will be implemented and complied with	Occupiers do not carry out control.	Low	Medium	As above	As above
Risk that compliance with other legislation will adversely affect implementation	None known.				
Risk that public or political concerns will adversely affect implementation	Public concerns around the use of toxins (sodium fluoroacetate and brodifacoum) and animal welfare issues may result in a reduction of available control methods.	Medium	High	Ability to effectively control possums to required RTC levels.	Education, advocacy, strict management of toxins and well trained staff and contractors.
Any other material risk	None known.				

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of possum

The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - the Southland community – by protection of biodiversity from possum impacts;
  - occupiers – primarily economic in protection from TB;
  - and other diseases carried by possums and also production loss;
- active exacerbators:
  - occupiers that allow spread from their land;
  - Crown as a landowner that allows spread from its land;
- passive exacerbators: as for active exacerbators.

Matters for consideration in allocation of costs of proposed possum programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed possum programme

Legislative rights and responsibilities	There are currently no legislative requirements on occupiers to control possums. The Department of Conservation may have conservation responsibilities on some High Value Areas of Crown land.
Management objectives	To reduce possum impacts and prevent spread across boundaries.
Stage of infestation	Possums occupy all favourable habitats in the region, i.e. the infestation is at its maximum extent.
Most effective control agents	Occupiers with assistance from ES.
Urgency	Medium.
Efficiency and effectiveness	Cost sharing between occupiers and Environment Southland with assistance to incentivise and coordinate occupiers is considered an efficient and effective method to facilitate occupier self-help programmes.
Practicality of targeting beneficiaries	Costs will be shared by beneficiaries. Estimate over 10 years at a ratio 75% private/25% public. $10/hectare for initial control in first year. The Southland community will contribute a significant portion of the cost to set up occupier self-help control programmes and provide ongoing assistance to occupiers to undertake ongoing maintenance.
Practicality of targeting exacerbators	Occupiers as principal exacerbators will be responsible for achieving Regional Pest Management Plan objectives on their land. This will cost $3-5/hectare/annum to maintain on an ongoing basis.
Administrative efficiency	Occupiers as principal exacerbators will be responsible for achieving Regional Pest Management Plan objectives on their land. This will cost $3-5/hectare/annum to maintain on an ongoing basis. Has worked well in practice and has been supported by the community since 2008 (290,000 hectares under PCAs).
Security	As above.
Fairness	As above.
Reasonable	As above.
Parties bearing indirect costs	Possum fur harvest may be reduced.
Transitional cost allocation arrangements	None required as the current programme is being extended.
Mechanisms available	Not applicable.

Proposed allocation of costs

It is proposed that costs for undertaking the sustained control programme for possums be covered in the following way.

Funding of inspection and monitoring costs		**Funding of control costs**		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Land holder control or contribution**
-	100%	-	30%	70%

SITE-LED PROGRAMMES - Stewart Island/Rakiura

Stewart Island/Rakiura site-led programme includes multiple pests.

African club moss

Description
African club moss is a fern ally or club moss – a primitive type of plant that evolutionally fits between mosses and ferns. It produces cones with spores rather than flowers. African club moss has creeping and irregularly branched stems that root at the nodes, forming a loose mat. The leaves are small and in four rows on the stem. African club moss grows on damp forest floors and stream banks. It can be found in gardens, shade houses, nurseries and ferneries.

African club moss reproduces both vegetatively and sexually. Pieces less than one centimetre long are capable of establishing new plants and spores can be picked up on clothing and footwear and carried into new areas.

Once established in an area, African club moss excludes desirable species from co-existing with it.

African club moss is only known from a few locations on Stewart Island/Rakiura. If it encroached further it could put forest regeneration at risk. The Department of Conservation operates a control programme for African club moss on Stewart Island/Rakiura.

Gunnera

Description
Gunnera is a summer green herb with leaves up to two metres long with five to seven lobes. Flower panicles extend up to one metre in length and contain hundreds of fruits that are dispersed by birds and water. It has been planted as an amenity plant around ponds and streams in gardens and parks throughout New Zealand.

The plant forms dense patches that exclude almost all other plant species. It is invasive in damp coastal bluffs, riparian margins and disturbed ground. Herbfields, turf communities and other low stature vegetation are also susceptible to invasion.

Gunnera has been part of a ten year eradication programme on the Stewart Island/Rakiura it is found in approximately 165 locations.

Hawthorn

Description
Hawthorn is a thorny much-branched, deciduous shrub or small tree growing up to ten metres tall. This plant has been widely planted throughout Southland, often as a hedgerow. It produces many long-lived seeds that are spread by birds.

The plant can form dense thickets, blocking access and replacing desirable species along forest margins, shrubland, short tussock grasslands and other low-growing habitats. It can also be found

along roadsides and in deserted habitations, where it acts as a seed source for invasion into areas of native vegetation.

Although common in regional Southland, hawthorn is only localised on Stewart Island/Rakiura to the area around Halfmoon Bay.

Heather

Description
Heather – see description under progressive containment programme.

Although common in regional Southland, heather is only localised on Stewart Island/Rakiura to the area around Halfmoon Bay. If it encroached further it could put the significant wetland complexes and alpine areas at risk.

The Department of Conservation is working towards eradication of heather on Stewart Island/Rakiura.

Knotweed

Description
Knotweed is a multi-stemmed, thicket-forming, rhizomatous perennial shrub. Stems are slender and hollow and zig-zag from leaf node to leaf node, up to 1.8 metres high. The leaves are heart to lancet-shaped, alternating, up to 40 centimetres long. Stems die in autumn and re-grow in spring from woody rhizomes Flowers small, white or pink, clustered along short branches.

Knotweed is capable of excluding other species and prevents native seedlings establishing. They tolerate wet to moderately dry conditions and warm to cold temperatures, but are intolerant of shade. Shrublands and waterways are vulnerable to invasion. The plants adversely impact amenity and conservation values in riparian margins and other disturbed areas.

Spanish heath

Description
Spanish heath is a brittle and erect woody perennial shrub growing up to two metres high, establishing in habitats from near sea level up to 1,000 metres. It is densely covered in small, needle-like leaves, arranged in groups of three or four. The plant produces masses of snowy white flowers from March to December. Seeds are very small and light, and are contained within smooth capsules about three millimetres long. They are readily dispersed by wind.

This plant can form dense stands on disturbed and bare sites. These stands can be persistent in short vegetation types such as herb fields, tussockland and fernland, preventing the recruitment of desirable species. It is usually succeeded in taller growing plant communities.

The Department of Conservation is working towards eradication of Spanish heath of Stewart Island/Rakiura.

Willows (crack and grey)

Description
Crack willow is a deciduous tree growing to 25 metres tall. It has a spreading crown and multiple trunks. Bright red rootlets are present when the plant is in or near water. The shoots are dark-brownish green and snap with a characteristic “crack” when bent.

Grey willow is a small tree growing up to seven metres high, although it often only grows to one to two metres high. The leaves are shiny on the upper surface and covered with soft grey hairs underneath. It is often found growing in swamps, riverbanks and wet areas behind coastal dunes.

The roots of crack willow provide protection from flooding by holding banks in place. However, it can form large, dense stands along river and stream channels, displacing native species, choking waterways and increasing the risk of flooding. The branches are very fragile and fragments break off readily. The smallest of fragments will root in mud and produce mature trees wherever conditions are favourable. Its growth and spread is exponential - slow to start with, then very rapid as the population grows.

Grey willow replaces native species in wetlands and forms vast dense stands. It can also cause blockages, flooding and structural changes in waterways even though it has been widely planted in many wet areas for soil reclamation and stabilisation purposes.

Although common in regional Southland, willows are only localised on Stewart Island/Rakiura to the area around Halfmoon Bay. If it encroached further it could put the significant wetland complexes and alpine areas at risk.

Feral cat

Description
Feral cats resemble domestic cats in both size and colouration. Coat colours vary from pure black to orange tabby and some resemble the striped dark and pale grey of the true European wild cat. They commonly revert to black, tabby or tortoiseshell with varying extents of white starting from the belly and breast. Adult male cats are generally larger than the females and can weigh up to five kilograms.

Feral cats tend to be solitary and territorial compared to domestic stray or unwanted cats that tend to form colonies. Territory is marked by scent secreted from anal glands and by spraying urine. Feral cats are mainly active at night. Their vision and hearing are acute.

Feral cats inhabit a wide range of urban, rural and forest habitats. They are found from sea level to alpine habitats. The diet of a feral cat is wide-ranging and includes small mammals, fish, birds and invertebrates. They produce two to three litters per year with an average of four young in each.

Feral cats have been branded as ‘the ultimate predators’ in New Zealand and have been nominated as amongst the “100 World's Worst" invaders. New Zealand’s unique native wildlife is particularly vulnerable to predation by cats. Feral cats kill young and adult birds and occasionally take eggs, prey on native lizards, fish, frogs and large invertebrates. Cats are highly efficient predators, and have been known to cause local extinctions of seabird species on islands around the world. Both sea and land birds are at risk, particularly those that nest or feed on or near to the ground.

Feral cats are implicated in a small way in the spread of bovine tuberculosis, with the potential to infect cattle. They also carry parasites and toxoplasmosis that causes abortions in sheep and illness in humans. Feral and domestic stray cats can be aggressive towards pet cats. Through fighting they cause severe injuries sometimes resulting in the pet cat having to be put down. Feral cats are likely to interbreed with the un-neutered domestic cat population and may spread infectious diseases.

Feral goat

Description
Feral goats vary in size and their colour can be white, black, brown or a combination of colours. Both sexes have horns. Adult males stand approximately 70 centimetres high and weigh 50-60 kilograms. Females are smaller and begin breeding at six months old. They can breed twice a year and twins are common. Males can mate from six months old but are usually excluded by other males until three to four years of age.

Feral goats are absent from Stewart Island/Rakiura, although there have been pet animals present on the Island in the past. Escapees (feral goats) are extremely damaging to native vegetation. They prevent seedling regeneration and in partnership with possums can cause complete forest collapse.

Feral pig

Description
Feral pigs can measure 90 to 200 centimetres in length, and weigh 50-90 kilograms. Their colour varies from dark grey to brown or black. Adult males develop tusks that protrude from their mouth. Sexually mature at two years of age, they breed once per year with litter size ranging from four to six piglets. The piglets are weaned at three to four months of age. Vegetation forms 70 percent of a pig's diet. Pig rooting can reduce the diversity of seedlings and saplings and cause a dramatic reduction in leaf cover on the forest floor.

Feral pigs are scattered throughout Southland but are not found on Stewart Island/Rakiura. Their distribution is assisted by people who continue to release pigs into the wild, despite this being an illegal activity. The pigs cause a number of impacts including rooting up pasture and eating forest seedlings, insects and scavenging nests. The scavenging habit of feral pigs contributes to their tendency to carry TB.

Hedgehog

Description
Hedgehogs are nocturnal insectivores. Their back and sides are completely covered with spines and they roll into a prickly ball when disturbed, or when hibernating. They are widespread through lowland Southland, occupying a wide range of habitats. On Stewart Island/Rakiura, they are less widespread and are found mainly around Halfmoon Bay.

These animals eat mainly insects, however they eat a wide range of food if the opportunity presents itself. They are a potentially serious predator of native invertebrates, lizards, and ground nesting birds.

House mouse

Description
House mice are small, omnivorous generalists that reach approximately 30 grams in weight and measure around 115 millimetres (without tail). They have a dull grey-brown back and a uniform grey belly with a very thin, grey-brown tail and large black eyes.

These animals can be found throughout Southland, except on Stewart Island/Rakiura, from the coast to high altitude (1,200-1,300 metres), predominantly in temperate forest (native and exotic), croplands and pasture, and subalpine tussock. They also occur in various urban habitats. House mice are very well adapted to dry conditions due to their ability to concentrate their urine, and as most of their water requirements can be taken from the moisture of their food.

Caterpillars, spiders and weta are a major part of the mouse's invertebrate diet. Additionally a range of seeds, including hard beech, mountain beech, kauri and rimu are consumed. Mice are agile climbers, good jumpers and can swim.

Consumption of seeds may alter the regeneration of these species. Prey on invertebrates may also have secondary effects on the vegetation due to changes in ecosystem processes.

They are not currently present on Stewart Island/Rakiura.

Mustelid (ferret, stoat, weasel)

Description
Ferrets, stoats, weasels are part of the mustelid family, which is a group of small to medium sized carnivores. Mustelids have large home ranges and are active day and night. They are opportunistic predators and have a strong musk odour. Ferrets are the largest mustelid in New Zealand. Male ferrets grow up to 44 centimetres and females up to 37 centimetres in length. The undercoat is creamy yellow with long black guard hairs that give the ferret a dark appearance. A characteristic black face mask occurs across the eyes and above the nose. Stoats have long, thin bodies with smooth pointed heads. Ears are short and rounded. They are smaller than ferrets. Males grow up to 30 centimetres and females up to 25 centimetres in length. Their fur is reddish-brown above with a white to yellowish underbelly. Stoats have relatively long tails with a distinctive bushy black tip. Weasels are the smallest and least common mustelid in New Zealand. Males grow to about 20 centimetres long. Their fur is brown with white undercoat, often broken by brown spots. Their tails are short, brown and tapering.

Mustelids inhabit a wide range of urban, rural and forest habitats.

Although habitat loss and modification remains a threat to native biodiversity, a more equally serious threat is from invasive introduced species. Introduced predators, such as ferrets, stoats, weasels and feral cats, pose a significant threat to our remaining natural ecosystems and habitats and threatened native species and can have a considerable negative impact on primary production. Ferrets, stoats, weasels and feral cats are distributed throughout the Southland region.

Mustelids were introduced in New Zealand in the 1880's in an attempt to manage growing rabbit populations. This had minimal impact on rabbit densities but had a significant impact on New Zealand's biodiversity. Mustelids are implicated in the extinction of some indigenous bird species and as the major cause of decline of many others. Ferrets are also a threat to agriculture, particularly

through their role as a carrier of bovine tuberculosis. Mustelids are a threat to poultry farms and carry parasites and toxoplasmosis, which can cause illness in humans and livestock.

Possum

Description
Possum – see description under sustained control animals.

Rat (Norway, ship and kiore)

Description
Ship rats are slender with large hairless ears, grey-brown on the back with a similarly coloured or creamish-white belly, or black all over. The uniformly-coloured tail is always longer than the head and body length combined. Adults usually weigh 120-160 grams but can exceed 200 grams. The Norway rat has brown fur on its back and pale grey fur on its belly. Adults normally weigh 150-300 grams but may reach up to 500 grams, and are up to 390 millimetres long. They have relatively small ears which usually do not cover the eyes when pulled forward. Their tail is shorter than their head to body length.

Breeding commences in rats as early as three to four months of age and female rats can produce 15-20 young per year. Mortality can be high.

Kiore have brown fur, with white-tipped grey fur on the belly, pale feet with a dark mark on the outer edge of the hind feet. Their ears cover the eyes when pulled forward and they have a thin tail, about the same length as body. They are smaller than other rats in New Zealand, with a maximum body length of 180 millimetres without the tail, and they usually weigh 60-80 grams, but can weigh up to 180 grams.

Rats inhabit a wide range of urban, rural and forest habitats. Ship rats are more common within forest areas.

Rats are omnivorous and opportunistic feeders eating 10 percent of their body weight per day. This makes them a competitor for food with many species and predators of others. They eat a variety of native flora and fauna, in particular native birds (eggs and fledglings), lizards, and invertebrates. They eat large quantities of native seeds, which reduces regeneration of native plants.

Proposed programme
Environment Southland is proposing a site-led programme for Stewart Island/Rakiura that will include the plant and animal species listed above.

Level of analysis
All of the pests included in the programme scored either a low or medium on the when assessed according to the guidance document ‘Meeting the requirements of the National Policy Direction for Pest Management 2015’.

The assessment of species within the Stewart Island/Rakiura Site-Led Programme has been combined and has a medium level of analysis.

Costs and benefits for site-led programmes generally have also been summarised in Section 13 of the cost benefit analysis undertaken by an independent economist.

Method
A qualitative assessment of the costs and benefits has been undertaken. Due to the specific values at Stewart Island/Rakiura, the intangible nature of the environmental and community benefits has been given additional weight for this analysis.

NPD section 6 - assessment

Options for response
The analysis considers two options for pest species at Stewart Island/Rakiura:
1. do nothing;
2. site-led.

Benefits and costs of options for management of pest species at Stewart Island/Rakiura

Benefits and costs of options for management of pest species at Stewart Island/Rakiura

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Doing nothing represents a significant risk to the values at Stewart Island/Rakiura. The high and unique biodiversity values at the site would be severely compromised. Stewart Island/Rakiura comprises multiple complex ecosystems and is home to many threatened and endemic species that would be put at risk by a do nothing approach. The economy of Stewart Island/Rakiura relies on ecotourism to support its residents and would also be compromised by a do nothing approach. The values at Stewart Island/Rakiura extend beyond the local community due to its international significance.	None known.
Site-led pest plants	Control of plants during initial stages of infestation will be cheaper than control once the plant gets more widespread.	Some pest plants provide food and habitat for native species, including birds, reptiles and invertebrates. Controlling pest plants risks creating light wells that could promote the establishment of other pest plant species.	Pest plant control prevents monocultures from establishing and disrupting ecosystems. Pest plant control protects native species and preserves the integrity of the islands ecological values.

Option	Basic economic assumptions	Costs	Benefits
		Controlling pest plants around waterways may result in raised water temperatures until native plant cover has re-established.	Pest plant control will contribute to keeping Stewart Island/Rakiura a high quality natural environment. Control programmes are supported by community groups. Pest plant control programmes supports Department of Conservation's programmes in the area. Targeting species that are low on the infestation curve is more cost effective than dealing with a widespread incursion.
Site-led pest animals	Costs for managing site-led animal species at Stewart Island/Rakiura are limited to costs associated with education, information and reducing the feral cat population. Max $18,000 (year 1) Max $2,000 (annual enforcement/education costs)	Reducing cat numbers would relieve predation pressure on rats and rat numbers may increase. Increasing rat numbers may increase the risk of leptospirosis Continued risk of cats transmitting toxoplasmosis	The main benefit of declaring and controlling pest animals at Stewart Island/Rakiura is preventing the transport and spread of species throughout the island and islets. Controlling pest animals will contribute to the high quality natural environment and experience of Stewart Island/Rakiura. Preventing the spread of pest animal species will protect a large range of native threatened species and ecosystems. Success of the site-led programme will also help to protect pest free islands such as Ulva Island and Whenua Hou. Removing the ability for domestic cats to interbreed with feral or stray cat populations will increase the effectiveness of feral cat control programmes by reducing the speed of population growth or recovery. Management of pest animal species will improve the natural

Option	Basic economic assumptions	Costs	Benefits
			environment, leading to a better experience for visitors and keeping the tourism industry viable.

Risks of Stewart Island/Rakiura site-led programme (animals) not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Biosecurity border is unable to prevent the transportation of species between islands.	Low-medium depending on the species.	High.	High ecological values on pest free islands and predation by mustelids/mice on Stewart Island/ Rakiura.	Education. Biosecurity Pathways plan.
	Not all domestic cats are neutered or microchipped.	Low-medium.	Medium.	Domestic cats interbreed with feral cats keeping feral cat population high.	Education. Subsidies for microchipping.
	Hard to police car rules compliance as no Environment Southland staff on Stewart Island/Rakiura.	High.	Medium.	Domestic cats interbreed with feral cats keeping feral cat population high.	Education. Subsidies for microchipping. Work with SDC and SPCA animal officers.
	Failure to detect incursions of new species.	High.	High.	High ecological values on pest free islands and predation by mustelids/mice on Stewart Island/Rakiura.	Education. Biosecurity Pathways plan.
	Failure to eradicate an incursion.	High.	High.	High ecological values on pest free islands and predation by mustelids/mice on Stewart Island/Rakiura.	Education. Biosecurity Pathways plan.
Extent to which the option will be implemented and complied with	Stewart Island/ Rakiura community have been complying with similar rules during the last programme with only limited incursions. In general they are supportive and	Low.	High.	High ecological values on pest free islands and predation by mustelids/mice on Stewart Island/Rakiura.	Education. Biosecurity Pathways plan.

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
	comply with the rules.				
Risk that compliance with other legislation will adversely affect implementation	None known.				
Risk that public or political concerns will adversely affect implementation	None known.				
Any other material risk	None identified.				

Residual risks

None identified.

