

Waitakere City Parks



Weed Management Strategy



Waitakere City Council
Te Tatao o Waitakere

Waitakere Weed Management Strategy

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Prepared for:
Waitakere City Council

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Adapted from:
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Executive Summary

The goal of the Waitakere Weed Management Strategy is:

"Protection of the quality, resilience, biodiversity and ecological integrity of Waitakere's natural habitat from the impacts of environmental weeds".

The goal of ecological restoration is to restore an ecosystem to a state where it is self-sustainable, biodiversity is maintained or improved and ecosystem services are retained. One key component of such ecological restoration is the control of environmental weeds. Environmental weeds permanently alter the structure, successional and ecological processes, and organisms present in ecological communities. Failure to effectively manage key weed threats, particularly at ecologically valuable sites, will lead to a loss of biodiversity, the progressive degradation of native ecological communities, and the loss of self-sustaining native bush in the city.

Weed management must consider the broader landscape context (i.e. why weeds are present, and what actions exacerbate their spread). This can be achieved through a holistic approach to the control of weeds throughout Waitakere considering all natural areas regardless of ownership. Connecting all areas and educating the public on weed issues can help achieve the City's Green Network vision.

It is essential to ensure the methodologies used to manage invasive weeds are the most efficient and effective use of resources possible, and are the most successful and environmentally sensitive methodologies available. Recognising that weed management undergoes continual improvement, including advancements in technology and methodologies, Waitakere City Council contracted Te Ngahere to review the current Weed Management Strategy for Waitakere, compiled in 2000. The principle aim of the review is to update the Strategy to ensure any new scientific or operational developments in weed control are incorporated into the Weed Management Strategy.

The revised Weed Management Strategy fits within Waitakere City Council's strategic framework as a mechanism to support the objectives of the Green Network Strategic Platform, as outlined in Waitakere City Council's Annual Plan and Long Term Council Community Plan 2006-2016.

This strategy guides weed management in Waitakere, primarily on Council owned land, but also guides the approach to advice and assistance given to private land owners by Waitakere City Council. The Auckland Regional Council has statutory powers on private land under the Biosecurity Act (1993) as outlined in the Regional Pest Management Strategy (2002-2007).

The following objectives define the Strategy's approach to achieving this goal. A series of targets are specified for each objective:

Objective 1: Protect priority (high value) areas from the impacts of weeds.

Targets:

- Identify a list of priority sites for site-led weed control programmes, including current areas of low to zero weed density and review every five years.
- Prepare Weed Management Plans with a practical/operational focus for priority sites.

- Monitor and audit the progress and success of plan implementation and produce an annual report describing the control results achieved for each site-led weed programme. Reports should include details of sites controlled, mapped distributions of current weed control targets, frequency of control visits, methodologies used and the results of monitoring.
- Assess whether weed control at each site is successfully achieving ecological restoration every 2 years and include within the annual report.
- Reassess and review Management Plans every five years to ensure progress along the restoration phase timeline.

Objective 2: Minimise future costs via adoption of Best Practice Guidelines and surveillance at priority sites.

Targets:

- Set up a system for recording new weed sightings made by the public or by Waitakere City Council staff and contractors, and reporting these to the Auckland Regional Council.
- Develop a database of weed distributions, and allocate responsibility for keeping it up to date.
- Facilitate regular weed mapping by contractors to monitor new weed infestations and their spread. This will identify areas that require weed control in the short term, which will minimise future costs.
- Ensure all contractors and staff involved in weed management are familiar with and abide by Best Practice Guidelines, including the most appropriate and efficient methodologies for each species and how to maintain areas at low to zero weed densities.
- Ensure the Weed Management Strategy objectives and targets and the Best Practice Guidelines are contained within all weed control contracts. Following the Best Practice Guidelines will maximise the effectiveness of weed control; therefore over time costs should reduce in some areas, allowing additional work to be completed in new priority parks and roadsides.

Objective 3: Support and facilitate community understanding and involvement in the management of weed impacts.

Targets:

- Develop and maintain supportive partnerships with stakeholders. Supportive partnerships are a key aspect of weed management in Waitakere, as most significant natural areas are owned or managed by agencies other than Waitakere City Council. For ecological restoration of the entire city, all restoration efforts need to be coordinated towards one vision (e.g. to restore the Green Network).
- Maintain community incentive, participation and education project funding.
- Develop relationships whereby community groups and their projects are aligned with suitably qualified staff and/or contractors to assist in the control of weeds (i.e. when infestations become too big a task for volunteers contractors can assist e.g. Green Network – community planting in parks).
- Encourage community groups where restoration has already begun, and management is ongoing to facilitate the success of volunteers.
- Support and facilitate partnerships with tangata whenua in restoration projects.
- Explore the actions and attitudes of the general public that facilitate the spread of environmental weeds.