Risks of Stewart Island/Rakiura site-led programme (Plants) not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Plant control goals are not met due to: • the infestation is more widely spread than thought. • the seed bank is larger than thought. • the seed life is longer than thought. • the environment and terrain makes it hard to reach all target plants.	Low-medium. The distribution and lifecycle of site-led programmes species is reasonably well known.	High.	High ecological values of Stewart Island/Rakiura.	Use of technology to find and control all locations. Education. Encourage the reporting of new infestations.
Extent to which the option will be implemented and complied with	Stewart Island/ Rakiura community have been complying with similar rules during the last plan. Most occupiers allow access.	Low.	Low.	High ecological values of Stewart Island/Rakiura.	Education. Use biosecurity act for access if required.
Risk that compliance with other legislation will adversely affect	None known.				

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
implementation					
Risk that public or political concerns will adversely affect implementation	Public in some areas of New Zealand are pushing for a ban on some herbicides. This may reduce the effectiveness of control.	Low.	Medium.	High ecological values of Stewart Island/Rakiura.	Education. Herbicides only used following best practise.
Any other material risk	None identified.				

Residual risks
None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of pest species at Stewart Island/Rakiura

The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - Stewart Island/Rakiura community
  - Stewart Island/Rakiura Community and Environment Trust
  - Titi Island committees and beneficiaries
  - Southland community
  - national community
  - tourists
  - tourism operators
  - Department of Conservation
  - Southland District Council
- active exacerbators:
  - cat colony advocates or any person who feeds colony cats within the Stewart Island/Rakiura area
  - cat owners who have not already, at the time the Regional Pest Management Plan becomes operative, microchipped and neutered their domestic cats.
  - non-compliant cat owners including holiday makers
  - any person who actively dumps unwanted domestic cats within the Stewart Island/Rakiura area
  - non-compliant pig or goat owners
  - occupiers who dislike the use of herbicide control on their property
- passive exacerbators:
  - occupiers who do not control site-led species on their land within the Stewart Island/Rakiura area
  - any person who does not remove pests from boats or planes travelling to or between the Islands of Stewart Island/Rakiura

Grouping of subjects

For the site two groups of subjects have been identified, feral cats will be addressed as an individual species because the management of that species will require direct costs to be covered by cat owners. All other Stewart Island/Rakiura site-led pests will be grouped together for the purposes of determining the appropriate cost allocation as they satisfy the criteria under paragraph 119 of the guidance document.

The cost allocations for the site-led species are shown below and are split by the same groupings.

Matters for consideration in allocation of costs of proposed Stewart Island/Rakiura site-led programme

The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed Stewart Island/Rakiura site-led programme

Site-Led Species	Legislative rights and responsibilities	Management objectives	Stage of infestation	Most effective control agents	Urgency	Efficiency and effectiveness
African club moss	None.	Ongoing control to reduce impacts of known infestations.	Lag.	Department of Conservation	Moderate.	Moderate.
Gunnera	None.	Reduce the geographic distribution.	Lag/Explosion	Environment Southland	Moderate.	Moderate.
Hawthorn	None.	Reduce the infestation to zero.	Lag.	Environment Southland	High.	High.
Heather	None.	Reduce the infestation to zero.	Lag.	Environment Southland	High.	High.
Knotweed (Indian Himalayan)	None.	Reduce the geographic distribution.	Lag.	Environment Southland	High.	High.
Spanish heath	None.	Reduce the infestation to zero.	Lag.	Environment Southland	High.	High.
Willow (crack, grey)*	None.	Reduce the infestation to zero.	Lag.	Environment Southland	Moderate.	Moderate.
Feral cat	Some rules relating to keeping cats are contained in the 'Southland District Council The keeping of animals, poultry and bees bylaw 2010'	Ongoing control to reduce impacts of known infestations.	Widespread.	Cat owners with support from Environment Southland.	Moderate.	Moderate.

Site-Led Species	Legislative rights and responsibilities	Management objectives	Stage of infestation	Most effective control agents	Urgency	Efficiency and effectiveness
	Cat owners will be responsible for getting cats neutered/ microchipped.					
Goat	Some rules relating to keeping goats are contained in the 'Southland District Council The keeping of animals, poultry and bees bylaw 2010'. Additional rules relating to goats are contained in the Wild Animal Control Act 1977.	Prevent the incursion or establishment of the species.	Not present.	Environment Southland.	High.	High.
Pig	Some rules relating to keeping pigs are contained in the 'Southland District Council The keeping of animals, poultry and bees bylaw 2010'. Additional rules relating to pigs are contained in the Wild Animal Control Act 1977.	Prevent the incursion or establishment of the species.	Not present.	Environment Southland.	High.	High.
Hedgehog	None.	Prevent the incursion or establishment of the species on pest free islands.	Explosion.	Environment Southland.	Moderate.	Moderate.
House mouse	None.	Prevent the incursion or establishment of the species	Not present.	Environment Southland.	High.	High.
Mustelids (ferret, stoat,	None.	Prevent the incursion or establishment	Not present.	Environment Southland.	High.	High.

Site-Led Species	Legislative rights and responsibilities	Management objectives	Stage of infestation	Most effective control agents	Urgency	Efficiency and effectiveness
weasel		of the species.				
Possum	None.	Prevent the incursion or establishment of the species on pest free islands.	Not present on some islands. Widespread on others.	Environment Southland.	High.	High.
Rat (Norway, ship and Kiore)	None.	Prevent the incursion or establishment of the species on pest free islands.	Not present on some islands. Widespread on others.	Environment Southland.	High.	High.

	All Stewart Island/Rakiura site-led species except for feral cats	Feral cats
Practicality of targeting beneficiaries	Practical to target some beneficiaries (Southland rate payers) through general rates.	Practical to target some beneficiaries (Southland rate payers) through general rates.
Practicality of targeting exacerbators	Impractical to specifically target exacerbators.	Reasonably practical to target domestic cat owners that have not already microchipped and neutered their cats.
Administrative efficiency	Funding through the general rate increases administrative efficiency through efficiency of scale because it targets multiple small programmes on multiple properties without having to individually target specific occupiers, beneficiaries and exacerbators.	Low cost programme will be efficient; however it does rely on participation from exacerbators.
Security	Environment Southland's contribution to the programme funding is secure. However the Department of Conservation contributions to the African club moss Programme is subject to central government funding which is expected to be secure for at least five years.	Environment Southland's contribution to the programme funding is secure.
Fairness	Programme is fair because it treats all Southland rate payers consistently to protect significant regional values (the values at the place).	Programme is fair, costs shared between domestic cat owners as exacerbator and Environment Southland through general rates on behalf of beneficiaries.
Reasonable	Protecting significant regional values through a general rate is a reasonable way to target all exacerbators and regional beneficiaries. It also allows for a reasonable allocation of resources (efficiency of scale).	The costs of the programme are reasonably low and predominatly target exacerbators. Environment Southland are contributing to the initial costs for existing occupiers with domestic cats so that the rules do not unreasonably impact any individual.
Parties bearing indirect costs	None.	None.

	All Stewart Island/Rakiura site-led species except for feral cats	Feral cats
Transitional cost allocation arrangements	None.	Environment Southland are contributing to the initial costs for existing occupiers with domestic cats. Future costs will be covered by domestic cat owners.
Mechanisms available	General (biosecurity) rate, is the most suitable available mechanisms.	General (biosecurity) rate, and imposing a cost through a rule are the suitable available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the Stewart Island/Rakiura site-led programme be covered in the following way.

All Stewart Island/Rakiura site-led species except for feral cats

Funding of inspection and monitoring costs		Funding of control costs		
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Department of Conservation contribution**
100%	-	40%	-	60%

Feral Cats

Funding of inspection and monitoring costs			Funding of control costs		
	General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Domestic Cat Owner contribution**
Year 1	100%	-	50%	-	50%
Year 2 onwards	100%	-	-	-	100%

SITE-LED PROGRAMMES – Omaui

Feral cat

Description
Feral cat - see description under site-led programme for Stewart Island/Rakiura.

Feral goat

Description
Feral goat - see description under site-led programme for Stewart Island/Rakiura.

Feral goats are found in low numbers around the Omaui peninsular and have been a target for control.

Hedgehog

Description
Hedgehog - see description under site-led programme for Stewart Island/Rakiura.

Mustelid (ferret, stoat, weasel)

Description
Mustelids - see description under site-led programme for Stewart Island/Rakiura.

Possum

Description
Possum - see description under site-led programme for Stewart Island/Rakiura.

Rat (Norway, ship and kiore)

Description
Rat - see description under site-led programme for Stewart Island/Rakiura.

Proposed programme
Environment Southland is proposing a site-led programme for feral cats at Omaui.

Level of analysis
The assessment of feral cats is considered to require a medium level of analysis when assessed according to the NPD guidance document.

The assessment of feral goats, hedgehogs, mustelids, possums and rats is considered to require a low level of analysis when assessed according to the NPD guidance document.

Method
A qualitative assessment of the costs and benefits has been undertaken. Due to the specific values at Omaui, the intangible nature of the environmental and community benefits has been given additional weight for this analysis.

NPD section 6 - assessment

Options for response

The analysis considers two options for feral cats at Omaui:

1. do nothing;
2. site-led.

Benefits and costs of options for management of pest species at Omaui

Benefits and costs of options for management of pest species at Omaui

Option	Basic economic assumptions	Costs	Benefits
Do nothing	No quantitative costs.	Doing nothing represents a significant risk to the values at Omaui. The biodiversity values at the site would be severely compromised. The Omaui community has worked hard to remove predation and grazing pressures on the Omaui environment, the gains they have made to date would be put at risk by a do nothing approach. Cats are not controlled. There is interbreeding between feral and domestic cats which contribute to higher feral cat numbers. People continue to feed feral or stray cats. High cat numbers mean continual predation on endangered species, continued re-invasion and lack of control puts Omaui Landcare group project at further risk. Presence of cats can detract from the visitor experience.	People are able to keep and breed domestic companion cats and domestic goats.
Site-led	Costs for managing site-led animal species at Omaui are limited to costs associated with education, information and reducing the feral cat population. Max $7,000 (year 1) Max $2,000 (annual enforcement/education costs).	Reducing cat numbers would relieve predation pressure on rodents and rabbits so rodent and rabbit numbers may increase. Cost to people who like keeping cats who will no longer be able to keep or breed domestic companion cats. Cost to people who like	Allows for continued control and reduces the risk of domestic animals becoming feral. Would have some benefits to native biodiversity including at risk species and ecosystems. Progressive containment would have some benefits to native biodiversity including at risk species and ecosystems.

Option	Basic economic assumptions	Costs	Benefits
		keeping goats who will no longer be able to keep or breed domestic goats.	Would produce some benefit to the recreational experience. Supports the work carried out by the Omaui Landcare Group. Supports community led wishes for cat ownership in the Omaui community.

Risks of Omaui site-led programme not achieving objectives

Risk type	Risk	Risk likelihood	Risk magnitude	Explanation of benefits at risk	Potential for mitigation
Technical and operational risks	Not all domestic cats are de-sexed or microchipped.	Medium.	High.	Protecting the values of Omaui.	Surveillance, monitoring and education.
	Hard to police transporting rules.	Low.	Medium.	Protecting the values of Omaui.	Surveillance, monitoring and education.
Extent to which the option will be implemented and complied with	People like keeping cats/ kittens and may be unwilling to de-sex.	High.	High.	Protecting the values of Omaui.	Education.
	People like keeping goats and may want to continue to keep them.	High.	High.	Protecting the values of Omaui.	Education.
	New people moving into the area unaware of the rules.	High.	High.	Protecting the values of Omaui.	Education.
Risk that compliance with other legislation will adversely affect implementation	None known.				
Risk that public or political concerns will adversely affect implementation	Public backlash on restrictions on cat and goat ownership.	High.	High.	Protecting the values of Omaui.	Education.
Any other material risk	None known.				

Residual risks

None identified.

NPD section 7 - allocation of costs and benefits

Beneficiaries, exacerbators and costs of proposed programme for control of pest species at Omaui
The beneficiaries and exacerbators of the programme are:

- beneficiaries:
  - Omaui Landcare Group;
  - Department of Conservation;
  - Invercargill City Council;
  - Omaui community;
  - Southland community;
  - national community;
  - tourists;
- active exacerbators:
  - cat colony advocates/any person who feeds colony cats within the Omaui site-led area;
  - non-compliant cat owners;
  - non-compliant goat owners;
  - any person who actively dumps unwanted domestic cats or goats within the Omaui site-led area;
- passive exacerbators:
  - any person who does not control pest species on their land within the Omaui site-led area.

Grouping of subjects
For the site two groups of subjects have been identified, feral cats will be addressed as an individual species because the management of that species will require direct costs to be covered by cat owners. All other Omaui site-led pests will be grouped together for the purposes of determining the appropriate cost allocation as they satisfy the criteria under paragraph 119 of the guidance document.

The cost allocations for the site-led species are shown below and are split by the same groupings.

Matters for consideration in allocation of costs of proposed site-led programme for Omaui site-led programme
The matters for consideration are listed in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown below.

Matters for consideration in allocation of costs of proposed site-led programme for Omaui site-led programme

	All Omaui site-led species except for feral cats	**Feral cats**
Legislative rights and responsibilities	Some rules relating to keeping goats are contained in the 'Invercargill City Council. Invercargill city council bylaw 2013/2 – keeping of animals, poultry and bees.	Some rules relating to keeping cats are contained in the 'Invercargill City Council. Invercargill city council bylaw 2013/2 – keeping of animals, poultry and bees. Cat owners will be responsible for getting cats neutered/microchipped.
Management objectives	To protect the values at the place	To supress feral cat numbers in Omaui area to protect the values at the place.

	All Omaui site-led species except for feral cats	Feral cats
Stage of infestation	Widespread (except goats – lag)	Widespread.
Most effective control agents	Occupiers, Omaui Landcare Group, Environment Southland and Department of Conservation	Cat owners with support from Environment Southland.
Urgency	Moderate	Moderate: feral cats are causing a known issue at the site. There is community support for implementation.
Efficiency and effectiveness	Moderate: species can be controlled to low numbers	High: assuming 50:50 cost sharing between cat owners and Environment Southland for neutering and microchipping.
Practicality of targeting beneficiaries	Practical to target some beneficiaries (Southland rate payers) through general rates.	Practical to target some beneficiaries (Southland rate payers) through general rates.
Practicality of targeting exacerbators	Impractical to specifically target exacerbators.	Reasonably practical to target domestic cat owners that have not already microchipped and neutered their cats.
Administrative efficiency	Funding through the general rate increases administrative efficiency through efficiency of scale because it targets multiple small programmes on multiple properties without having to individually target specific occupiers, beneficiaries and exacerbators.	Low cost programme will be efficient; however it does rely on participation from exacerbators.
Security	Omaui Landcare Group currently has adequately funding.	High, one off costs needed to implement the programme.
Fairness	Programme is fair because it treats all Southland rate payers consistently to protect significant regional values (the values at the place).	Cost allocation is fair as Environment Southland is subsidising cat owners.
Reasonable	Protecting significant regional values through a general rate is a reasonable way to target all exacerbators and regional beneficiaries. It also allows for a reasonable allocation of resources (efficiency of scale).	Costs are reasonable as Environment Southland is subsidising cat owners.
Parties bearing indirect costs	None.	None.
Transitional cost allocation arrangements	None.	Environment Southland is contributing to the initial costs for existing occupiers with domestic cats. Future costs will be covered by domestic cat owners.
Mechanisms available	General (biosecurity) rate, is the most suitable available	General (biosecurity) rate, and imposing a cost through a rule are

	All Omaui site-led species except for feral cats	Feral cats
	mechanisms.	the suitable available mechanisms.

Proposed allocation of costs

It is proposed that costs for undertaking the Omaui site-led programme, except for feral cats, be covered in the following way.

Funding of inspection and monitoring costs			Funding of control costs	
General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Omaui Landcare Group, Department of Conservation**
100%	-	-	-	100%

It is proposed that costs for undertaking the Omaui site-led programme for feral cats be covered in the following way.

Funding of inspection and monitoring costs			Funding of control costs		
	General rate	**Targeted rate on productive land**	**General rate**	**Targeted rate on productive land**	**Domestic Cat Owner contribution**
Year 1	100%	-	50%	-	50%
Year 2 onwards	100%	-	-	-	100%

Meeting the requirements of the Biosecurity Act 1993 and National Policy Direction for Pest Management 2015: Analysis of costs and benefits

Report prepared for Environment Southland as part of the preparation of a Regional Pest Management Plan

March 2018

Prepared By:

Simon Harris

For any information regarding this report please contact:

Simon Harris

Phone: 0274 356 754

Email: simon@landwaterpeople.co.nz

LWP Ltd
PO Box 70
Lyttelton 8841
New Zealand

LWP Client Report Number:	2017-05
Report Date:	March 2018
LWP Project:	2017-05

Table of Contents

Executive Summary

Approach

This report provides the information required for Environment Southland (ES) to determine whether their options for management of pests in the region are likely to meet the requirements of the Biosecurity Act (1993) and the National Policy Direction for Pest Management (NPD). The report analyses four options for each pest based on the categories described in the NPD. These are:

- Sustained Control – where further spread onto uninfested properties is prevented, but the pest is allowed to increase in density on already infested areas.
- Progressive Containment – where the pest is reduced in extent or is contained within its existing infested area.
- Eradication – where the pest is removed from the region.
- Do Nothing – where the pest is allowed to continue to spread, and land holders undertake control as their own circumstances indicate.

The costs and benefits of each option are modelled using estimates of the pest's spread into new areas, rate of increase in density, the costs of control, and lost production. It also takes into account the costs of intervention in the form of inspection, monitoring and enforcement costs. The inspection, monitoring and enforcement costs are subject to change through the plan development process and are indicative only in this report. The net benefit is estimated over 100 years and is the difference between the costs and benefits of the proposed option and the costs and benefits that would be incurred if the region were not to intervene – i.e. the Do Nothing scenario. It should be noted that losses of production will occur from other causes in all scenarios, but the production losses included here are only those that are associated with the pest. This net benefit is then adjusted for the risk that the proposed objective will not be achieved to provide an estimate of the risk adjusted net benefit. Assumptions used in undertaking the modelling were provided by Environment Southland and are described in detail in the report and in Appendix A.

The results of the analysis of costs and benefits are summarised in Table 1. The table describes each proposed plan objective, the risk adjusted net benefit associated with that option, and the option which provides the highest risk adjusted net benefit.

However, the risk adjusted net benefit is based only on those costs that are quantified – these are the loss of production and the costs of control. Pests are also associated with a range of other impacts that cannot be reliably quantified in monetary terms, including those to mana whenua, biodiversity, recreation, and amenity values. For pests where the risk adjusted net benefit is positive, the proposed plan option is justified even without consideration of those items. Where the risk adjusted net benefit is negative it is important that these other impacts are taken into consideration.

Outcomes of analysis of costs and benefits

The outcomes of the analysis of costs and benefits is described below according to the plan option and outcome of the analysis.

Sustained Control pests with a positive net benefit - Rabbits, Broom - rural, Gorse - rural, Nodding thistle. These Sustained Control pests all produce a positive net benefit, although it

is important to remember that those pests which rely on boundary control have only a limited chance of achieving anything different from the Do Nothing option.

Sustained Control pests with a negative quantified net benefit – Gorse and Broom in an urban setting, and ragwort produce a negative risk adjusted net benefit. Other non-monetised net benefits are therefore necessary to justify their inclusion in the plant.

Progressive Containment pests with a positive quantified net benefit – Wilding conifers produces a positive net benefit, with the analysis including values for biodiversity benefit of $32.1/ha/annum. It should be noted that the control costs proposed are $20,000 per annum to inspect and control 345,000 ha, which impacts on the relative benefits and costs of the analysis.

Canada goose – does not show a net benefit to management by the council when the risk of not meeting the Eradication objective is taken into account.

Exclusion pests – These are considered likely to be of net benefit because of the small costs involved and the potential costs of establishment of the Exclusion pests, which are known to have had impacts elsewhere.

The *Site led pests* programme is considered likely to have a net benefit because of the requirement for land holder agreement, which suggests that the costs of control will be exceeded by the benefits to the parties involved.

Outcomes of funding analysis

The report also provides information on each of the items that must be considered in developing a funding policy for the pest management plan, and provides a recommendation on the funding options based on that information. The funding recommendations are provided in the last five columns of Table 1. They are divided into the programme related costs of inspection, monitoring and enforcement; and the cost of undertaking the control work. For cost of control the funding is divided into whether the funding is sourced from General Rate, a Targeted rate (generally on productive land), and /or from exacerbators in the form of contribution or requirement for control.

For pests that are solely production related - the funding recommendations are for a targeted rate on productive land for plan related costs, and generally exacerbator control depending on efficiency of the measure.

For the pests where there is both a productive and biodiversity related benefit - the costs are apportioned between the General and Targeted rate depending on a qualitative assessment of the relative benefit to each party. They are not definitive and it is entirely appropriate that decision makers attach different weightings to various considerations to produce an alternative conclusion.

Good Neighbour Rules (GNR)

GNRs are proposed for feral rabbits, broom, gorse, nodding thistle, ragwort and wilding conifers as part of wider Sustained Control programmes for which the costs and benefits are assessed above. The relative reasonableness of the costs incurred between the occupier required to control and the neighbour otherwise affected must be considered under Section 7 of the NPD.

For rabbits - the difference in costs between the source and landholder affected depends on the proneness of the land involved. Requiring control of a boundary on land where the source is High or Extreme proneness is not likely to be reasonable.

For possums a GNR is only likely to be close to reasonable when both the receptor and source are low prone land (e.g. pastoral land). In higher prone forested land the 500m buffer appears unlikely to make any difference to the costs experienced by neighbouring landholders because of the distances that possums move over. The costs of the GNR for possums would therefore be unreasonable.

For light infestations of nodding thistle, gorse, broom, and wilding conifers in hill and high country the costs incurred by occupiers who would be required to control under the GNR would be similar to the costs for the neighbour otherwise affected, although only on certain land types. A GNR for these situations would be reasonable.

For dense infestations of broom and gorse the costs for the party required to control are 50% higher than for the neighbour. In these situations a judgement needs to be made by the council as to whether the costs of compliance are reasonable.

For dense infestations of wilding conifers the costs of control for the party required to control are 8 – 9 times the costs for the neighbour, and boundary control is not likely to meet the tests of reasonableness in the NPD.

For ragwort the costs are likely to be reasonable where dairy properties are the affected parties. However where other property types are affected the costs are not likely to be reasonable.

Table 1: Summary of cost benefit outcomes and funding recommendations.

Analytical outcomes						Funding of inspection and monitoring costs		Funding of control costs		
Pest	**Proposed Objective**	**Risk Adjusted Net Benefit of Proposed Objective (NPV6% $m)**	**Highest Value Plan Objective**	**Biodiversity or other benefits needed for plan to be positive ($/ha NPV)**	**Biodiversity or benefits for Highest Value Plan objective ($/ha NPV)**	**General Rate**	**Targeted rate on productive land**	**General Rate**	**Targeted rate on productive land**	**Land holder control or contribution**
Canada geese	Eradication	-$0.145 to -$2.40	Do Nothing	-	-	100% (Sustained control)		100% (Sustained control)	100% (Eradication)	
Rabbits (feral)	Sustained Control with Boundary only	$3.38	Sustained Control with full control		-	-	100%			100%
Nodding Thistle	Sustained Control	$7.8	Sustained Control	-	-		100%			100%
Broom – Urban	Sustained Control	-$0.33	Sustained Control	-	-		100% urban land, or complainant charged			100% to prevent spread
Broom – Rural	Sustained Control	$13.9	Sustained Control	-	-	50% biodiversity-	50% biodiversity, 100% productive	50% biodiversity		50% biodiversity, 100% to prevent spread
Gorse – Urban	Sustained Control	-$0.33	Sustained Control	-	-		100% urban land, or complainant charged			100% to prevent spread
Gorse - Rural	Sustained Control	$10.6	Sustained Control	-	-		100%			100%
Wilding Conifers	Progressive Containment	$12.4	Progressive Containment	$41.5/ha/year[1]	-		100%	100% Initial		100% Ongoing
Ragwort	Sustained Control	-$1.6	Sustained Control			100%				100%
Exclusion Pests	Exclusion	Likely to be positive	Exclusion			100%		100%		
Site Led Pests	Site Led	Likely to be positive assuming land holder agreement	Site Led			100%		To be determined	To be determined	To be determined

[1] Assume a biodiversity benefit of $41.5/ha/annum based on a willingness to pay survey (Kerr, et al., 2007).

1 Background

Environment Southland is reviewing its Regional Pest Management Plan (RPMP) to bring it in line with the requirements of the National Policy Direction (2015) (NPD). The NPD specifies a number of potential outcomes which are:

- Exclusion (Exclusion Programme)
- Eradication (Eradication Programme)
- Progressive Containment (Progressive Containment Programme)
- Sustained Control (Sustained Control Programme).
- Protecting values in places (Site led pest programme).

Section 6 of the NPD also specifies the requirements for analysing costs and benefits of the RPMP. Section 6 has 5 requirements:

1. Considerations to determine the level of analysis.
2. Requirements for undertaking the analysis of costs and benefits
3. Considerations for assessing the risks that the plan will not meet its objectives.
4. Requirements for taking into account risks that the plan will not meet its objectives.
5. Requirements for documentation of the analysis and the underlying assumptions.

The NPD also sets out how an assessment of the allocation of costs for the plan is to be undertaken in Section 7. This has two sections:

1. Considerations in grouping for the purposes of cost allocation.
2. Requirements in determining the appropriate cost allocation.

As with Section 6 on the analysis of costs and benefits, there is a requirement to document the analysis and underlying assumptions.

Ministry for Primary Industry (MPI) has also released guidance notes to accompany the NPD (NPD Guidance).

The analysis undertaken here follows the requirements of the NPD for each of the pests to be assessed. Environment Southland has categorised its pests into the new plan types, and has developed approaches to meet the desired objectives. It has also categorised the pests according to the requirements of Section 6(1) to determine the level of analysis that needs to be undertaken using the guidance material provided by MPI. This indicates that all pests in the RPMP are either low or medium in terms of the level of analysis required with the exception of Wilding Conifers which require a high level of analysis.

The sections that follow set out the analysis undertaken and results of the analysis in a format that responds to the requirement of the NPD and provides analysis of the potential funding arrangements for each pest.

The analysis is undertaken in two parts. For plant pests a generic model was applied to all pests as described in Section 4, with assumptions varied by pest. For animal pests separate

modelling was undertaken for each pest, with the method for each of the animal pests described within the section.

2 Canada Goose

2.1 Description

Canada goose (*Branta canadensis*) is a large waterfowl native to North America and parts of Europe. It was established in NZ in 1905, and has spread to large parts of the South Island and the North Island from 1970. In the South Island birds tend to breed in the high country near lakes and rivers, and travel to inland or coastal lakes and waterways from November (non-breeders) through to February (breeding birds), remaining there through the winter.

Population trends in New Zealand have been increasing since their introduction, with approximately 50,000 birds currently present. Trends from the mid 1980s – mid 2000s suggest that populations were stable in the South Island, although it should be noted that this stability was during periods of heavy culling and may have omitted expansion of habitat since aerial surveys were repeated over the same areas of established populations. Environment Southland suggest an estimate of 4500 – 5000 birds in Southland, with significant potential for population expansion into new habitat.

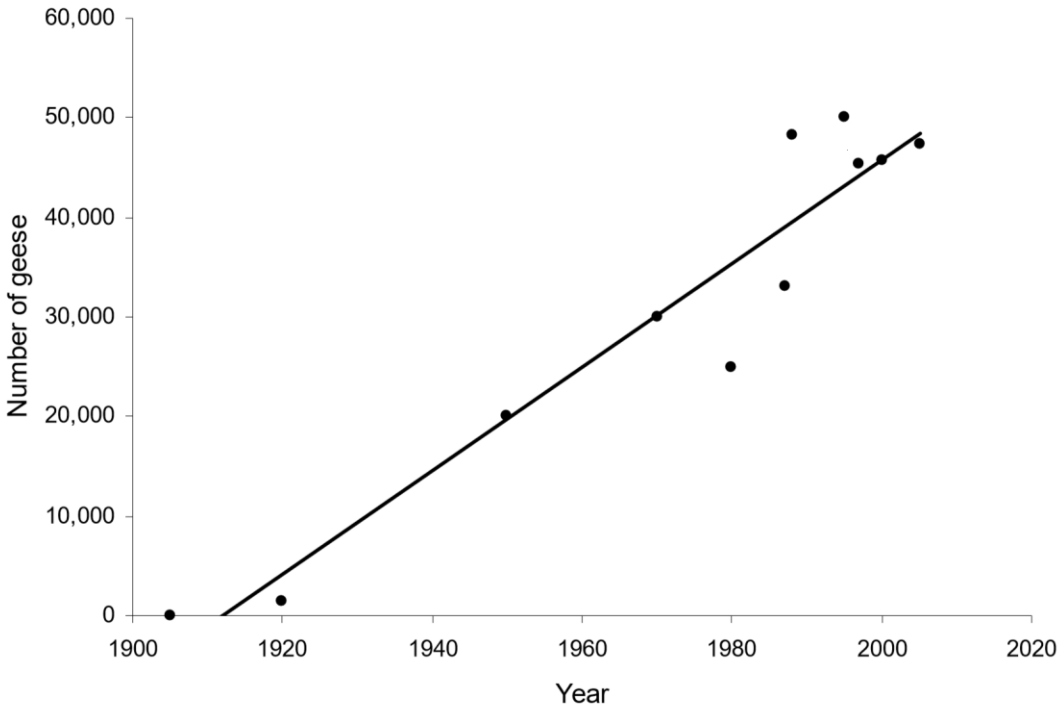

Figure 1: Canada goose population trend in New Zealand since establishment, based on anecdotal historical data (Spurr, et al., 2005)

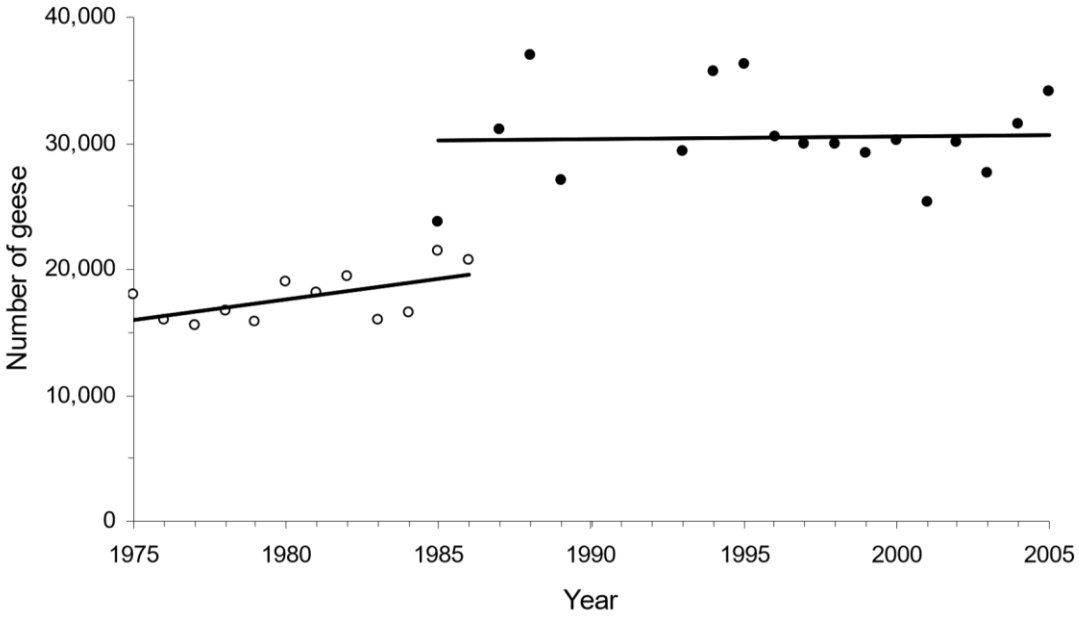

Figure 2: South Island Canada goose population trend from counts in April 1975–1986 (○), and June 1985–2005 (●) (from Potts 1984; Holloway et al. 1997; M. Webb, Fish & Game, unpubl. data 2005, cited in (Spurr, et al., 2005)).

Canada geese feed on pasture, particularly fields adjacent to lakes, irrigated pasture, and emergent re-sown pasture, and are most damaging on annual compared with perennial pasture ((Spurr, et al., 2005). The damage tends to be focused on specific properties rather than spread out, with farms in the high country and adjacent to lakes and lagoons most affected. Although geese will graze on crops, damage to arable cropping appears limited and this is not a major land use in Southland. Canada geese also foul pasture with droppings which may be avoided by stock, are a nuisance in urban areas. Their nuisance value can be particularly important in an airport setting where they represent a danger to aviation because of their size.

Canada geese do however represent a hunting resource and for a proportion of the hunting population they provide recreational benefits. They are also valued by some community members for their aesthetic appeal.

2.2 Proposed plan

ES are proposing an Eradication plan for Canada goose.

2.3 Level of analysis

The assessment of Canada geese is considered to require a Level 2 analysis under the guidelines of the NPD Guidance.

2.4 Method

Two models of linear population growth are used, with population maxima being reached in 50 or 100 years' time under each model. A linear model is determined to be appropriate based on historical increases in population from monitoring results between 1990 and 2012 (see Figure 3). The maximum population is unknown, so the analysis is undertaken by

assuming that the rate of increase occurs for either 50 or 100 years before maximum population is reached. No impact of control in the absence of regional intervention is assumed. Historically it was only necessary for Fish and Game to undertake culls on two occasions at specific locations in relation to excessive pasture grazing. However, this work did not necessarily prevent the spread of geese.

In the mid 2000s geese were actively hunted by only about 5% of licensed game bird hunters in the Wellington region and 10% of hunters in Central South Island region (Spurr, et al., 2005). However Fish and Game Southland note that of those hunters who specifically target geese, there are some extremely experienced groups in Southland, with the most successful group shooting 800 birds per year on average (Z Moss pers. comm.). In total, with Fish & Game's knowledge of those that hunt geese they estimate approximately 2640 birds are harvested by hunters annually.

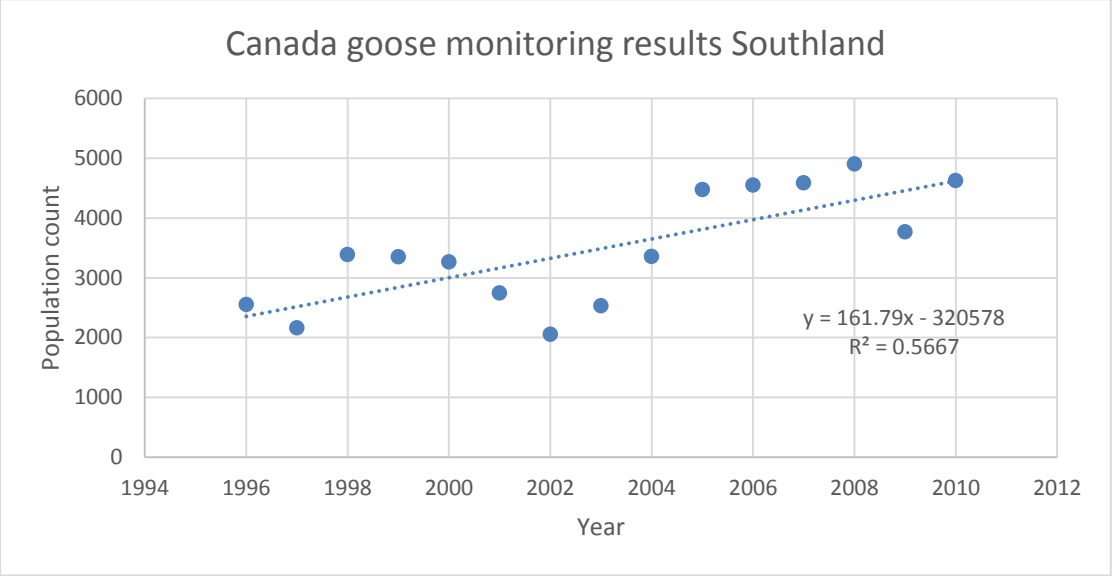

Figure 3: Southland Canada goose population trend from Fish and Game monitoring[2]

Canada geese were estimated to consume on average 0.35 kgDM/day from (White, 2006) based on 6 – 8% of body weight. Canada geese can cause significant differences in monthly dry-matter availability in goose-grazed pasture. Pasture consumption ranged from less than 100 kg/ha in winter to 900 kg/ha in late summer – early autumn, and was positively correlated with the number of geese present. Densities of grazing geese ranged from 3.7/ha in spring to 20.2/ha in autumn ((Win, 2001). The value of DM was estimated at $0.23/kgDM based on the standing costs of feed. If feed had to be imported to the property to replace that eaten by Canada goose, such as might occur for the replacement of autumn and winter feed, the costs would be higher at $0.4 - $0.5/kgDM.

Eradication is logistically very difficult due to their mobility, with movement of birds into the region, and redistribution of birds within the region following culling efforts. In order to achieve eradication, control would be required across the region across approximately 20

[2] Zane Moss, Southland Fish and Game, pers.comm.

key locations plus removal from all other locations almost simultaneously. There would be a need to prevent uncoordinated control in order to prevent disturbance of birds and a reduction in the efficacy of culling techniques. In order to achieve eradication therefore the control effort would need to control a large number of birds across a number of sites at the same time. Indicatively the analysis uses a doubling of the current estimated removal rate (from hunting) to 5300 birds per annum over a 10 or 20 year period. ES has estimated a cost of $40/bird for the removal cost , which results in a total cost of $216,000 per annum, plus an additional $19,000 per annum for monitoring, advice, etc. Sustained control would involve a lesser effort of 500 birds culled per annum in addition to the current hunting effort, with a cost of $20,000 per annum, with additional costs of $19,000 per annum.

A discount rate of 6% is used for the analysis (see Section 4.4).

2.5 NPD Section 6 Assessment

2.5.1 Impacts of Canada geese

Canada geese feed on pasture adjacent to water bodies. They can cause significant local loss of pasture, fouling of pasture, they are capable of causing a nuisance in urban settings (although this has only occurred in Te Anau to date in Southland) and pose a risk to aircraft in the vicinity of airports.

2.5.2 Options for response

The analysis considers three options for Canada geese:

1. Do Nothing
2. Sustained control
3. Eradication (fast and slow)

2.5.3 Benefits and costs of options for management of Canada geese

The benefits and costs of the three management options are shown in Table 2. Table 3 shows the net benefit of the plan relative to the Do Nothing, and suggests that in the absence of any risk to achievement of the objective there is a positive net benefit to both Sustained control and fast Eradication under a range of assumptions about rate of spread. Fast Eradication produces a higher net benefit than sustained control, but if Eradication were to take 20 years to achieve complete removal of Canada geese from Southland there would be a net negative outcome. However the risk of Eradication should be noted, given likely behavioural responses of geese, the need for repeated access at a large number of locations and the inherent logistical, public awareness and political challenges. These risks are discussed further below.

Table 2: Benefits and Costs of Canada goose management options

Option	Rate of spread	Loss of pasture	Control costs (NPV)	Total costs
Do Nothing	*Fast spread (50 yrs. to max population)*	$3,066,453		$3,066,453
	Slow spread (100 years to max population)	$3,068,117		$3,068,117
Sustained control		$2,315,614	$653,713	$2,969,327
Eradication	*Fast eradication (10 years)*	$646,394	$1,931,180	$2,577,574
	Slow eradication (20 years)	$1,044,313	$2,880,552	$3,924,864

Table 3: Net Benefit of Eradication at two different rates of spread

Net benefit ($million NPV (6%))	Sustained control	Eradication achieved in:	
		10 years	20 years
Short expansion (50 years to max population)	$0.10	$0.49	-$0.86
Long expansion (50 years to max population)	$0.10	$0.49	-$0.86

2.5.4 Risks of Canada geese Plan

Technical and operational risks: It is difficult to ensure eradication due to the mobility of the birds and their apparent (Spurr, et al., 2005) ability to learn and avoid control measures. Furthermore continued invasion from other regions in the South Island is likely if they also do not attempt to eradicate Canada geese. It seems highly unlikely that eradication could be achieved without significant resources and co-ordinated action across surrounding regions.

Sustained control is less risky since it requires culling of birds rather than complete control. However there are risks that poorly conducted control operations will fragment existing populations and lead to spread to new habitats, and a risk that birds become accustomed to control measures leading to avoidance and other changes in behaviour. Anecdotally this has already happened to a certain extent with helicopter hunting.

Implementation and compliance:

Requires expertise to control Canada geese due to specialised techniques and their mobility. Control in urban areas can be difficult.

Compliance risks are minimal as they are recognised as a pest by landholders in most situations. There may however be risks from operations being disrupted by disgruntled hunters.

Other legislative risks: None known

Public or political concerns: It is likely that there may be substantial opposition to eradication and control from hunters, given that some of them specialise in Canada goose hunting. There may be sections of the community that appreciate the presence of Canada goose for aesthetic reasons.