- Encourage the development of neighbourhoods with low to zero weed density zones.
- Provide educational material to the wider community, including nurseries and landscapers and advocate for participation in the restoration of local neighbourhoods.

Objective 4: Eradicate or contain specific weed species wherever they occur, where this is practical and affordable.

Targets:

- Make submissions on all new potential weed-led programmes proposed for inclusion in Auckland Regional Council's Regional Pest Management Strategy (RPMS). Submissions will take into account the principles of feasibility and practicality of undertaking the proposed programme, and suggest a site-led approach if appropriate.
- Containment programmes should follow the RPMS guidelines and a proven successful process of weed management adequate to allow for a gradual reduction of infestations over time for containment species. This may require the preparation of plans covering species-specific methodologies.
- Ensure all sightings of total control pest plants are reported to Auckland Regional Council for their records.
- Quantitatively map the distribution of any weed species chosen for a weed-led programme over the long term. Mapping will be used for communicating the distribution of weeds, self-auditing and measuring progress and success.

Objective 5: Address legal responsibilities under the Regional Pest Management Strategy (RPMS) (2002-2007).

Targets:

- Report annually to Council and Auckland Regional Council the amount of work undertaken to meet RPMS obligations.
- Obtain an official understanding with Auckland Regional Council that clarifies roles and responsibilities and helps co-ordinate ecological restoration programmes. This will also ensure the policies and recommendations of the Auckland Regional Council are both feasible and upheld.
- Maintain funding to meet Waitakere City Council's obligations under the RPMS and the Biosecurity Act to the highest standard possible.

Roadside Objectives

Along with the relevant, overriding goal and objectives of this Weed Management Strategy, roadside weed management has three specific objectives, all of which strive towards the Green Network vision of restoring native ecosystems by reducing the incidence of invasive weeds, and decreasing weed habitat:

Objective 6: Enhance native roadside habitat to create a significant buffer to adjacent sites, protect threatened species and improve the water quality of local streams.

Targets:

- Control all environmental weeds as specified within the 5-year roadside work programme.

- Ensure all contractors are aware of, and can identify threatened plants located along roadsides and are aware of any known locations of threatened plant species.
- Compile guidelines that dictate when it is appropriate to revegetate roadsides.
- Avoid unnecessary clearance of vegetation along waterways.

Objective 7: Ensure optimum health and safety along roadsides by managing vegetation in a way that will reduce the fire risk and maintain site lines.

Targets:

- Cut or graze long dry grass along roadsides to reduce the fire risk.
- Continue maintaining sightlines for all road users along roadsides.
- Prioritise environmental weeds and other exotic species when removing vegetation for health and safety reasons.
- Control gorse when it is the dominant vegetation cover (i.e. in areas where it becomes greater than 80% of the vegetation cover along the roadside).
- Control pampas when it is greater than 80% of the vegetation cover (i.e. greater than 80% of the vegetation cover along the roadside).
- Control pampas along total control roads (as per the 5-year roadside work programme).

Objective 8: Manage roadside vegetation to facilitate the protection of roadside assets, flood mitigation and stability enhancement.

Targets:

- Prioritise environmental weeds and exotic species when clearing vegetation to protect the roadside asset.
- Prioritise environmental weeds and exotic species when clearing channels that carry storm water.
- Plant native species in areas that have been cleared of vegetation to prevent erosion and slips.
- Manage vegetation along drainage systems to allow for the unimpeded movement of water.
- Comply with resource consent requirements when pruning or removing any vegetation.

In addition to the above objectives, actions and targets, Best Practice Guidelines are outlined. It is extremely important for these guidelines to be followed to ensure effective weed control and the minimisation of future problems.

A new process is recommended for effective weed control including a sequence of restoration phases based on years of weed control experience and the characteristics of environmental weed infestations. The phases are: Initial control; Long term initial control, Follow-up control, Low density follow-up control and Forest protection. The restoration phases follow optimal timing, frequency of control and control methodologies for the various stages of weed control operations.

Utilising the Best Practice Guidelines and the restoration phases recommended in the Weed Management Strategy should achieve the Green Network vision through more effective and efficient weed control operations. Working with the community to stop the spread of weeds along with improved weed control techniques should help neighbourhoods, the Council and other stakeholders achieve the ecological restoration goals of this Strategy.