Other risks: The re-release or spread of birds by hunters or others is a possibility under an eradication approach.

Indicative estimates of the risk of non-achievement of the plan objectives are shown in Table 4 below. The table shows for example that if the plan objective is Sustained control, the analysis estimates that there is a 50% of having the same outcomes as Do Nothing, and 50% of the achieving the intended Sustained control objective. However for Eradication, there is a 45% chance of the outcomes being the same as Do Nothing, 50% chance of being the same as Sustained Control, and only a 5% chance of achieving Eradication in 20 years. This approach is indicative only, but allows the calculation of a risk adjusted Net Benefit as shown below in Table 5

Table 4: Risk of achievement of an objective for Canada Goose control

		Probability of achieving an objective (what was actually achieved)			
		Do Nothing	**Sustained control**	**Eradication in 10 years**	**Eradication in 20 years**
Plan Ojective (what was intended)	**Do Nothing**	100%	0%	0%	0%
	Sustained control	50%	50%	0%	0%
	Eradication	45%	50%	0%	5%

The risk adjusted net benefit as calculated using the adjustments in Table 4 shows that there is a net negative outcome when the probability of not achieving the objectives are taken into account. These figures reflect that fact that while Sustained control is more achievable than Eradication, the low net benefit associated with it means that only a small chance of non-achievement makes it not worthwhile. Eradication has a higher net benefit before risk is taken into account, but it is extremely difficult to achieve with a mobile and widespread pest. It is reasonable to conclude therefore that there is no net benefit associated with Canada goose control and control is likely to be best left to individuals affected.

Table 5: Risk adjusted net benefit of RPMP objectives for Canada goose control ($million NPV)

Net benefit ($million NPV (6%))	**Sustained control**	**Eradication achieved in:**	
		10 years	**20 years**
Short expansion (50 years to max population)	-$0.28	-$1.45	-$2.40
Long expansion (50 years to max population)	-$0.28	-$1.45	-$2.40

2.6 NPD Section 7 - Allocation of Costs and Benefits

2.6.1 Beneficiaries, exacerbators and costs of proposed plan for control of Canada geese

The beneficiaries and exacerbators of the plan are:

- Beneficiaries: Pastoral farmers adjacent to Canada goose habitat, general public.

- Active exacerbators: Any persons transporting Canada geese into the region
- Passive exacerbators: Any persons with Canada geese on their property not undertaking control.

The direct costs of Canada goose control are the inspection and control costs which are estimated at between $650,000 NPV (6%) for Sustained control, and between $660,000 and $990,000 NPV (6%) for Eradication. There are also some indirect costs associated with reduced hunting opportunities - these are likely to be greatest in the Eradication scenario but will still occur to some extent with the Sustained control scenario.

The benefits of the plan accrue to all arable and pastoral land holders for avoided losses of $0.8 million for Sustained control, and between $2.0 and 2.4 million for Eradication (NPV (6%)) (assuming the the outcomes are achieved). There are also some potential benefits to the wider community from the avoidance of impacts to biodiversity.

2.6.2 Matters for consideration in allocation of costs of Canada goose Plan

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 4 below.

Table 4: Matters for consideration in allocating costs for proposed Canada geese plan

Legislative rights and responsibilities	None known.
Management objectives	Eradication.
Stage of infestation	Medium – Canada geese have been present in New Zelaand for over a century, and in Southland for many decades. They are well established in the region.
Most effective control agents	Specialist Canada goose control agents (contractors and Council staff) required. Hunters appear to be moderately effective.
Urgency	Moderate – further expansion is possible but is not likely to occur in the near future given the length of time they have been present.
Efficiency and effectiveness	It is likely to be more efficient to eradicate than other options, but the low probabiliy of achievement means it is not a viable option. Management and control by the Council is likely to be the most effective due to specialist skills required to ensure long-term viability of control techniques. However it would be very difficult to prevent control being undertaken by hunters or landholders, so management and control by council would have limited additional value. Use of rates would also potentially reduce the incentive for landholders to work with hunters, increasing costs for the ratepayer.
Practicality of targeting beneficiaries	The main beneficiaries are limited in extent but there would need to be a specific and potentially non-objective classification system in order to target them. Furthermore the birds are mobile and have a range of alternate habitats, which means that more widespread benefits are also difficult to target.
Practicality of targeting exacerbators	Canada geese are very mobile so difficult to target exacerbators. Furthermore much of the Canada geese habitat is on public land.
Administrative efficiency	General Rate is efficient due to the difficulty of targeting the main beneficiaries.
Security	General Rate offers high security of funding for long-term control effort required to achieve eradication.
Fairness	The main beneficiaries are not targeted.
Reasonable	Given the difficulty in targeting exacerbators and beneficiaries and the habitat of Canada geese on public lands and waterways, the General Rate is a reasonable approach.
Parties bearing indirect costs	Hunters will bear some indirect costs, particularly with Eradication.
Transitional cost allocation arrangements	Not required.
Mechanisms available	General Rate, targeted rate (rural properties) and direct charges are the most readily available mechansisms. Levies are expensive to establish and administer.

2.6.3 Proposed allocation of costs

Targeting exacerbators is problematic because much of the Canada goose habitat is on public land. Targeting beneficiaries with a rating mechanism is similarly problematic because of the mobile nature of birds and it wide potential feeding opportunities. While the immediate beneficiaries are those adjacent to Canada geese habitat, a targeted rating mechanism would need to demonstrate it had covered all the Canada geese habitat but had not included non-Canada geese habitat, and it would also need to address issues around distance from habitat for benefits to occur. Administratively such a rating district would be difficult to define, expensive to establish, and subject to challenge.

For Eradication because of the high level of costs, it may be necessary to develop a separate rating mechanism that targeted a mix of immediate (those with a Canada geese problem) and future beneficiaries (those protected from future spread and population growth). However it appears that Eradication produces a significant negative risk adjusted net benefit and is not a worthwhile option, and the next most appropriate option would be Sustained control. Because of the relatively low level of costs for this option, and the administrative costs of targeting beneficiaries or exacerbators, it is recommended that the costs for Sustained control of Canada geese, if undertaken as an option, be charged to the General Rate.

3 Rabbits (Feral)

3.1 Description

Rabbits were first released in the 1800s and soon became a significant agricultural pest as well as affecting native tussock ecosystems. Mustelids and cats were brought in an attempt to control rabbits but had little impact on rabbits but significant impact on native birdlife and other fauna. Rabbits survive best in dry and semi-arid environments, where although their reproduction rate is lower than in more productive agricultural environments, mortality is significantly lower.

Rabbits have a life span of up to seven years but there are high rates of mortality among young animals. Female rabbits can be pregnant for 70% of a year and a single adult doe can produce 20 – 50 young.

The introduction of Rabbit Haemorrhagic Disease (RHD) in 1997 significantly reduced rabbit numbers to the point where they were no longer considered a significant problem but there is evidence that RHD is losing its effectiveness in some situations.

3.2 Proposed Plan

The proposed programme for rabbits is for Sustained Control, with intervention undertaken where rabbits are above Maclean's Scale 3.

3.3 Method for analysis of Rabbit options

The analysis undertaken here is based on information collected for a report prepared for Environment Canterbury in the 1994[3] - because rabbits have been at low levels since the introduction of RHD, there has been little new information collected since that time on which to base updated assessments. Therefore, most of the assumptions are derived from the experience of workers in the field or are extrapolated from this older data. This section details the background assumptions, the model used, the results, and the significance of the results.

In order to determine the costs of spillover, an estimate was made of the likely impact on costs from rabbits moving between properties. This requires assumptions regarding the increase in control costs, the amount of area on a property likely to be affected by these increased control costs, and the proportion of land holders not controlling rabbits.

While there is no reliable guide to the increase in population as a result of rabbit spillover, experience in the field suggests that on high and extremely rabbit prone land a poisoning interval of three years would be reduced to at least two years by spillover[4]. On moderately prone land a poisoning interval of seven years would be reduced to 3 - 4 years[5]. The cost for highly rabbit prone land increases from $17.36h/a/year to $30.38/ha/year with spillover, and from $67/ha/year to $100/year for extremely prone land because of the shortened poisoning interval[6].

Table 6: Estimate of annual costs of control by rabbit proneness class

Rabbit Proneness Class	Total Operation cost/ha	Annual cost/ha without spillover	Annual cost/ha with spillover	Increase in cost/ha/year from spillover
Moderate	$121.53	$17.36	$30.38	$13.02
High	$114.58	$28.65	$57.29	$28.65
Extreme	$200.00	$66.67	$100.00	$33.33

The proportion of land in the different rabbit proneness classes is shown for Southland in Table 7.

Table 7: Area in each rabbit proneness class for Southland (ha)

Area of land in Rabbit Proneness Class (ha)				Total Area
Low	**Moderate**	**High**	**Extreme**	
41,750	110,000	49,100		200,850

[3] Brown Copeland and Co Ltd. 1994. "Meeting the Requirements of the Biosecurity Act 1993: Economic Evaluation of Options for Regional Pest Management Strategies". Contract report prepared for Environment Canterbury.
[4] In other words, if a property owner undertakes no control, high rabbit numbers will cause rabbits to migrate onto the neighbour's property and thereby cause the neighbour to have to poison more frequently.
[5] Without discounting
[6] These costs assume an operation cost of $200/ha on extremely prone land , reducing on high and moderately prone land in proportion to the operation costs used in the 1994 report.

The spread model is based on the concept that poisoning occurs in areas within which rabbits are able to move freely, but which have some sort of physical or natural boundary preventing rabbits from moving between them (such as altitude, rabbit proof fencing, rivers etc.). A complete area is poisoned because this ensures that migrating rabbits are not easily able to reinfest a poisoned area, which maximises the poison interval and lowers overall control costs.

Within a property these poisoning areas are referred to as blocks, and while a block will have a natural boundary with other blocks in the same property there is not necessarily a migratory boundary with the neighbouring property. It is assumed here that all blocks on a clear property which are on the boundary with a property which is not controlling rabbits are affected by spillover. The degree of infestation is not critical, since the increased levels of rabbits on one part of any block will necessitate the entire block being re-poisoned at the earlier interval. The block area varies depending on locations, but these have not been clearly defined in Southland. For that reason, this analysis uses information on block size/property size ratios from Canterbury. Using this methodology, it is calculated that one property not controlling rabbits will cause a reduced poison interval on an area of poisoning blocks equal to ~60% of the average property size.

The numbers of properties not controlling is estimated at 5%. At the height of rabbit infestations prior to RHD introduction non-control of rabbits reached as high as 70% in very rabbit prone parts of the country. However, it is expected that with better returns from high country farming, a better equity position, and the presence of RHD, more control will be undertaken now than was the case at that time. Furthermore, the rabbit problem in Southland is not as severe as parts of Otago and Canterbury, and the returns from the predominantly moderately rabbit prone land in Southland are relatively high, so it is likely that an even lower proportion of farmers in Southland will not control rabbits. While it is possible to produce an extreme case where 50% of the land holders do not control rabbits, a lower limit is used in this paper so that the results are conservative with respect to the benefit which land holders gain from reducing spillover.

It is assumed that the properties not controlling are evenly distributed among those controlling, which produces a higher cost to spillover than if they were to all clump together.

Production benefits are derived on a stock unit basis from work undertaken by Ogle Consulting for ES (Ogle, 2014). These stocking rates and returns are shown in Table 8.

Table 8: Stocking rates and returns per stock unit for rabbit prone land

	Moderate	**High**	**Extreme**	**Returns per su ($)**
Stocking Rate (su/ha)	2	1	0.1	$46.73

Inspection and monitoring costs are estimated at $15,000 per annum, which is based on targeted monitoring on known prone properties.

3.4 NPD Section 6 Assessment

3.4.1 Level of analysis

The Sustained Control objective for rabbits is considered to require a medium level of analysis. This assessment is provided in Appendix B.

3.4.2 Impacts of Rabbits (Feral)

Rabbits (*Oryctolagus cuniculus)* cause damage to pastoral agriculture through reduced pasture quality and animal intake. There are also potential damages to biodiversity associated with high rabbit because they browse on vulnerable native plant communities, and as prey they support the mammalian predators of native birds and animals.

Rabbits also provide some benefits associated with commercial hunting for meat and recreational hunting.

3.4.3 Options for response

Two options for a Sustained control response are considered:

- Boundary control, where rabbits must be kept below Maclean's Scale 3 within 500m of a boundary where the neighbour is controlling rabbits.
- Full control, where rabbits are required to be kept under Maclean's Scale 3 throughout rabbit prone areas.

It is assumed that control is only undertaken on very prone parts of Southland.

3.5 Risks of Rabbits (Feral) Plan

Technical and operational risks: Operational risks with failure of poisoning operations are known, particularly with repeated control efforts in high population densities causing neophobia (bait avoidance). These risks are lower with the presence of RHD, and regular poisoning operations are less common.

Implementation and compliance: There is a some of non-compliance in areas with high rabbit population numbers in rabbit prone areas, particularly given the relatively low return from grazing in very rabbit prone areas. This will be mitigated by the use of complaints and regular inspection of known prone locations to identify problem areas.

Other legislative risks: Risks arise to the availability of poisons through the Hazardous Substances and New Organisms (HSNO) Act. There are also RMA requirements to be met in relation to poisoning operations.

Public or political concerns: The use of 1080 to is considered controversial and may attract opposition.

Other risks: None known

Summary: There are risks associated with the rabbit plan although these are likely to be reasonably low as long as RHD has a reasonable level of effectiveness and returns for high country sheep and beef remain at a reasonable level.

3.5.1 Net Benefit and Risk Adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan. These are shown in Table 9 below. In addition to the quantified costs and benefits, there are potential benefits associated with preventing damage to biodiversity. There are also intergenerational implications that should be taken into account.

The analysis shows that at 100% probability of success the Boundary Control option generates a net benefit of $3.38 million (NPV(6%)), compared with $7.05 million (NPV(6%)) for the Full Control plan that requires control on all rabbit infested land. The sensitivity analysis (Table 10) shows that the results are reasonably robust to the assumptions made about discount rate, proportion controlling. However, if moderately prone land is excluded from the analysis, on the assumption that this land type is most likely to be controlled voluntarily and does not exhibit a significant rabbit problem with RHD, then the result is negative[7] for the Full Control option.

In order for the options to be worthwhile there would need to be a greater than 74% probability of success for the Boundary Control option, and 45% for the Full Control option. There are also potentially biodiversity benefits on 2,000 ha for the Boundary Control option, and 8,000 ha for the Full Control option.

The analysis suggests that the Full Control has the highest net benefit of the options considered for those values quantified, and protects a greater area from damage to biodiversity values.

Table 9: Outcomes of analysis of costs and benefits for Rabbits (Feral) (NPV6%)

Scenario Option	Control Costs ($m)	Production loss ($m)	Inspection, monitoring and enforcement ($m)	Total ($m)	Net Benefit of plan option ($m)	Probability of success for plan to still be positive
Do Nothing	$1.31	$11.53	$0.00	$12.84	$0.00	
Boundary Control	$0.68	$8.55	$0.24	$9.46	$3.38	74%
Full Control	$2.61	$0.00	$3.17	$5.79	$7.05	45%

[7] This was tested because it is reasonable to assume that control may take place regardless of the plan on moderately prone land because it is significantly more worthwhile than rabbit control on high and extreme prone land .

Table 10: Assessment of sensitivity of results to assumptions for Rabbits (Feral) (NPV(6%) $million)

	Discount rate			Proportion not controlling			Moderate rabbit prone land included in the analysis	
Do Nothing	6%	4%	8%	10%	5%	20%	Yes	No
Boundary Control	$3.38	$4.61	$2.62	$3.38	$3.38	$14.23	$3.38	$0.76
Full Control	$7.05	$9.61	$5.47	$7.05	$7.05	$37.73	$7.05	-$1.20

NPD Section 7 - Allocation of Costs and Benefits

3.5.2 Beneficiaries, exacerbators and costs of proposed plan for control of Rabbits (Feral)

The beneficiaries and exacerbators of the plan are:

- Beneficiaries: The beneficiaries of the plan are land holders with high rabbit populations (production benefits), neighbouring land holders from the prevention of spread, and the wider community from prevention of damage to biodiversity, and prevention of soil erosion.
- Active exacerbators: Any persons transporting Rabbits (Feral) into or around the region
- Passive exacerbators: Any persons with Rabbits (Feral) on their property not undertaking control.

The direct and indirect costs associated with the plan are shown below in Table 11. The benefits and costs of the plan options, and the parties to whom they accrue, are shown in Table 12. They show that control costs for land holders are the largest cost for both the Boundary and the Full Control approaches. There are potentially some indirect costs for commercial and recreational hunting from the Full Control plan that have not been assessed here. There are however significant benefits for the exacerbators in both the Boundary and Full Control approaches.

Table 11: Direct and indirect costs of plan for Rabbits (Feral) ($ million PV6%)

Plan option	Control costs on land holders	Inspection and monitoring costs
Boundary Control	$0.68	$0.24
Full Control	$2.61	$3.17

Table 12: Benefits and costs of plan for Rabbits (Feral) that accrue to different beneficiaries and exacerbators ($ million PV(6%))

	Plan option	Those currently infested	Those experiencing spillover costs
Benefits	**Boundary Control**	$2.98	$1.31
	Full Control	$11.53	$1.31
Costs for exacerbators	**Boundary Control**	$0.68	$0.00
	Full Control	$2.61	$0.00

3.5.3 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD and the analysis for each of these matters is shown in Table 4 below.

Table 4: Matters for consideration in allocating costs for proposed Rabbits (Feral) plan

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread but only a problem in limited areas.
Most effective control agents	Land holders are the most effective agents to undertake control at low levels, since this ensures that management of the land is aimed at reducing rabbit proneness. At high levels specialist skills are required to undertaken aerial or ground poisoning operations.
Urgency	Low because populations appear generally stable and rabbits are very widespread.
Efficiency and effectiveness	It is most efficient to require land holders to control since this will encourage management of the land to reduce population densities. Inspection and enforcement costs are most efficiently targeted at beneficiaries, which are neighbouring properties for the prevention of spillover, and the wider community from biodiversity and soil erosion benefits.
Practicality of targeting beneficiaries	Beneficiaries from production gains are able to be targeted through a rate based on rabbit proneness or geographical area. Wider community beneficiaries are able to be targeted through General Rate.
Practicality of targeting exacerbators	Rabbit numbers can be established through inspection and land holders can be targeted. Exacerbators can therefore be readily targeted.
Administrative efficiency	The administrative efficiency of a targeted rate based on rabbit proneness will be low, and a geographically based rate on pastoral properties (area based) is likley to be most efficient for targeting the production beneficiaries from preventing spillover. The wider benefits can be most appropriately targeted through the General Rate.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs of the programme are reasonably high and ongoing for some land holders. However, some immediate benefit is received in terms of saved production losses.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	Programmes for rabbit control have been in place over a long period. There are no specific problems likely to be encountered requiring transitional arrangements.
Mechanisms available	General Rate, targeted rate (rural properties) and direct charges are the most readily available mechanisms. Levies are expensive to establish and administer. User charges are appropriate for costs of control.

3.5.4 Proposed allocation of costs

The control costs are appropriately targeted at exacerbators since they are able to be targeted, and by requiring them to undertake control there is likely to be greater efficiency in control of the rabbit populations.

The inspection, monitoring, and control costs are likely to be significant, but in both options they are less than the spillover costs avoided from uncontrolled rabbits on a boundary. Therefore the majority of the costs should be charged to land holders in the prone areas.

- Inspection and monitoring costs: 100% targeted rate for rabbit prone areas where inspection will occur.
- Control costs: 100% land holder control.

4 Method for Plant Pests

For plant pests a generic model was developed to assist in estimating the change in costs associated with a pest over time under the different management options. This model mathematically calculates the estimated impacts associated with pest management options, and has four components discussed below. Detailed assumptions used for each pest are included in a table in Appendix A.

4.1 Infested area

The infested area is determined by the area currently infested, the number of active sites, the rate of spread, and the generation of new sites which are user inputs. The area of the largest current site is user input, then it is assumed that the remaining sites are of equal size covering the remaining area. The area of each site is increased annually by the rate of spread on a quadrant basis. Each quadrant of an infested area keeps expanding until it reaches its nearest boundary then stops increasing in area. The distance from boundaries is user input but there is no assumption about the proximity of infestations to each other – i.e. the model assumes that the current infestations and new infestations are equidistant, and do not coalesce into a larger site until the area is fully occupied.

New sites are generated at a user input rate each year. This allows for the fact that mathematically the rate of increase in area of a larger number of sites is greater than for a single site expanding on its boundary.

Once the fully available area is occupied all infested areas cease expanding. It is assumed that pest spread will continue under the Do Nothing scenario regardless of land holder control, but that other plan options will have user input success in preventing spread depending on the option.

4.2 Density

The density of pests in an infested area increases in a logistic fashion according to the equation:

$$N_y = N_{y-1} + N_{y-1} * r * (1 - \frac{N_{y-1}}{D})$$

Where

N_y = density in year y

r = logistic growth constant

D = maximum density

The value for r is estimated from the period between first arrival at a site and full density, which is a user input estimate (sensitivity tested).

4.3 Losses

Losses arise from control costs and production loss, as well as from displaced biodiversity and impacts on other values. The model calculates production loss and control costs and uses area displaced as a proxy for the impact on other biodiversity, amenity, and recreation values.

It is assumed that once an area is infested control costs are required and that a proportion will undertake control, with the proportion under each plan option user input. The control costs are fixed on an area basis.

Production losses are assumed where control is not undertaken, with the loss proportional the area displaced. It is assumed that infested land where control is not undertaken is unable to be used for productive purposes, hence both revenue and variable costs are zero. The losses are greater than the straight operating profit/ha because fixed costs are still incurred by the operation. For each land use type, the losses equal the revenue/ha less the variable costs/ha. The revenue, costs and production losses used in the model are shown in Table 13. These are based on the last five year's reported farm budgets from DairyNZ[8] and Beef and Lamb NZ Table 13.

Table 13: Estimated revenue, costs and production losses by land use type in pest model

Land use	Revenue ($/ha/year)	Fixed Cost ($/ha/year)	Variable Cost ($/ha/year)	Reduction in operating profit/ha ($/ha/year)
High country	$105	$35	$49	$56
Hill country	$347	$123	$151	$195
Intensive finishing breeding	$1,065	$375	$438	$627
Crop	$3,041	$1,405	$1,263	$1,778
Dairy	$10,188	$2,931	$7,811	$2,377
Intensive pasture	$4,106	$1,227	$2,896	$1,210
All intensive systems	$3,948	$1,253	$2,654	$1,294
All extensive pasture	$245	$86	$108	$137

4.4 Estimate of NPV

The analysis is collated into an annual cashflow for each management option for 100 years. These are then converted into a net present value at a discount rate of 6% (NPV(6%)). Sensitivity testing is undertaken for the r value, rate of spread, cost of control, gross margin for loss of production, and discount rate (4% and 8%).

Choice of discount rate is important and a higher rate favours investments with earlier returns or costs that are further in the future. The discount rate of 6% is chosen because it matches the NZ Treasury recommendation[9]. It is higher than the 4% used by Auckland and Regional Council, but because most of the quantified benefit is associated with agricultural losses and control costs for land holders the 6% better reflects their cost of capital. Decision makers should note the impact of the higher and lower discount rates in the sensitivity testing when determining the best course of action.

The risks that the option will not meet the objective were identified for each pest and mitigation options considered where appropriate. The residual risk associated with the

[8] DairyNZ data for revenue and operating expenses at the Southland level is used, then adjusted using more detailed national data to estimate the proportion of fixed expenses.
[9] http://www.treasury.govt.nz/publications/guidance/planning/costbenefitanalysis/currentdiscountrates

different outcomes was estimated as a user input based on observation of success rates in similar programmes. The assumptions differ for each objective. For example if the objective is Eradication then there is a probability of achieving Eradication, but also a probability that some other outcome will be achieved – reduction, stable infestations, or continued expansion. The probabilities are assigned to each potential outcome such that the probabilities sum to 1. The risks for each plan option are assumed to be the same unless there is a reason why a particular pest is likely to differ from the standard assumptions for that objective type. The risk assumptions for each plan option are shown in **Error! eference source not found.** to Table 52.

In addition to this approach sensitivity tests were undertaken on the risk adjusted outcome for a range of variables. These show whether the highest rated option changes as different variables are changed and are presented as a table of the highest rated option for each sensitivity test.

4.5 Scenarios

The model tests four scenarios – one , the Do Nothing scenario, and three that relate to the three primary NPD objectives of Sustained Control, Progressive Containment, and Eradication. This approach allows the model to efficiently test a wide range of pests regardless of the proposed objective, and compares it with the other potential objectives for the plant. The descriptions for each of three scenarios are set out below.

Do Nothing – no control is required of land holders, and although land holders may individually undertake control, the lack of co-ordination means that the pest continues to spread. The majority of the model is focused on assessing impacts of the expected rate of spread and rate at which infested habitats are occupied. The outcomes for the Do Nothing scenario reflect the loss of production from land infested by the pest when control is not undertaken by landholders, and the costs of control where landholders do undertake control and don't incur production losses.

Sustained Control – In this scenario control is undertaken and the model assumes that because control is co-ordinated there is no further spread of the pest but also no reduction in its extent. The proportion of the land controlled is greater than in the Do Nothing scenario because the rules require land holder control under a range of circumstances with the proportion controlled generally high in pests with limited distribution (90%) but lower in widespread pests (30% - 50%). However, in the areas where control is not undertaken the pest continues to increase in density. Per ha costs of control are the same as for the Do Nothing scenario.

Progressive Containment– This scenario is essentially the same as the Sustained Control scenario but the control effort results in a reduction in the area of the pest affected. The reduction is estimated by the period over which area affected is reduced to 0 - 50 years for the pests of limited distribution, and 100 – 1000 years for more widespread pests. The proportion controlling is also assumed to be higher and is set at 95% for all pests. In areas not under control the pest continues to increase in density. Per ha costs of control are twice that of the Do Nothing scenario to reflect the fact that more careful control is required.

Eradication – This scenario assumes that all land is under control and no further increase in density or area is expected. It is assumed that Eradication can be achieved in 20 years for all pests of limited distribution and 50 years for more widespread pests. It is assumed that inspection and monitoring costs are 1.5 times that for Progressive Containment for all pests

of limited distribution, and 2.5 times that of Progressive Containment for widespread pests. Per ha control costs are assumed to be 5 times that of the Do Nothing scenario to reflect the fact that very high levels of control are required if Eradication is to be achieved.

The costs of inspection, monitoring and enforcement are varied by scenario for each pest to reflect the fact that these costs vary in both intensity and aggregate requirements depending on how widespread a pest is and how intensively it is being managed. Thus where the objective is Eradication, significantly more intensive inspection is required than where the objective is Sustained Control. The ratio of inspection costs are given in relation to the costs for Sustained Control inspection, and are shown in Table 14 below. The inspection costs should be seen as indicative only and are subject to change through the planning process.

Table 14: Ratio of inspection costs by objective for each scenario considered (base Sustained Control = 1)

	Ratio of inspection costs (Sustained Control = 1)	
Pest	**Progressive Control/ Sustained Control**	**Eradication/ Sustained Control**
Nodding Thistle	4	6
Broom	20	50
Gorse	20	50
Wilding conifers	20	50
Ragwort	20	50

4.6 Net Benefit analysis

The net benefit is estimated over 100 years and is the difference between the costs and benefits of the proposed option and the costs and benefits that would be incurred if the region were not to intervene – i.e. the Do Nothing scenario. This is calculated by subtracting the alternative scenarios from the Do Nothing scenario, and if the result is positive it indicates that the overall losses caused by the pest are lower than in the alternative scenarios, and therefore the alternatives are preferred. This net benefit is then adjusted for the risk that the proposed objective will not be achieved to provide an estimate of the risk adjusted net benefit. Assumptions used in undertaking the modelling were provided by Environment Southland and are described in detail in the report and in Appendix A.

However, the risk adjusted net benefit is based only on those costs that are quantified – these are the loss of production and the costs of control. Pests are also associated with a range of other impacts that cannot be reliably quantified in monetary terms, including those to mana whenua, biodiversity, recreation, and amenity values. For pests where the risk adjusted net benefit is positive, the proposed plan option is justified even without consideration of those items. Where the risk adjusted net benefit is negative it is important that these other impacts are taken into consideration.

The analysis therefore provides estimates of the threshold value that these other biodiversity, recreation, and amenity values would need to exceed in order for the plan objective to be positive. This threshold value is calculated by dividing any negative net benefit by the area protected by the proposed programme.

4.6.1 Caveats

The results generated from the plant pest model are based on a range of user inputs and assumptions about the behaviour of the pest. The best information available is used in generating these inputs, but the results should be treated as indicative of the likely outcomes under those conditions, and not definitive. They are intended as appropriate for the level of analysis required and the degree of information available rather than the most comprehensive CBA that could be undertaken for any given pest.

5 Nodding Thistle

5.1 Description

Nodding Thistle (*Carduus nutans*) is an upright thistle. It invades crop land, pasture, and non productive areas, and occurs in a number of locations in Southland. It prevents stock movement, competes with pasture species, causes injuries to the mouths and eyes of stock, and contaminates wool. The seed is windblown but it can also be spread by stock, water, vehicles, and in dirt.

5.2 Proposed Plan

ES is proposing that Nodding Thistle is controlled through the Sustained Control objective described in Section 1(b) of the NPD.

5.3 NPD Section 6 Assessment

5.3.1 Level of analysis

The assessed level of analysis for Nodding Thistle under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

5.3.2 Impacts of Nodding Thistle

Nodding Thistle has the potential to cause loss of production from pastoral agriculture in hill and high country.

5.3.3 Benefits for management of Nodding Thistle

Benefits from the management of Nodding Thistle accrue from the prevention of loss of production from pastoral agriculture in hill and high country. Cost of control and lost production if allowed to spread are NPV(6%) $159,000,000 for those not currently infested.

5.3.4 Costs of Nodding Thistle Plan

The plan will incur costs of inspection, and monitoring. These are $18,500 annually for the plan option. Costs for all three options considered are an NPV(6%) of $300,000 for Sustained Control, NPV(6%) $1,000,000 for Progressive Containment, and NPV(6%) $1,000,000 for Eradication (which has a shorter time frame).

5.3.5 Risks of Nodding Thistle Plan

Technical and operational risks: Sustained Control has relatively few risks, although Nodding Thistle has been under control for a long period with limited progress and the likelihood of having any significant impact appears limited.

Implementation and compliance: Ensuring compliance with management regime will be difficult and will require education, inspection and potentially enforcement. These all carry risks.

Other legislative risks: None known

Public or political concerns: Spread of Nodding thistle on riverbeds is a public concern.

Other risks: None known

5.3.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan, as shown in Table 15 below. In terms of those alternatives considered, the Sustained Control option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 16 below which suggests the conclusion is robust under changes to a range of assumptions, apart from a lower discount rate when Eradication produces higher net benefit, and a larger spread distance when Progressive Containment has the highest net benefit.

These factors suggest that the Sustained Control option has the highest net benefit if the assumptions made in this analysis are considered reasonable.

Table 15: Outcomes of analysis of costs and benefits for Nodding thistle.

Plan	Total control costs and lost production PV(6%)	Net Benefit of plan NPV(6%)	Risk adjusted net benefit of plan NPV(6%)
Do Nothing	$189,000,000		
Eradication	$39,000,000	$149,940,000	$-40,090,000
Progressive containment	$22,000,000	$166,800,000	$-1,170,000
Sustained Control	$27,000,000	$161,870,000	$7,800,000

Table 16: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Sustained Control
Time to full occupation 50% of base	Sustained Control
Time to full occupation 150% of base	Sustained Control
Distance of spread 50% of base	Sustained Control
Distance of spread 200% of base	Sustained Control
Cost of control +20% from base	Sustained Control
Cost of control -20% from base	Sustained Control
Loss of production impacts -20% from base	Sustained Control
Loss of production impacts +20% from base	Sustained Control
Discount rate 4%	Sustained Control
Discount rate 8%	Sustained Control

5.4 NPD Section 7 - Allocation of Costs and Benefits

5.4.1 Beneficiaries, exacerbators and costs of proposed plan for control of Nodding Thistle

The beneficiaries and exacerbators of the plan are:

- Beneficiaries: Rural community from prevention of spread and production benefits.
- Active exacerbators: Any persons transporting Nodding Thistle into or around the region.
- Passive exacerbators: Any persons with Nodding Thistle on their property not undertaking control.

The direct and indirect costs associated with the plan are shown below in Table 17 and Table 18.

Table 17: Direct and indirect costs of plan for Nodding Thistle

Plan option	Control costs land holders (PV (6%))	Inspection and monitoring costs (PV (6%))
Sustained Control	$6,000,000	$300,000
Progressive containment	$20,000,000	$1000,000
Eradication	$38,000,000	$1000,000

Table 18: Benefits and costs of plan for Nodding Thistle that accrue to different beneficiaries and exacerbators

Plan option	Benefits for those currently infested (PV (6%))	Benefits for those not currently infested (PV (6%))	Costs for exacerbators (PV (6%))
Sustained Control	$3,090,000	$159,000,000	$6,000,000
Progressive containment	$8,880,000	$159,000,000	$20,000,000
Eradication	$-7,869,281	$159,000,000	$38,000,000

5.4.2 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 19 below.

Table 19: Matters for consideration in allocating costs for proposed Nodding Thistle plan

Legislative rights and responsibilities	None known
Management objectives	Sustained Control
Stage of infestation	Late stage – nodding thistle is throughout Southland
Most effective control agents	Landholders are most effective because it requires control and measures to ensure that seed does not spread.
Urgency	Low urgency as it has been present for a long time and has liklely reached most of Southland.
Efficiency and effectiveness	It is likely that requiring landholders to control will improve the efficiency of control measures as land will be managed to reduce infestation and spread.
Practicality of targeting beneficiaries	Beneficiaries are the wider rural community for prevention of spread onto productive land.
Practicality of targeting exacerbators	Nodding thistle is easily seen and exacerbators can be targeted.
Administrative efficiency	Exacerbators control requires inspection and enforcement, while generate rate would have greater administrative efficiency
Security	Rating mechanisms are most secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement
Reasonable	Costs are likely to be significant on some properties.
Parties bearing indirect costs	None likely
Transitional cost allocation arrangements	None required as control has been required for Nodding thistle for some time.
Mechanisms available	General rate, targeted rate (rural properties) and direct charges are the most readily available mechansisms. Levies are expensive to establish and administer.

5.4.3 Proposed allocation of costs

The recommended approach is for a mix of land holder control as exacerbators and a targeted rate for productive land in the wider community for inspection, monitoring, and enforcement costs.

- Inspection and monitoring costs: 100% targeted rate on productive rural land as beneficiaries
- Control costs: 100% land holders as exacerbators

6 Broom - Urban

6.1 Description

Broom is a woody weed with an almost leafless structure. The stems are green, and it produces seeds in a pod that bursts explosively to disperse the seeds. It forms dense stands that can exclude other plants. Broom causes loss of production by excluding stock and displacing pasture. Broom may also increase costs for establishment of forestry plantings, and tends to be a fire hazard. It is found throughout New Zealand and is regarded as a pest in most areas.

6.2 Proposed Plan

ES is proposing that Broom is controlled through the Sustained Control objective described in Section 1(b) of the NPD.

6.3 NPD Section 6 Assessment

6.3.1 Level of analysis

The assessed level of analysis for Broom under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

6.3.2 Impacts of Broom in urban area

Broom has the potential to cause damage to amenity values and increased fire risk in urban settings.

6.3.3 Benefits for management of Broom

The benefits of the management of Broom in an urban setting are prevention of damage to amenity values and potentially some reduction in risk of fire. There are no quantified benefits associated with its control.

6.3.4 Costs of Broom Plan

The plan will incur costs of control, inspection, and monitoring. These are $33,730 annually for the strategy option. Costs for all three options considered are a NPV of NPV $600,000 for Sustained Control, NPV $11,000,000 for Progressive Containment, and NPV $27,000,000 for Eradication (which has a shorter time frame).

6.3.5 Risks of Broom Plan

Technical and operational risks: There is a long history of attempts to control Broom, with little evident impact on a widespread basis. The technical risks of preventing spread for a well established and widespread plant are considerable and there is a low probability of success.

Implementation and compliance: As noted there is a long history of regulated Broom control with widespread non-compliance. The implementation and compliance risks are substantial and the likelihood of anything of significance beyond the Do Nothing scenario in areas where it is already present are minimal.

Other legislative risks: None known

Public or political concerns: High cost and widespread nature of Broom.

Other risks: None known

6.3.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan, as shown in Table 20 below. In terms of those alternatives considered, the Do Nothing option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 21 below which suggests that it is not affected by major changes in assumptions. In addition to the quantified costs and benefits, there are potential benefits associated with preventing damage to amenity values. However these values could only be achieved be complete control of broom on sections, and a control strategy that only targeted boundaries would not have any substantive benefits.

These factors suggest that the control of Broom in urban settings will not produce a positive net benefit.

Table 20: Outcomes of analysis of costs and benefits for Broom

Plan	Total control costs and lost production PV(6%)	Net Benefit of plan NPV(6%)	Risk adjusted net benefit of plan NPV(6%)
Do Nothing	$6,000,000		
Eradication	$34,000,000	$-28,300,000	$-26,350,000
Progressive containment	$14,000,000	$-8,280,000	$-10,980,000
Sustained Control	$2,000,000	$4,090,000	$-330,000

Table 21: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Do Nothing
Time to full occupation 50% of base	Do Nothing
Time to full occupation 150% of base	Do Nothing
Distance of spread 50% of base	Do Nothing
Distance of spread 200% of base	Do Nothing
Cost of control +20% from base	Do Nothing
Cost of control -20% from base	Do Nothing
Loss of production impacts -20% from base	Do Nothing
Loss of production impacts +20% from base	Do Nothing
Discount rate 4%	Do Nothing
Discount rate 8%	Do Nothing

6.3.7 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 22 below.

Table 22: Matters for consideration in allocating costs for proposed Broom (urban) plan

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread.
Most effective control agents	Land holders.
Urgency	Very low - well established and widespread.
Efficiency and effectiveness	The effectiveness of a Sustained Control plan is likely to be low, given that past intensive control efforts appear to have had little impact on spread. The efficiency of requiring land holders to control in uneconomic circumstances is also likely to be marginal.
Practicality of targeting beneficiaries	Beneficiaries are confined to urban areas.
Practicality of targeting exacerbators	Location of Broom can be established through an inspection programme. Therefore exacerbators are able to be targeted.
Administrative efficiency	A targeted rate on urban areas would be reasonably efficient.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs of the programme are potentially high for some land holders with little benefit received.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	Programmes for Broom control have been established for a long period. No transitional mechanisms are likely to be required.
Mechanisms available	General Rate, targeted rate (urban properties), and direct charges are the most readily available mechanisms. Levies are expensive to establish and administer.

6.3.8 Proposed allocation of costs

The management of Broom in an urban setting potentially has very high costs associated with it. Care is therefore needed in terms of identifying who should pay for control. The benefits are largely associated with amenity values in an urban setting. The approach to funding recommended here targets the beneficiaries and exacerbators.

- Inspection and monitoring in urban areas – direct charge to complainant or targeted urban rate.
- Control - land holder.

7 Broom - Rural

7.1 Proposed Plan

ES is proposing that Broom is controlled in a rural setting through the Sustained Control objective described in Section 1(b) of the NPD.

7.2 NPD Section 6 Assessment

7.2.1 Level of analysis

The assessed level of analysis for Broom under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

7.2.2 Impacts of Broom

Broom has the potential to cause loss of production from pastoral agriculture in hill and high country. It also causes impacts to biodiversity in tussock landscapes, grasslands and riverbeds.

7.2.3 Benefits for management of Broom

Prevention of loss of production from pastoral agriculture in hill and high country. Impacts to biodiversity in tussock landscapes, grasslands and riverbeds. Net benefits are NPV $289,760,000 relative to the pest being kept at its current level for those not currently infested.

7.2.4 Costs of Broom Plan

The plan will incur costs of control, inspection and monitoring. These are $34,440 annually for the strategy option. Costs for all three options considered are a NPV of NPV $600,000 for Sustained Control, NPV $11,000,000 for Progressive Containment, and NPV $27,000,000 for Eradication (which has a shorter time frame).

7.2.5 Risks of Broom Plan

Technical and operational risks: There is a long history of attempts to control Broom, with little evident impact on a widespread basis. The technical risks of preventing spread for a well established and widespread plant are considerable and there is a low probability of success.

Implementation and compliance: As noted there is a long history of regulated Broom control with widespread non-compliance. The implementation and compliance risks are substantial and the likelihood of anything of significance beyond the Do Nothing scenario in areas where it is already present are minimal.