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1. Introduction

Waitakere City Council's Green Network vision for 2020 is as follows: "The Waitakere Ranges will be permanently protected. There will be a network of bush and trees, (the Green Network) from the Ranges, through town centres and suburbs, to the coasts, bringing the natural world into people's everyday lives and filling the streams and forests with life" To achieve this vision the land needs to be managed in a way that encompasses all issues affecting the ecosystem services the natural environment provides. A requirement of ecological restoration is realising that everything within the City is connected. Managing the environmental weed infestations throughout Waitakere requires a holistic approach.

Waitakere City Council contracted Te Ngahere to write a Weed Management Strategy for Waitakere to ensure a coordinated, strategic approach to weed control that utilises the best methodologies and technology available.

This Weed Management Strategy will be in line with Waitakere City Council's strategic framework as a mechanism to support the objectives of the Green Network Strategic Platform, as outlined in Waitakere City Council's Annual Plan and Long Term Council Community Plan 2006-2016. This Strategy recognises the importance of putting theory into practice through a layered approach. Philosophies and values have been incorporated into the long-term vision and concepts of the Green Network. Principles and objectives found within the Weed Management Strategy are derived from the Green Network vision. For objectives to be achieved, sound theory must be followed. This includes ensuring Best Practice Guidelines are utilised during all weed control operations.

During this process, feedback loops must be in place to ensure actions (i.e. the implementation of weed control) use the most up-to-date technology and latest theories, so that in turn the principle objectives are achieved. In a similar manner, all actions need to relate as a whole back to the overall strategic vision and objectives. This should provide a holistic approach to the restoration of the environment and a return of ecosystem services. This is particularly important when components of weed control are separated between different Council staff (e.g. Parks Assets, Transport Assets and Special Projects). Bringing it back to the strategic principles and vision of Council, the Green Network and this Weed Management Strategy should help co-ordinate the different actions of all people involved in weed management in Waitakere. See Figure 1.1 for a diagrammatic representation of this Strategic Model.

Waitakere City Council recognises the importance of putting theory into practice. The focus of this Strategy is to retain a practical focus, so that objectives can easily be incorporated into actions in the field. A number of the objectives within this Strategy cannot be achieved without following Best Practice Guidelines (see Section 9.0). The guidelines have been revised to include innovative techniques of weed control that if followed will help increase the efficiency of control and over time will allow for the area controlled for environmental weeds to increase. For weed management in Waitakere to reach optimal success, it is important that the Weed Management Strategy recommendations are upheld.

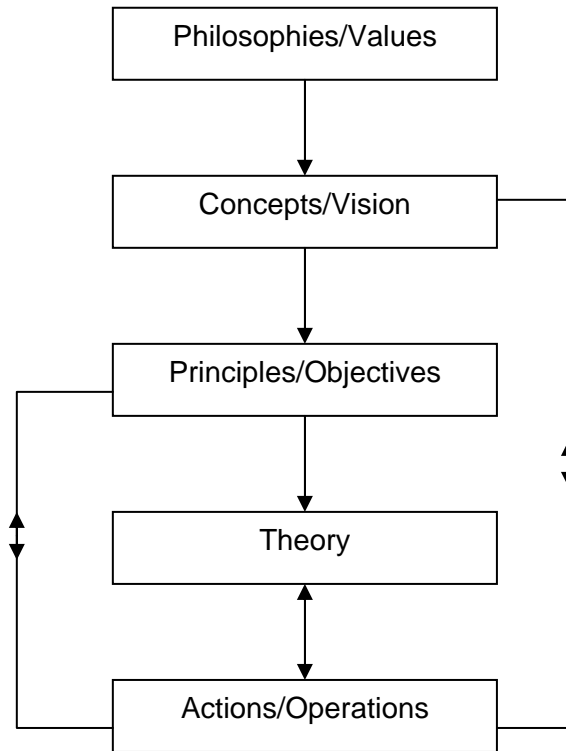


Figure 1.1: Strategic Model showing how theory is incorporated into actions, while staying focused on overriding principles and goals.

1.1 Overview of Weed Issues in Waitakere

Environmental weeds are plants that can significantly and adversely affect the health of native plant and animal communities and the long-term survival of many native species. Weeds permanently alter the structure, successional and ecological processes (e.g. native plant regeneration), and organisms present in ecological communities. Approximately half of all plant species (c. 2200 species) growing wild in New Zealand are introduced. Nationally more than 240 of these species are recognised as invasive weeds (Owen 1998), with the current total number likely to be closer to 300 species. Failure to manage key weed threats in Waitakere will inevitably lead to local extinction of plant and animal species and the progressive degradation of native communities.