Other legislative risks: None known

Public or political concerns: High cost and widespread nature of Broom.

Other risks: None known

7.2.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan, as shown in Table 20 below. In terms of those alternatives considered, the

Sustained Control option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 21 below which suggests that it is not affected by major changes in assumptions. In addition to the quantified costs and benefits, there are potential benefits associated with preventing damage to biodiversity on 302,000 ha, and intergenerational implications that should be taken into account.

These factors suggest that the Sustained Control option is favoured as producing the highest net benefit if the assumptions made in this analysis are considered reasonable. However, the conclusion is dependent on the ability of the Council to prevent spread into uninfested areas, and this is unproven at present.

Table 23: Outcomes of analysis of costs and benefits for Broom

Plan	Total control costs and lost production PV(6%)	Net Benefit of plan NPV(6%)	Risk adjusted net benefit of plan NPV(6%)
Do Nothing	$353,000,000		
Eradication	$370,000,000	$-16,390,000	$-12,630,000
Progressive containment	$150,000,000	$203,480,000	$3,070,000
Sustained Control	$64,000,000	$289,760,000	$13,940,000

Table 24: Impact of sensitivity testing on highest value option

Sensitivity test	**Highest value option (risk adjusted)**
Base net benefit	Sustained Control
Time to full occupation 50% of base	Sustained Control
Time to full occupation 150% of base	Sustained Control
Distance of spread 50% of base	Sustained Control
Distance of spread 200% of base	Sustained Control
Cost of control +20% from base	Sustained Control
Cost of control -20% from base	Sustained Control
Loss of production impacts -20% from base	Sustained Control
Loss of production impacts +20% from base	Sustained Control
Discount rate 4%	Sustained Control
Discount rate 8%	Sustained Control

7.3 NPD Section 7 - Allocation of Costs and Benefits

7.3.1 Beneficiaries, exacerbators and costs of proposed plan for control of Broom

The beneficiaries and exacerbators of the plan are:

- Beneficiaries: Rural community from prevention of spread and production benefits.
- Active exacerbators: Any persons transporting Broom into or around the region.
- Passive exacerbators: Any persons with Broom on their property not undertaking control.

The direct and indirect costs associated with the plan are shown below in Table 25 and Table 26.

Table 25: Direct and indirect costs of plan for Broom

Plan option	Control costs land holders (PV (6%))	Inspection and monitoring costs (PV (6%))
Sustained Control	$36,000,000	$600,000
Progressive containment	$138,000,000	$11,000,000
Eradication	$343,000,000	$27,000,000

Table 26: Benefits and costs of plan for Broom that accrue to different beneficiaries and exacerbators

Plan option	Benefits for those currently infested (PV (6%))	Benefits for those not currently infested (PV (6%))	Required benefit for community for biodiversity and ecological benefits in order for option to be positive	Costs for exacerbators (PV (6%))
Sustained Control	$-1,892,983	$292,000,000	$-289,760,000	$36,000,000
Progressive containment	$-77,294,488	$292,000,000	$-203,480,000	$138,000,000
Eradication	$-281,466,695	$292,000,000	$16,390,000	$343,000,000

7.3.2 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 22 below.

Table 27: Matters for consideration in allocating costs for proposed Broom plan

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread.
Most effective control agents	Land holders.
Urgency	Very low - well established and widespread.
Efficiency and effectiveness	The effectiveness of a Sustained Control plan is likely to be low, given that past intensive control efforts appear to have had little impact on spread. The efficiency of requiring land holders to control in uneconomic circumstances is also likely to be marginal.
Practicality of targeting beneficiaries	Beneficiaries are widespread throughout the region, although largely related to pastoral agriculture.
Practicality of targeting exacerbators	Location of Broom can be established through an inspection programme. Therefore exacerbators are able to be targeted.
Administrative efficiency	General Rate is highly efficient for collecting community benefits related to biodiversity. Targeted rural rate is appropriate and efficient for benefits to pastoral agriculture.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs of the programme are potentially high for some land holders with little benefit received.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	Programmes for Broom control have been established for a long period. No transitional mechanisms are likely to be required.
Mechanisms available	General Rate, targeted rate (rural properties), and direct charges are the most readily available mechanisms. Levies are expensive to establish and administer.

7.3.3 Proposed allocation of costs

The management of Broom potentially has very high costs associated with it. Care is therefore needed in terms of identifying who should pay for control. The benefits are largely associated with production, although there are benefits for biodiversity in parts of the landscape, particularly high country. The approach to funding recommended here separates out the requirements for funding dependent on where the control is required, and therefore to whom the benefits accrue.

- Inspection and monitoring in hill country and lowland where productive values are concerned – rate targeted at productive rural properties.
- Control in hill country and lowland s where productive values are concerned – 100% exacerbators control to prevent spread onto neighbouring properties.
- Inspection and monitoring in high country where biodiversity and productive values are concerned – 50% targeted rural rate, 50% General Rate.

- Control in high country where biodiversity and productive values area concerned – control initially funded 50% General Rate, 50% land holder.
- Ongoing control in high country to prevent recurrence and spread - land holder.

8 Gorse - urban

8.1 Description

Gorse is an erect shrub growing to 5 m in height that was introduced to Southland for use as a fencing shrub and for shelter. Gorse is widespread in Southland, and causes loss of production by excluding stock and displacing pasture. Gorse may also increase costs for establishment of forestry plantings. Gorse is considered a good nursery plant for the regeneration of native forest where a suitable native seed source is available.

8.2 Proposed Plan

ES is proposing that Gorse is controlled through the Sustained Control objective described in Section 1(b) of the NPD. This analysis assesses the benefits and costs of Gorse control in an urban and rural setting.

8.3 NPD Section 6 Assessment

8.3.1 Level of analysis

The assessed level of analysis for Gorse under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

8.3.2 Impacts of Gorse - urban

Gorse in an urban setting it causes primarily loss of amenity but in some situations may represent a potential fire risk.

8.3.3 Benefits for management of Gorse - urban

There are no quantified benefits from the management of gorse in an urban setting, apart from the reduction in costs of control for landholders to whom it may spread in the absence of a strategy. There may be benefits in terms of improved amenity values.

8.3.4 Costs of Gorse - urban Plan

The plan will incur costs of control, inspection and monitoring. These are $33,680 annually for the strategy option. Costs for all three options considered are a NPV of NPV $600,000 for Sustained Control, NPV $11,000,000 for Progressive Containment, and NPV $27,000,000 for Eradication (which has a shorter time frame).

8.3.5 Risks of Gorse Plan

Technical and operational risks: There is a long history of attempts to control Gorse, with little evident impact on a widespread basis. The technical risks of preventing spread for a well established and widespread plant are considerable.

Implementation and compliance: There is a long history of regulated Gorse control with widespread non-compliance. The implementation and compliance risks are substantial and the likelihood of additional control beyond the Do Nothing scenario in areas where it is already present are low.

Other legislative risks: None known

Public or political concerns: High cost and widespread nature of Gorse.

Other risks: None known

8.3.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan, as shown in Table 31 below. In terms of those alternatives considered, the Do Nothing option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 32 below which suggests that the conclusion is robust to changes in single assumptions. There are some amenity benefits that may accrue if land is kept clear of gorse in urban settings, but these benefits would not exist if a boundary control approach were the only option used.

These factors suggest that the management of gorse in an urban setting is not likely to be worthwhile.

Table 28: Outcomes of analysis of costs and benefits for Gorse - urban

Plan	Total control costs and lost production PV(6%)	Net Benefit of plan NPV(6%)	Risk adjusted net benefit of plan NPV(6%)
Do Nothing	$6,000,000		
Eradication	$34,000,000	$-28,260,000	$-26,310,000
Progressive containment	$14,000,000	$-8,260,000	$-10,960,000
Sustained Control	$2,000,000	$4,090,000	$-330,000

Table 29: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Do Nothing
Time to full occupation 50% of base	Do Nothing
Time to full occupation 150% of base	Do Nothing
Distance of spread 50% of base	Do Nothing
Distance of spread 200% of base	Do Nothing
Cost of control +20% from base	Do Nothing
Cost of control -20% from base	Do Nothing
Loss of production impacts -20% from base	Do Nothing
Loss of production impacts +20% from base	Do Nothing
Discount rate 4%	Do Nothing
Discount rate 8%	Do Nothing

8.3.7 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 30.

Table 30: Matters for consideration in allocating costs for proposed Gorse - urban

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread.
Most effective control agents	Land holders.
Urgency	Very low - well established and widespread.
Efficiency and effectiveness	The effectiveness of a Sustained Control plan is likely to be low, given that past intensive control efforts appear to have had little impact on spread. The efficiency of requiring land holders to control in uneconomic circumstances is also likely to be high.
Practicality of targeting beneficiaries	Beneficiaries are located in urban areas and readily targeted.
Practicality of targeting exacerbators	Location of gorse can be established through an inspection programme. Therefore exacerbators are able to be targeted.
Administrative efficiency	Targeted urban rate is appropriate and efficient for benefits to urban area.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs of the programme are potentially high for some land holders with little benefit received.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	Programmes for gorse control have been established for a long period. No transitional mechanisms are likely to be required.
Mechanisms available	General Rate, targeted rate (urban properties) and direct charges are the most readily available mechanisms. Levies are expensive to establish and administer.

8.3.8 Proposed allocation of costs

The management of Broom in an urban setting potentially has very high costs associated with it. Care is therefore needed in terms of identifying who should pay for control. The benefits are largely associated with amenity values in an urban setting. The approach to funding recommended here targets the beneficiaries and exacerbators.

- Inspection and monitoring in urban areas – direct charge to complainant or targeted urban rate.
- Control - land holder.

9 Gorse - rural

9.1 Description

Gorse is an erect shrub growing to 5 m in height that was introduced to Southland for use as a fencing shrub and for shelter. Gorse is widespread in Southland, and causes loss of production by excluding stock and displacing pasture. Gorse may also increase costs for establishment of forestry plantings. Gorse is considered a good nursery plant for the regeneration of native forest where a suitable native seed source is available.

9.2 Proposed Plan

ES is proposing that Gorse is controlled through the Sustained Control objective described in Section 1(b) of the NPD. This analysis assesses the benefits and costs of Gorse control in an urban and rural setting.

9.3 NPD Section 6 Assessment

9.3.1 Level of analysis

The assessed level of analysis for Gorse under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

9.3.2 Impacts of Gorse

Gorse has the potential to cause loss of production from pastoral agriculture in hill and high country.

9.3.3 Benefits for management of Gorse

The quantified benefits from Gorse management are the prevention of loss of production from pastoral agriculture in hill country and prevention of control costs. The costs of lost production and control costs if allowed to spread are NPV(6%) $217 million for landholders currently not infested.

9.3.4 Costs of Gorse Plan

The plan will incur costs of control, inspection and monitoring. These are $19,180 annually for the strategy option. Costs for all three options considered are a NPV of NPV $300,000 for Sustained Control, NPV $6,000,000 for Progressive Containment, and NPV $15,000,000 for Eradication (which has a shorter time frame).

9.3.5 Risks of Gorse Plan

Technical and operational risks: There is a long history of attempts to control Gorse, with little evident impact on a widespread basis. The technical risks of preventing spread for a well established and widespread plant are considerable.

Implementation and compliance: There is a long history of regulated Gorse control with widespread non-compliance. The implementation and compliance risks are substantial and the likelihood of additional control beyond the Do Nothing scenario in areas where it is already present are low.

Other legislative risks: None known

Public or political concerns: High cost and widespread nature of Gorse.

Other risks: None known

9.3.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the plan, as shown in Table 31 below. In terms of those alternatives considered, the Sustained Control option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 32 below which suggests that the conclusion is robust to changes in single assumptions.

These factors suggest that the Sustained Control option is favoured as producing the highest net benefit if the assumptions made in this analysis are considered reasonable, provided the plan is able to prevent spread.

Table 31: Outcomes of analysis of costs and benefits for Gorse (rural)

Plan	Total control costs and lost production PV(6%)	Net Benefit of plan NPV(6%)	Risk adjusted net benefit of plan NPV(6%)
Do Nothing	$297,000,000		
Eradication	$442,000,000	$-145,550,000	$-4,220,000
Progressive containment	$179,000,000	$117,630,000	$4,520,000
Sustained Control	$79,000,000	$217,640,000	$10,580,000

Table 32: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Sustained Control
Time to full occupation 50% of base	Sustained Control
Time to full occupation 150% of base	Sustained Control
Distance of spread 50% of base	Sustained Control
Distance of spread 200% of base	Sustained Control
Cost of control +20% from base	Sustained Control
Cost of control -20% from base	Sustained Control
Loss of production impacts -20% from base	Sustained Control
Loss of production impacts +20% from base	Sustained Control
Discount rate 4%	Sustained Control
Discount rate 8%	Sustained Control

9.4 NPD Section 7 - Allocation of Costs and Benefits

9.4.1 Beneficiaries, exacerbators and costs of proposed plan for control of Gorse

The beneficiaries and exacerbators of the plan are:

- Beneficiaries: Rural community from prevention of spread and production benefits.
- Active exacerbators: Any persons transporting Gorse into or around the region.
- Passive exacerbators: Any persons with Gorse on their property not undertaking control.

The direct and indirect costs associated with the plan are shown below in Table 33 and Table 34.

Table 33: Direct and indirect costs of plan for Gorse

Plan option	Control costs land holders (PV (6%))	Inspection and monitoring costs (PV (6%))
Sustained Control	$45,000,000	$300,000
Progressive containment	$172,000,000	$6,000,000
Eradication	$427,000,000	$15,000,000

Table 34: Benefits and costs of plan for Gorse that accrue to different beneficiaries and exacerbators

Plan option	Benefits for those currently infested (PV (6%))	Benefits for those not currently infested (PV (6%))	Costs for exacerbators (PV (6%))
Sustained Control	$-2,358,960	$220,000,000	$-217,640,000
Progressive containment	$-96,321,314	$220,000,000	$-117,630,000
Eradication	$-350,752,590	$220,000,000	$145,550,000

9.4.2 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown Table 35.

Table 35: Matters for consideration in allocating costs for proposed Gorse (rural) plan

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread.
Most effective control agents	Land holders.
Urgency	Very low - well established and widespread.
Efficiency and effectiveness	The effectiveness of a Sustained Control plan is likely to be low, given that past intensive control efforts appear to have had little impact on spread. The efficiency of requiring land holders to control in uneconomic circumstances is also likely to be low.
Practicality of targeting beneficiaries	Beneficiaries are widespread throughout the region, although largely related to pastoral agriculture.
Practicality of targeting exacerbators	Location of gorse can be established through an inspection programme. Therefore exacerbators are able to be targeted.
Administrative efficiency	Targeted rural rate is appropriate and efficient for benefits to pastoral agriculture.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs of the programme are potentially high for some land holders with little benefit received.
Parties bearing indirect costs	No indirect costs are expected.
Transitional cost allocation arrangements	Programmes for gorse control have been established for a long period. No transitional mechanisms are likely to be required.
Mechanisms available	General Rate, targeted rate (rural properties) and direct charges are the most readily available mechanisms. Levies are expensive to establish and administer.

9.4.3 Proposed allocation of costs

The control of gorse primarily provides production benefits, and the prevention of any spread is of benefit to the rural land. Therefore, rural land holders should bear the majority of any costs. Because land holders are able to determine whether control is worthwhile on their own property, in the absence of any wider benefit the major gains will come from preventing spread. Therefore, the recommendations for funding are:

- Inspection and monitoring costs to prevent spread onto neighbouring properties – 100% targeted rate on rural productive land.
- Control costs to prevent spread – 100% land holders as exacerbators.

10 Wilding Conifers

Wilding conifers and the associated analysis shown here covers the following confier species:

- Lodgepole or contorta pine
- Dwarf mountain pine
- Bishop or muricata pine
- Corsican pine
- Maritime pine
- Ponderosa pine
- Radiata pine
- Scots pine

The term refers to plants that have spread naturally, with low economic benefits and with potential to spread further in an uncontrolled manner. It is appropriate to group these species because they behave similarly, occupy similar habitat, and in some cases occur as mixed stands that must be controlled together.

10.1 Proposed programme

ES is proposing that Wilding Conifers are controlled through a Progressive Containment regime. It may be that differential levels of effort will be applied to different areas depending on the risk of spread and damage to biodiversity values.

10.2 NPD Section 6 Assessment

10.2.1 Level of analysis

The assessed level of analysis for Wilding Conifers under the requirements of the NPD and using the Guidance approach is Level 3. The detail of the requirement for assessment is shown in Appendix B.

10.2.2 Method

The method is adapted from Velarde, Paul, Monge, & Yao, (2015) with that publication providing assumptions and other information. This information was combined with the plant pest spread model to estimate a combination of area infested and occupation, which was not estimated directly by Velarde et al. (2015) paper. This section should be read in conjunction with Section 4 which describes the plant pest model in greater detail. Key assumptions are detailed below.

Rate of spread – the rate of spread for Wilding Conifers was adapted from Velarde *et al.* (2015) by converting the formula they used for estimating the national rate of spread to account for the estimated current area infested in Southland (42,188 ha[10]). This gave a formula of:

$$Area_t = 6.6262E - 10 \times t^{7.192}$$

[10] From Wildlands 2016

Where Area = area in ha, t = time since 1900 when it is assumed that wildings first occurred in the region.

This formula was then used to estimate the time since 1900 when the full habitat was occupied, which is the year 2045, or approximately 30 years from now. The annual distance of spread was then adjusted in the pest spread model through trial and error so that the year when the full habitat was infested with some level of wildings occurred in 2045, which is a spread distance of 150m/year. This approach allows the model to replicate the approach taken by the Velarde *et al.*(2015) paper of increasing each infestation in concentric circles with a given distance of spread. The approach here is likely to produce a lower estimate of spread because a mathematical rather than GIS based approach is used in the model, which means that interaction between different infestations sites is not taken into account. However, because the year in which the full habitat is infested is unaltered, the difference in costs should not be significant and will be within the error bounds for the study.

Estimate of productive land affected – an estimate of the proportion of land affected was made based on the proportion of Land use Capability (LUC) Class 6 and 7 land that is in grassland of some sort (85%), and comparing this with the proportion of affected land in private ownership in 2025 (75%). Because a proportion of short and tall tussock grassland will be in public ownership, the lower proportion of 75% of potentially affected land being productive is used for the purposes of this analysis.

Estimating the impact on water yield – the Velarde *et al.*(2015) report uses an estimate of 46% reduction on water yield from wilding infested catchments with complete cover. They multiply this by the proportion of the region in wildings, and use GDP as a proxy for the impact on irrigation. It is likely that the impacts on water yield, hydro generation, and irrigation are highly complex because the impacts will depend on the source catchment (alpine river, foothills river, lowland streams, and groundwater), since each of these has different susceptibility to wildings. They will also be affected by the timing of the water yield reduction and the location of the wilding populations.

Nevertheless the approach adopted in Velarde *et al.*(2015) is considered sufficient for the purposes of this study. The reduction in water yield is, however, assumed to be 20%, which is less than half the assumption used in the Velarde *et al.* (2015) report. This is to allow for potential differences in land type and climatic patterns between the study sites where the yield measurements were made and the situation that exists in Southland. It also ensures that the estimate is conservative in relation to the impacts on irrigation. The assumption is that there is a linear relationship between the reduction in water yield and irrigation impacts. Hydro impacts are not considered likely to be major in Southland because the major hydro resource in Lake Manapouri is currently forested and therefore not particularly vulnerable to impacts from wilding invasion.

Table 36: Estimated proportion of wilding prone land in productive land use

LUC class	Grassland (ha)	Other vulnerable (ha)	Not vulnerable (ha)	Total (ha)
6	234,000	42,000	234,000	510,000
7	100,000	14,689	248,000	362,000
Total	**334,000**	**57,000**	**482,000**	**872,000**

Proportion	**85%**	**15%**	**NA**	

Any impacts on irrigation are likely to occur primarily in the upper part of the Mataura catchment where the majority of irrigation takes place. The impact on irrigation for the catchment is estimated using the irrigated and dryland figures for an assessment of wilding impacts in Canterbury (Harris, 2016). The irrigated areas in Southland are estimated from Statistics NZ 2012 Agricultural Census data as 17,200 ha. The impact of wildings is assumed to occur only on Class 6 and 7 land and only in proportion to the land potentially occupied by wildings (13%) which is $1.12/ha infested by wildings.

Biodiversity benefits - the biodiversity benefits in the Velarde et al. (2015) paper were estimated using a choice modelling experiment for three native species – *Hebe cupressoides*, *Brachasips robustus*, and *Galaxias macronasus* (Kerr & Sharp, 2007). In a study of household preferences on the impact of wilding pines, they suggest reasonable mid-range values for protection of these species are of $70/household per annum, $120/household per annum and $140/household per annum, giving an aggregate $330/household/annum. Multiplied by the 38,000 estimated households in Southland (Statistics NZ privately occupied dwellings) this gives an annual cost of $12.5 million per annum. It is assumed that this benefit is all lost when wildings occupy their full potential habitat which gives an average biodiversity value of $41.5/ha/annum for land currently unaffected.

Non quantified costs. There are a range of costs that have not been quantified here. These include:

- Reduction in tourist visits from reduced amenity values.
- Impact on recreational use of water, through reduction in amenity values and desirability of lcoations.
- Drinking water supply from reduction in available water.
- Landscape values, although this is dependent on the location, scale and density of wilding infestations.
- Cultural and historic values by impact on historic buildings and structures, and earthworks and *urupa and* grave sites from conifer trees and their roots.
- Increased fire risk from longer lasting fires and fires that are more expensive to control from the need for chemicals, heavier equipment, and the more frequent need for the use of aircraft. They may also increase insurance premiums and require maintenance in the form of firebreaks and access control.
- Honey production from the replacement of manuka shrublands and shading of flowering species. These impacts have not been costed.
- Carbon sequestration – the Wilding Conifers accumulate significant levels of carbon which potentially has a market value depending on their status and tradeability.
- Erosion control in unstable land.

Many of these are not realistically quantifiable within the scope of this study. The Valerde *et al.*(2015) report estimates the impact on international tourism, but this is not considered appropriate for a regional scale study due to a lack of any detailed information on tourism

sites likely to be affected in Southland. Carbon sequestration values are potentially quantifiable based on the value of carbon (~$18/NZU August 2016) and estimates are available of the amount of carbon sequestered per ha at maturity for plantation forestry. However, this report follows the guidance of Valerde *et al.*(2015) who consider the impacts are not able to be quantified because of uncertainty about the status of wilding forests in the Emissions Trading Scheme. It should be noted that at current carbon prices the gains from carbon sequestration are potentially very significant if the full potentially habitable area were infested with dense stands of wildings.

10.2.3 Impacts of Wilding Conifers

Wilding Conifers have the potential to cause loss of production on high country properties, and significant impacts on biodiversity in tussock grasslands. They may also cause impacts for irrigators and other water users through reduced water availability, honey production, and landscape and amenity values.

10.2.4 Benefits for management of Wilding Conifers

Prevention of loss of production on high country properties, and significant impacts on biodiversity in tussock grasslands. Wildings also cause losses for:

- Indigenous biodiversity from replacement of habitat and shading.
- Hydro generation through reduction of available water.
- Irrigation through a reduction in available water.
- Reduction in tourist visits from reduced amenity values.
- Impact on recreational use of water, through reduction in amenity values and desirability of lcoations.
- Drinking water supply from reduction in available water.
- Landscape values, although this is dependent on the location, scale and density of wilding infestations.
- Cultural and historic values by impact on historic buildings and structures, and earthworks and urupa and grave sites from conifer trees and their roots.
- Increased fire risk from longer lasting fires and fires that are more expensive to control from the need for chemicals, heavier equipment, and the more frequent need for the use of aircraft. They may also increase insurance premiums and require maintenance in the form of firebreaks and access control.
- Honey production from replacement of manuka shrublands and shading of flowering species. These impacts have not been costed.

Allowing wilding pines to spread will cause an additional NPV(6%) $30 million in costs for control, lost production, reduced irrigation, and loss of biodiversity.

10.2.5 Costs of Wilding Conifers Programme

The plan will incur costs of control, inspection, and monitoring. These are $20,000 annually for the Progressive Containment option. Costs for all three options considered are an NPV(6%) of $200,000 for Sustained Control, NPV $600,000 for Progressive Containment,

and NPV $2,000,000 for Eradication. In addition, the removal of wildings will incur costs from reduced:

- Carbon sequestration – the Wilding Conifers accumulate significant levels of carbon which potentially has a market value depending on their status and tradeability.
- Erosion control in unstable land.

10.2.6 Risks of Wilding Conifers Programme

Technical and operational risks: There are significant technical and operational risks with the control of wildings. They tend to occur across large areas of the landscape, and require individual control of scattered plants in order to halt spread. Wildings can occur in difficult to access locations and there are no reliable chemical control agents.

Implementation and compliance: There are significant risks to compliance with the plan because of the substantial costs that can be involved, coupled with the low productive value of the land. Furthermore, conifers are also planted for production purposes, and plantation forests do not always have associated plans for the management of wilding spread. This has created some opposition amongst land holders to requirements to manage wildings that impose costs on their operations. The low level of costs allowed to inspect and manage wildings increases the risk of non-achievement.

Other legislative risks: Some parties will have a consented right to grow conifer species, which may conflict with the requirements of the management plan. The status of wildings within the Emissions Trading Scheme may create risks for removing pre 1990s wilding stands, or by creating benefit from increasing infestations of wildings.

Public or political concerns: Wilding control in the high country is an emotive subject, with potentially high costs for land holders and iconic landscape values.

Other risks: None known

10.2.7 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the programme, as shown in Table 37, Table 38 and Table 39 below. In terms of those alternatives considered, the Progressive Containment option has the net benefit and the highest risk adjusted net value when risks associated with achievement of the objectives are taken into account. The sensitivity analysis in Table 40 shows that the conclusion that Progressive Containment has the highest risk adjusted net benefit is robust to a range of changes in the assumptions used apart from a higher rate of spread and a lower discount rate where Eradication is favoured. The potential benefits associated with preventing damage to biodiversity on 220,000 ha of land are included in this analysis based on a non-market valuation study of endangered species in the high country. It should be noted that the non-market values estimated in that study may not cover the full range of values that are associated with biodiversity.

Because the analysis only takes a regional viewpoint, national benefits and costs have been excluded. However there are additional national benefits that will arise from Wilding Conifer control, and there may also be an input of national funding into reduction of areas infested by wilding conifers that will reduce the regional costs.

There are a range of other values that have not been covered by this study, including landscape values, impacts on rural firefighting costs etc., as detailed in Section 10.2.4 and 10.2.5. There are also intergenerational implications that should be taken into account because of the enormous cost of returning any infested land to the current state.

These factors suggest that the Progressive Containment option is favoured as producing the highest net benefit if the assumptions made in this analysis are considered reasonable and if the Council is satisfied about the value of biodiversity. However, it should be noted that the conclusion should have a disclaimer regarding the low level of costs assumed as required to achieve the outcomes, and the non-inclusion of other non-market benefits and costs, because, for example: the returns from carbon sequestration could readily outweigh the net benefits calculated here.

Table 37: Scenario outcomes by item for Wilding Conifers

	Scenario outcome ($ million NPV)			
Item	**Do Nothing**	**Sustained Control**	**Progressive containment**	**Eradication**
Cost of control	$0.2	$0.2	$0.6	$1.6
Cost of lost production	$23.0	$10.6	$0.0	$0.0
Inspection, monitoring etc.	$0.0	$0.0	$0.3	$0.8
Hydro losses	$0.0	$0.0	$0.0	$0.0
Irrigation losses	$0.6	$0.2	$0.0	$0.0
Biodiversity losses	$22.4	$7.6	$0.0	$0.0
Total	**$46.1**	**$18.6**	**$1.0**	**$2.4**

Table 38: Net benefit for plan option by item for Wilding Conifers

	Net Benefit ($ million NPV)		
Item	**Sustained Control**	**Progressive containment**	**Eradication**
Cost of control	$0.0	-$0.4	-$1.4
Cost of lost production	$12.4	$23.0	$23.0
Inspection, monitoring etc.	$0.0	-$0.3	-$0.8
Hydro benefits	$0.0	$0.0	$0.0
Irrigation benefits	$0.4	$0.6	$0.6
Biodiversity benefits	$14.7	$22.4	$22.4
Total	**$27.6**	**$45.2**	**$43.8**

Table 39: Outcomes of analysis of costs and benefits for Wilding Conifers

Programme	Risk adjusted net benefit (NPV(6%) $ million
Eradication	$4.20
Progressive Containment	$12.4
Sustained Control	$12.0

Table 40: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Progressive Containment
Time to full occupation 50% of base	Progressive Containment
Time to full occupation 150% of base	Progressive Containment
Distance of spread 50% of base	Progressive Containment
Distance of spread 200% of base	Eradication
Cost of control +20% from base	Progressive Containment
Cost of control -20% from base	Progressive Containment
Loss of production impacts -20% from base	Progressive Containment
Loss of production impacts +20% from base	Progressive Containment
Discount rate 4%	Eradication
Discount rate 8%	Progressive Containment

10.3 NPD Section 7 - Allocation of Costs and Benefits

10.3.1 Beneficiaries, exacerbators and costs of proposed programme for control of Wilding Conifers

The beneficiaries and exacerbators of the programme are:

- Beneficiaries: Wider community from prevention of impacts to biodiversity. Land holders from protection of production values.
- Active exacerbators: Any persons transporting Wilding Conifers into or around the region.
- Passive exacerbators: Any persons with Wilding Conifers on their property not undertaking control, or persons with plantation forestry which is spreading seeds onto neighbouring properties.

The direct and indirect costs associated with the programme are shown below in Table 41 and Table 42.

Table 41: Direct and indirect costs of programme for Wilding Conifers

Plan option	Control costs land holders (PV (6%))	Inspection and monitoring costs (PV (6%))
Sustained Control	$200,000	$20,000
Progressive Containment	$600,000	$300,000
Eradication	$2,000,000	$800,000

Table 42: Benefits and costs of programme for Wilding Conifers that accrue to different beneficiaries and exacerbators

Programme option	Benefits for those currently infested (PV (6%))	Benefits for those not currently infested (PV (6%))	Costs for exacerbators (PV (6%))
Sustained Control	$29,000,000	$6,240,000	$200,000
Progressive Containment	$29,000,000	$16,320,000	$600,000
Eradication	$29,000,000	$15,400,000	$2,000,000

Table 43: Estimate of share of net benefit by benefit type for Sustained Control option (% of total net benefit)

Item	Share of net benefit for Progressive containment
Cost of control	0%
Cost of lost production	45%
Inspection, monitoring etc.	0%
Hydro benefits	0%
Irrigation benefits	1%
Biodiversity benefits	53%
Total	100%

10.3.2 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 44 below.

Table 44: Matters for consideration in allocating costs for proposed Wilding Conifers programme

Legislative rights and responsibilities	None known.
Management objectives	Sustained Control.
Stage of infestation	Widespread but continuing to expand in suitable habitats in the high country.
Most effective control agents	The areas that wildings occupy are generally either not grazed, or grazed at low densities. The most effective control agents will depend on the circumstances but will involve a mixture of land holder and external agency control.
Urgency	There is moderate urgency to control wildings as the opportunity to prevent widespread occupation of high country habitats is limited.
Efficiency and effectiveness	The most efficient approach is likely to be requiring land holder control since they have management control over the land being infested. However, this is not always effective if the control required is widespread, diffficult, and expensive. In those situations it may be more effective to undertake control directly, and require land holders to maintain the pest infestations at low levels. This also ensures an incentive to control seed sources within the property.
Practicality of targeting beneficiaries	The main beneficiaries are the wider community for biodiversity benefits and this group can be readily target through the General Rate. Land holder benefits can be targeted through direct charges, and the rural community through a targeted rural rate. Levies or rates could be charged against irrigated properties potentially affected the reduction in water associated with wilding spread.
Practicality of targeting exacerbators	Location of wildings can be established through an inspection programme or remote monitoring. Therefore exacerbators are able to be targeted.
Administrative efficiency	General Rate is highly efficient for collecting community benefits related to biodiversity. Rural rate can be targeted to collect benefits from preventing spread and damage to productive values. Targeting irrigated properties would be more problematic that a targeted rural rate and would require a higher standard of consultation and establishment of benefits.
Security	Rating mechanisms are generally secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgement.
Reasonable	The costs for wilding control can be extremely high for dense infestations, and typically the cost of control greatly outweighs any production benefits.
Parties bearing indirect costs	Wilding control can cause erosion and landscape impacts.
Transitional cost allocation arrangements	If land holder control is to be required then some transitional mechanisms will be required to ensure that the ongoing costs of control are manageable.
Mechanisms available	General Rate, targeted rate (rural properties) and direct charges are the most readily available mechansisms. Levies are expensive to establish and administer.

10.3.3 Proposed allocation of costs

The analysis in Table 43 suggests that the biodiversity benefits and lost production benefits both amount to ~50% each of the net benefit from the Progressive Containment option. Other benefits are negligible.

The analysis therefore suggests that the cost of the programme should be spread between the landholders who benefit, including those protected from spread, and the wider regional community.

Landholder control (as exacerbators) has the potential to increase the effectiveness of control but it should be kept in mind that for large infestations on high country properties the costs of doing so would be unreasonably large. It is therefore recommended that the costs of large scale control programmes should be funded mostly from the General Rate for reasons of practicality and efficiency. Ongoing removal of wildings following effective control should be the role of landholder as exacerbators.

The recommendation for funding is therefore:

- Inspection and monitoring costs: 100% General Rate.
- Initial large scale control: General Rate.
- Ongoing control following initial control: 100% landholder

11 Ragwort

11.1 Description

Ragwort (*Jacobaea vulgarisis*) is a biennial or perennial herb that grows 30 – 120cm tall, with an erect rigid stem and yellow daisy like flowers. It is wind spread and produces a very large number of long lived seed that can colonise bare ground rapidly. Ragwort invades disturbed forest and shrubland, short tussockland, fernland, herbfield, wetlands and coastal areas throughout New Zealand. In a productive setting it is usually considered a pest only of dairying because it is palatable to sheep. It taints milk if eaten by lactating cows.

11.2 Proposed Strategy

ES is proposing that Ragwort is controlled through the Sustained Control objective described in Section 1(b) of the NPD.

11.3 NPD Section 6 Assessment

11.3.1 Level of analysis

The assessed level of analysis for Ragwort under the requirements of the NPD and using the Guidance approach is Level 2. The detail of the requirement for assessment is shown in Appendix B.

11.3.2 Impacts of Ragwort

Ragwort has the potential to cause loss of production on dairy farms as its major impact.

11.3.3 Benefits for management of Ragwort

Prevention of loss of production on dairy farms. There is a negative net benefit relative to the pest being kept at its current level, primarily because effective control will require its removal on properties where it is not currently a major pest.

11.3.4 Costs of Ragwort Strategy

The plan will incur costs of control, inspection and monitoring. These are $27,460 annually for the strategy option. Costs for all three options considered are a NPV of NPV $500,000 for Sustained Control, NPV $900,0000 for Progressive Containment, and NPV $22,000,000 for Eradication.

11.3.5 Risks of Ragwort Strategy

Technical and operational risks: Ragwort has been present in New Zealand for many years, and it likely to have occupied most habitats in Southland. No progress has been made in reducing ragwort infestations anywhere in New Zealand under a RPMP, and given the number of viable seeds produces and its wide potential dispersal it is unlikely that intervention by the regional council will make any difference to the infestation on individual properties.

Implementation and compliance: Because of the widespread nature of ragwort in order to achieve uniform compliance there would need to be a very large inspection programme, with regular follow ups through the season.

Other legislative risks: None known.

Public or political concerns: Ragwort is highly visible in flower and can be the cause of concern for those landholders who consider they are affected by infestations on a neighbouring property.

Other risks: There is a biocontrol agent released for ragwort, athough its efficacy in Southland does not appear to have been as good as in other parts of the country. Care should be taken to ensure that any control requirements do not interfere with establishment and spread of other biocontrol agents that may be released in the future.

11.3.6 Net Benefit and risk adjustment

The analysis produces an estimate of the total costs and benefits of the different options for the strategy, as shown in Table 1 below. In terms of those alternatives considered, the Do Nothing option has the highest net value. The sensitivity of this conclusion to changes in various input parameters is shown in Table 3 below, which suggests that Sustained Control may be of a higher net benefit with a lower discount rate or higher rates of spread.

These factors suggest that a strategy for control of ragwort is unlikely to meet the tests of the Biosecurity Act if the assumptions made in this analysis are considered reasonable.

Table 1: Outcomes of analysis of costs and benefits for Ragwort

Strategy	Total NPV	Net Benefit of strategy	Risk adjusted net benefit
Do Nothing	$679,000,000		
Eradication	$610,000,000	$69,430,000	$-2,1640,000
Progressive reduction	$257,000,000	$421,920,000	$-9,130,000
Sustained control	$703,000,000	$-23,780,000	$-1,620,000

Table 3: Impact of sensitivity testing on highest value option

Sensitivity test	Highest value option (risk adjusted)
Base net benefit	Do Nothing
Time to full occupation 50% of base	Sustained control
Time to full occupation 150% of base	Do Nothing
Distance of spread 50% of base	Do Nothing
Distance of spread 200% of base	Sustained control
Cost of control +20% from base	Do Nothing
Cost of control -20% from base	Do Nothing
Loss of production impacts -20% from base	Do Nothing
Loss of production impacts +20% from base	Do Nothing
Discount rate 4%	Sustained control
Discount rate 8%	Do Nothing

11.4 NPD Section 7 - Allocation of Costs and Benefits

11.4.1 Beneficiaries, exacerbators and costs of proposed strategy for control of Ragwort

The beneficiaries and exacerbators of the strategy are:

- Beneficiaries:
- Active exacerbators: Any persons transporting Ragwort into or around the region
- Passive exacerbators: Any persons with Ragwort on their property not undertaking control.

The direct and indirect costs associated with the strategy are shown below in Table 4 and Table 5.

Table 4: Direct and indirect costs of strategy for Ragwort

Plan option	Control costs landholders	Inspection and monitoring costs
Sustained control	$62,000,000	$500,000
Progressive reduction	$246,000,000	$9,000,000
Eradication	$588,000,000	$22,000,000

Table 5: Benefits and costs of strategy for Ragwort that accrue to different beneficiaries and exacerbators

Strategy option	Benefits for those currently infested	Benefits for those not currently infested	Required benefit for community for biodiversity and ecological benefits in order for option to be positive	Costs for exacerbators
Sustained control	$300,600,000	$-323,924,241	$23,780,000	$62,000,000
Progressive reduction	$754,970,000	$-323,924,241	$-421,920,000	$246,000,000
Eradication	$415,000,000	,$-323,924,241	$-69,430,000	$588,000,000

11.4.2 Matters for consideration in allocation of costs

The matters for consideration are spelt out in Section 7(2)(d) of the NPD, and the analysis for each of these matters is shown in Table 45 below.

Table 45: Matters for consideration in allocating costs for proposed Ragwort plan

Legislative rights and responsibilities	None known
Management objectives	Sustained Control
Stage of infestation	Late stage – ragwort is throughout Southland
Most effective control agents	Landholders are most effective because it requires control and measures to ensure that seed does not spread.
Urgency	Low urgency as it has been present for a long time and has liklely reached its full habitat
Efficiency and effectiveness	It is likely that requiring landholders to control will improve the efficiency of control measures as land will be managed to reduce infestation and spread.
Practicality of targeting beneficiaries	Beneficiaries are the wider rural community for prevention of spread onto productive land.
Practicality of targeting exacerbators	Ragwort in flower is easily seen and exacerbators can be targeted.
Administrative efficiency	Exacerbators control requires inspection and enforcement, while generate rate would have greater administrative efficiency
Security	Rating mechanisms are most secure.
Fairness	Charges relate directly to benefits or exacerbators. Fairness is a politically determined judgenemtn
Reasonable	Costs are likely to be significant on some properties.
Parties bearing indirect costs	None likely
Transitional cost allocation arrangements	None required as control has been required for ragwort for some time.
Mechanisms available	General rate, targeted rate (rural properties) and direct charges are the most readily available mechansisms. Levies are expensive to establish and administer.

11.4.3 Proposed allocation of costs

The recommended approach is for a mix of land holder control as exacerbators and a targeted rate for productive land in the wider community for inspection, monitoring, and enforcement costs.

- Inspection and monitoring costs: 100% targeted rate on productive rural land as beneficiaries. A levy on dairy properties could be considered, although this is not likely to be an efficient mechanism for collection of funding requirements.
- Control costs: 100% land holders as exacerbators

12 Exclusion Pests

Exclusion pests include :

Table 46: Pests to be included in an exclusion programmes

Common names	Scientific name	Area	Page
Plants			
Boneseed	*Chrysanthemoides monilifera*	All Southland	
Chilean needle grass*	*Nassella neesiana*	All Southland	
Nassella tussock*	*Nassella trichotoma*	All Southland	
Animals			
Rook	*Corvus frugilegus*	All Southland	
Wallaby - Bennett's, Dama, Parma, Brushtail Rock and Swamp	*Macropus rufogriseus rufogriseus, M. eugenii, M. parma, Petrogale penicillata, Wallibia bicolour*	All Southland	
Marine			
Asian paddle crab	*Charybdis japonica*	All Southland	
Sabella (Mediterranean fanworm)**	*Sabella spallanzanii*	All Southland	
Sea squirts (clubbed tunicate, Australian droplet tunicate, pyura & didemnum)	*Styela clava Eudistoma elongatum, Pyura doppelgangera and Didemnum vexillum*	All Southland	

The total expenditure on these pests is expected to be $XX,000 per annum.

12.1 NPD Section 6 Assessment

The analysis for these pests is undertaken at Level 1 because they are not present in the region, there is no opposition to their management, and the management costs are relatively low.

The objectives for exclusion pests will meet the requirements of Section 6 if the Council considers that the benefits of reducing the risks of these pests being introduced to the region and causing damage to biodiversity, conservation, amenity, and production values exceeds the expenditure of $xx,000 per annum.

12.2 NPD Section 7 Assessment for Exclusion Pests

Because these pests are not present there are no exacerbators, and therefore the most appropriate source of funding is from the beneficiaries. Rating is the most efficient and secure source of funding. The majority of the pests are biodiversity related, for which funding from the General Rate is most appropriate. There is unlikely to be major efficiency benefits from targeting production beneficiaries, given the diffuse and uncertain nature of the benefits, and therefore the recommendation is that all the funding for Exclusion pests be sourced from General Rate.

13 Site Led Pests

The group of pests included in Site Led programmes are:

Table 47: Pests included in site-led programmes

Common names	Scientific name	Area
Plants		
African club moss	*Selaginella kraussiana*	Zone 1
Gunnera	*Gunnera tinctoria*	Zone 1
Hawthorn	*Crataegus monogyna*	Zone 1
Heather	*Calluna vulgaris*	Zone 1
Knotweed	*Fallopia japonica, F. sachalinensis and Persicaria wallichii* (syn *Polygonum polystachyum*)	Zone 1
Spanish heath	*Erica lusitanica*	Zone 1
Willow (Crack, Grey)*	*Salix fragilis*, *S. cinerea*	Zone 1
Any other pest plant in RPMP		Any Zone as required
Animals		
Feral cat	*Felix catus*	Zone 1 & 2
Feral goat	*Capra hircus*	Zone 1 & 2
Feral pig	*Sus scrofa*	Zone 1
Hedgehog	*Erinaceous europaeus*	Zone 1 & 2
House mouse	*Mus musculus*	Zone 1
Mustelids (ferret, stoat, weasel	*Mustelo furo, M. ermine, M. nivalis*	Zone 1 & 2
Possum	*Trichosurus vulpecula*	Zone 1
Rat (Norway, ship and Kiore)	*Rattus norvegicus, R. rattus R. exulans*	Zone 1 & 2
Any other pest animal in RPMP		Any Zone as required

Zone 1: Rakiura/Stewart Island
Zone 2: Omaui

The Site Led status is for these pests relates to specific areas where conservation and biodiversity objectives are targeted. Site led programmes will only be undertaken where there is land holder agreement. Any cost sharing arrangements and ongoing obligations for land holders will be part of the agreement.

13.1 Section 6 Assessment

The level of analysis for Site led Pests is 1, because the expenditure on any single site will be limited, and because the programme will only be undertaken where feasible and in conjunction with the land holder.

The proposed costs for the Site Led pests are shown in the qualitative cost benefit analysis, although it should be noted that these will be finalised once the locations are known and agreed. The agreement of the land holder signals that for them the benefits of the programme are likely to exceed the costs they will incur. Therefore, as long as the Council is

satisfied that the benefits of the site led programme exceed the costs, the requirements of Section 6 of the NPD will have been met.

13.2 Section 7 Assessment

The cost sharing arrangements will be agreed at the time when specific sites are identified. However, because the benefits for the Councils are primarily to biodiversity, it is appropriate that the Council's contribution be covered from the General Rate which reflects the community nature of the benefits.

14 Good Neighbour Rules (GNR)

The good neighbour rule is covered by Section 8 of the NPD. These require that the:

- Pest would spread onto adjacent land;
- That the pest would cause unreasonable costs for the adjacent land holder (receptor);
- The receptor land holder is controlling the pest;
- The requirement on the land holder from whence the pest (source) is spreading is not more than is required to prevent the pest spreading;
- The costs of compliance for the source land holder are reasonable relative to the cost that the receptor land holder would incur from the pest spreading.

The first two of these are covered by the plan requirements and identification of the biology of the pest species, which all spread naturally in the absence of intervention and cause control costs. For each of the pests for which a GNR rule would apply a primary analysis of costs and benefits has already been undertaken. This GNR analysis therefore focuses on whether the costs for the source land holder are reasonable relative to the costs caused by the spread of the pest in the absence of the rule. These GNRs apply in addition to the rules for management in the proposed programmes for feral rabbits, gorse, broom, nodding thistle, ragwort and wilding conifers.

The GNR analysis is undertaken using the model developed for the joint Biosecurity Managers Group as described by Harris, Hutchison, Sullivan, and Bourdot (2016). The model provides a tabular output describing the boundary distance required before the benefits outweigh the costs, and the relationship between the costs for the source and receptor land holders. These are given in Appendix D to assist and inform any decisions as to whether the rule is reasonable as per the requirements of clause 8(1)(e)(ii) of the NPD.

14.1 Feral rabbits

The analysis for feral rabbits in Section 3 is based on boundary control, and it shows that overall there is likely to be a net benefit from a boundary control regime. In terms of reasonableness the analysis suggests that the costs are likely to be similar or lower for the source landholder as opposed to the receptor landholder where the rabbit proneness is moderate or low and the receptor is of a higher proneness class. Requiring control on land where the source is High or Extreme proneness will result in the costs of the source being between 1.7 and 7.7 times the additional costs of control for the receptor landholder. Costs are unlikely to be reasonable in any situations where the receptor is Low proneness because rabbits are generally maintained at low levels on these land types without control being undertaken.

14.2 Possums

Possums are controlled under the site led programme in Possum Control Areas. The assessment of their ability to meet the tests for GNR therefore assumes that the overall costs and benefits of the site led programme are established.

The good neighbour rule does not appear to meet the tests of reasonableness in the NPD, because the boundary control distance of 500m provides no benefit in terms of control costs for recipient landholders. The only situation which comes close is when both the source and receptor landholder are low prone land (pasture and open country), where the costs of the source landholder are approximately 50% more than the savings in costs for the receptor landholder.

14.3 Nodding thistle

For light infestations of nodding thistle on hill and high country properties the the costs of control for the source and receptor land holders are likely to be similar. The requirement for a GNR is therefore likely to meet the reasonable tests of the NPD. Very dense infestations on boundaries are relatively rare and have not been tested here.

14.4 Gorse

For light infestations of Gorse in the source property, the costs of control for the source and receptor land holders are likely to be similar. For dense infestations the cost of control for source land holders exceeds the costs for the receptor landholder by more than 50%. For broom in urban settings the costs for the source land generally exceeds that for the receptor by a significant margin and the GNR inclusion is not likely to meet the reasonableness tests of the NPD.

14.5 Broom

For light infestations of Broom in the source property, the costs of control for the source and receptor land holders are likely to be similar. For dense infestations the cost of control for source land holders exceeds the costs from spread for the receptor landholder by more than 50%. For broom in urban settings the costs for the source land generally exceeds that for the receptor by a significant margin and the GNR inclusion is not likely to meet the reasonableness tests of the NPD.

14.6 Wilding conifers

Wilding conifers refer to a range of species which are yet to be defined. The assumed boundary distance is 200 m. For light infestations of wilding conifers the source property, the costs of control for the source and receptor land holders are likely to be similar. For dense infestations on the source property the costs of control for the source are 8 – 9 times the additional cost caused by the spread to the adjacent receiving landholder and the GNR inclusion is not likely to meet the reasonableness tests of the NPD.

14.7 Ragwort

For light infestations and where the receptor land use is dairy, the costs of control of ragwort are likely to be similar on both the receptor and source properties, and the GNR would meet the reasonableness test of the NPD. However where the receptor is other land use types these tests are not likely to be met.

15 References

Harris, S. 2016. *Cost benefit analysis of options for pest management in Canterbury.* Christchurch : LWP Ltd contract report prepared for Environment Canterbury, 2016.

Harris, S, et al. 2016. *Economic Assessment of Good Neighbour Rules under the National Policy Direction for Pest Management 2015.* Christchurch : LWP Ltd Contract Report LWP-2016-014, 2016.

Harris, S. 2014. *Lower Waitaki Plan Change: Economic impacts of flow changes.* s.l. : Harris Consulting Contract report, May 2014 prepared for Environment Canterbury, 2014.

Kerr, G N and Sharp, B M.H. 2007. *The Impact of Wilding Trees on Indigenous Biodiversity: A Choice Modelling Study.* Lincoln : LIncoln University Research Report No 303, 2007.

Latham, A D. M, Latham, M C and Warburton, B. 2016. *Review of current and future predicted distributions and impacts of Bennett's and dama wallabies in mainland New Zealand.* Wellington : MPI Technical Paper No 2016/15, 2016.

Ogle, G. 2014. *Calculation of Nitrogen and Phosphorous losses to groundwater and waterways from farm systems in the Upper Waitaki.* s.l. : Ogle Consulting report prepared for Environment Canterbury., 2014.

Patterson, M G and Cole, A O. 2013. *'Total economic value' of New Zealand's land based ecosystems and their services. In:Dymond J.R. ed. Ecosystem Services in New Zealand - conditions and trends.* Lincoln : Manaaki Whenua Press. pp 496 - 510, 2013.

Spurr, E B and Coleman, J. 2005. *Review of Canada goose population trends, damage, and control in New Zealand.* Lincoln : Landcare Research Science Series. 30. Manaaki Whenua Press. 1-31 p. ., 2005.

Taylor, N, et al. 2015. *Upper Waitaki Limit Setting Process: Social-Economic Profile of the Waitaki catchment.* s.l. : Environment Canterbury http://files.ecan.govt.nz/public/pc5/Waitaki_Technical_Reports/Social-economic_profile_of_the_Waitaki_catchment.pdf, 2015.

Velarde, S J, et al. 2015. *Cost benefit analysis of wilding conifer management in New Zealand. Part 1 - Impacts under current management.* Rotorua : Scion S0013 http://www.wildingconifers.org.nz/images/wilding/articles/Strategy/CBA_Wilding_Conifers_Final.pdf, 2015.

White, E G. 2006. *Canada Geese in New Zealand.* Lincoln : Information Paper No.4, Centre for Resource Management, Lincoln University and University of Canterbury, 2006.

Win, A. 2001. *Seasonal grazing of Canada goose (Branta canadensis) on high country farmland, Canterbury, New Zealand.* Lincoln : MSc thesis, Lincoln University, 2001.

16 Appendices

Appendix A Assumptions used in plant pest modelling

Table 48: Assumptions for Plant Pest Spread Model (PPSM) Part A

Pest	Programme	Current Area infested (ha)	Number of active sites (locations)	Largest area of a location	Potential habitat/area (ha)	Current densities (%)	Density at full occupancy (%)	Time of first arrival at a site to 90% occupancy at a site/to all of Southland	Low distance of spread (Min)	High distance of spread (Max)	How often is it likely to generate new foci of infestation	Cost of control low density ($/ha/annum)	Cost of control high density ($/ha)	Inspection costs ($/annum)
Nodding Thistle	Sustained Control	67462	1532	1240	872000	10	20	5	50	200	3	$10	$45	$18,500
Broom Urban	Sustained Control	994	3373	15	5945	10	50	15	10	50	1	$100	$1,000	$33,730
Broom Rural	Sustained Control	43622	1722	22443	1042817	10	50	15	10	50	1	$100	$1,000	$34,440
Gorse Urban	Sustained Control	993	3368	15	5945	10	50	15	10	50	1	$100	$1,000	$33,680
Gorse Rural	Sustained Control	54360	959	22443	1042817	10	50	15	10	50	1	$100	$1,000	$19,180
Wilding conifers	Progressive containment	42188	3	14062.6667	345311	1	80	20	150	150	3	$0.47	$2,200	$20,000
Ragwort	Sustained Control	62402	2746	2897	875988	10	80	5	1	20	3	$120	$150	$27,460

Table 49: Assumptions for Plant Pest Spread Model (PPSM) Part B

Pest	Density of new infestations (%)	Proportion productive land	Years to establishment of new sites to significant seed spread	Number of new foci established each time	Proportion controlled Sustained	Proportion controlled progressive	Proportion controlled Do Nothing	Years to progressive	Years to eradication	Production model type	Inspection cost ratio strategy/sustained	Inspection cost ratio Progressive/Sustained	Inspection cost ratio Eradication/sustained	Distance to North Boundary (km)	Distance to East Boundary (km)	Distance to South Boundary (km)	Distance to West Boundary (km)
Nodding Thistle	0.125	0.75	2	3	0.5	0.95	0.4	50	20	Hill country	1	4	6	200	200	200	200
Broom Urban	2	0.75	2	1	0.5	0.95	0.4	1000	50	Hill country	1	20	50	200	200	200	200
Broom Rural	2	0.75	2	1	0.5	0.95	0.4	1000	50	Hill country	1	20	50	200	200	200	200
Gorse Urban	2	0.75	2	1	0.5	0.95	0.4	1000	50	Hill country	1	20	50	200	200	200	200
Gorse Rural	2	0.75	2	1	0.5	0.95	0.4	1000	50	Hill country	1	20	50	200	200	200	200
Wilding conifers	0.0005	0.75	2	3	0.5	0.95	0.2	1000	50	High country	1	20	50	200	200	200	200
Ragwort	0.125	0.23623383	2	3	0.5	0.99	0.4	1000	50	Dairy	1	20	50	200	200	200	200

Appendix B Assessment of level of analysis under the NPD Guidance

Organism	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Comments	Analysis Intensity
Nodding thistle	H	M	M	M	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and some data exists.	**2**
Wilding Conifers	H	M	M	H	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and quality data exists.	**3**
Broom	M	M	L	M	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and some data exists.	**2**
Gorse	M	M	L	M	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and some data exists.	**2**
Ragwort	M	M	L	M	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and some data exists.	**2**
Feral rabbit	M	M	L	H	Some in community oppose management, overall costs are high, benefits exceed costs, impacts are known to occur, control measures are available and quality data exists.	**2**
Canada Goose	M	M	L	M	Control supported by community, overall costs are moderate - high, benefits may not exceed costs, impacts are known to occur, control measures are available and limited data exists.	**2**
Possum	M	M	L	M	Control supported by community, overall costs are moderate - high, benefits may not exceed costs, impacts are known to occur, control measures are available and some data exists.	**2**

Appendix C Risk adjustment for net benefit calculation of Plant Pests

Table 50: Assumptions for risk adjustment of net benefit for Nodding thistle and Ragwort pests

	Matrix of risk	Outcomes actually achieved			
		Do Nothing	Sustained Control	Progressive containment	Eradication
Plan undertaken	**Do nothing**	80%	20%	0%	0%
	Sustained Control	80%	20%	0%	0%
	Progressive containment	80%	20%	0%	0%
	Eradication	80%	20%	0%	0%

Table 51: Assumptions for risk adjustment of net benefit for Gorse and Broom

	Matrix of risk	Outcomes actually achieved			
		Do Nothing	Sustained Control	Progressive containment	Eradication
Plan undertaken	**Do nothing**	80%	20%	0%	0%
	Sustained Control	75%	25%	0%	0%
	Progressive containment	75%	25%	0%	0%
	Eradication	75%	25%	0%	0%

Table 52: Assumptions for risk adjustment of net benefit for Wilding Conifers

	Matrix of risk	Outcomes actually achieved			
		Do Nothing	Sustained Control	Progressive containment	Eradication
Plan undertaken	**Do nothing**	80%	20%	0%	0%
	Sustained Control	50%	45%	5%	0%
	Progressive containment	10%	50%	35%	5%

	Eradication	5%	60%	30%	5%

Appendix D GNR result tables

Note: green = ratio source/additional receptor costs <1.2, orange = 1.2 – 1.5, red = >1.5 or No costs incurred by receptor landholder.

Table 53: Good Neighbour Rule Model outcomes for Feral Rabbits

Feral rabbits NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder

Land use for the Source of infestation	Land holder who receives the infestation			
	Low	Moderate	High	Extreme
Low	No costs	0.29	0.13	0.11
Moderate	No costs	2.33	1.06	0.91
High	No costs	4.40	2.00	1.72
Extreme	No costs	7.68	3.49	3.00

Table 54: Good Neighbour Rule Model outcomes for Possums

Possums NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder

Land use for the Source of infestation	Land holder who receives the infestation			
	Low	Moderate	High	Extreme
Low	1.52	No effect[11]	No effect	No effect
Moderate	4.12	No effect	No effect	No effect
High	4.12	No effect	No effect	No effect
Extreme	4.12	No effect	No effect	No effect

[11] No effect means the boundary control has no effect on the costs of the receptor landholder, and therefore it is not a reasonable requirement.

Table 55:Good Neighbour Rule Model outcomes for Gorse: Dense infestation on Source property

Gorse NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is scattered plants

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Arable	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Horticulture	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Hill country	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
High country	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Conservation	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Forestry	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs
Non Productive	No costs	No costs	No costs	No costs	1.00	1.00	No costs	1.00	No costs

Table 56:Good Neighbour Rule Model outcomes for Gorse: Dense infestation on Source property

Gorse NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is dense

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Arable	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Horticulture	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Hill country	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
High country	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Conservation	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Forestry	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs
Non Productive	No costs	No costs	No costs	No costs	1.54	1.54	No costs	1.54	No costs

Table 57:Good Neighbour Rule Model outcomes for Broom: Scattered infestation on Source property

Broom NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is scattered plants

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Arable	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Horticulture	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Hill country	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
High country	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Conservation	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Forestry	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs
Non Productive	No costs	No costs	No costs	No costs	1.00	1.00	1.00	1.00	No costs

Table 58:Good Neighbour Rule Model outcomes for Broom: Dense infestation on Source property

Broom NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is dense

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Arable	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Horticulture	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Hill country	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
High country	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Conservation	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Forestry	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs
Non Productive	No costs	No costs	No costs	No costs	1.54	1.54	1.54	1.54	No costs

Table 59:Good Neighbour Rule Model outcomes for Nodding thistle tussock: scattered infestation on Source property

Nodding thistle NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is scattered plants

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Arable	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Horticulture	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Hill country	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
High country	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Conservation	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Forestry	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs
Non Productive	No costs	No costs	No costs	No costs	1.00	1.00	No costs	No costs	No costs

Table 60:Good Neighbour Rule Model outcomes for Ragwort: Scattered infestation on Source property

Ragwort NPD Section 8(e)(ii) - Ratio of costs for Source land holder to the costs for the Receiving land holder - Source infestation is scattered plants

Receptor land use

Source land use	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Sheep and beef Intensive	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Arable	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Horticulture	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Hill country	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
High country	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Conservation	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Forestry	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs
Non Productive	1.00	No costs	No costs	No costs	No costs	No costs	No costs	No costs	No costs

Table 61:Good Neighbour Rule Model outcomes for Wilding pines (various species): Scattered infestation on Source property

Lodgepole or contorta pine NPD Section 8(e)(ii) - Ratio of costs for Source Landholder to the costs for the Receiving landholder - Source infestation is scattered plants

Receptor Landuse

Source Landuse	Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Arable	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Horticulture	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Hill country	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
High country	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Conservation	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Forestry	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs
Non Productive	No costs	No costs	No costs	No costs	1.00	1.00	1.00	No costs	No costs

Table 62:Good Neighbour Rule Model outcomes for Wilding pines (various species): Dense infestation on Source property

Lodgepole or contorta pine NPD Section 8(e)(ii) - Ratio of costs for Source Landholder to the costs for the Receiving landholder - Source infestation is dense

Source Landuse	Receptor Landuse: Dairy	Sheep and beef Intensive	Arable	Horticulture	Hill country	High country	Conservation	Forestry	Non Productive
Dairy	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Sheep and beef Intensive	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Arable	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Horticulture	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Hill country	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
High country	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Conservation	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Forestry	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs
Non Productive	No costs	No costs	No costs	No costs	8.89	8.89	8.89	No costs	No costs