The Waitakere Ranges, in the western part of the city, are largely covered in native vegetation. Some is virgin bush, but most is in various stages of regeneration after substantial clearance pre-1900. Nevertheless, the Ranges are botanically rich, containing more than a quarter of New Zealand's flowering plant species and two thirds of all native fern species. Forty-three regionally threatened native plants are found in the Waitakere Ranges (Waitakere City Council, 2004).

In 2003 the Council initiated the Waitakere Ranges and Foothills Protection Project in response to concerns expressed that this area continues to be under pressure and further action is needed to secure more protection for future generations. Through the extensive community consultation process pests and weeds were clearly identified as one of the key threats to the area. The development of a pest management strategy helps contribute to the management of this issue.

The amenity and scenic values of the Waitakere Ranges and those of the Waitakere Regional Park are of particular value to Waitakere and to the Region as a whole. The size and relatively pristine condition of the Regional Park and the number of visitors to the park each year make this environment such an important asset to the City. These values are under threat from pest plants invasions and need to be constantly addressed.

The foothills of the Ranges and the northern part of the city is mainly rural, comprising orchards, vineyards, horticulture and lifestyle blocks, while the urban area is located to the east, alongside the Waitemata Harbour. Remnants of native vegetation within the eastern area of the city, mainly on reserve and esplanade land, are valuable for their rarity within the largely urbanised Tamaki Ecological District.

Waitakere's history of successive modification and clearance associated with timber harvesting, agriculture and horticulture, and more recently, urban expansion, has rendered many of its natural areas vulnerable to weed invasion. In more developed areas, remnants have become fragmented and surrounded by development, or interspersed with residential properties. Streams, train lines and roads connect urban areas with more remote tracts of undeveloped land in the Ranges and foothills, and tend to act as corridors for the spread of weeds occurring further up in the catchment. Waitakere City Council's policy to encourage fencing and regeneration of riparian margins will enhance instream habitat and water quality, but may exacerbate the weed problem if active control and restoration do not accompany this initiative.

Waitakere contains many kilometres of coastline, ranging from sheltered harbours and estuaries to the exposed west coast wilderness areas. Coastal habitats are particularly susceptible to weed invasion as they often contain open, low stature vegetation communities, and are also valued sites for recreation and residential development.

The combination of modified, fragmented natural areas in close proximity to residential areas is a recipe for weed invasion. New Zealanders are keen gardeners, and the climate of Waitakere means that a wide range of plants are able to grow here. Ornamental plants are often chosen because they are easy to cultivate, however these same characteristics can make them successful invaders. Only a small proportion of plants now regarded as weeds were accidentally introduced (Sullivan *et al.* 2005; Esler 1987). Ninety percent of terrestrial invasive weeds were deliberately introduced into New Zealand, and of these, 75% were ornamental plants (Buddenhagen *et al.* 1998). Waitakere City Council's Invasive or Environmental Weeds List notes that 275 plants have been identified as actual or potential threats to Waitakere's native vegetation (25 of these are new additions as of May 2006). This figure is likely to increase as other species invade from surrounding areas, or additional exotic plant species naturalise and form self-sustaining wild populations through vectors such as dumped household vegetation.

1.1.1 Environmental weed definition

It is important to note that this Strategy considers environmental weeds only. Environmental weeds are exotic plants that can potentially disrupt, damage, alter, inhibit, destroy or otherwise negatively impact on a native ecosystem and the services that ecosystem provides to the natural environment. It does not consider horticultural or agricultural weeds. Environmental weeds are also commonly known as invasive weeds or pest plants.

1.2 Roles and Responsibilities

Waitakere City Council has a number of roles in relation to weed management. These include:

- Responsibilities as a landowner, including legal obligations under the Regional Pest Management Strategy (RPMS) and Biosecurity Act.
- Commitment to progress a sustainable eco-city under the City's Long Term Council Community Plan.
- Obligations for sustainable management under the Resource Management Act.
- Commitment to protecting the City's native vegetation and fauna habitat under the District Plan, the Wildlife Act and the goals of the New Zealand Biodiversity Strategy.
- A role in advocating and educating the public and community groups regarding weed management and the threat of invasive weeds to the environment.

1.3 Waitakere City Council's Strategic Framework

Waitakere City Council's Annual Plan and Long Term Council Community Plan 2006-2016 both contain a vision for integrating the Council's social, economic and environmental goals. Of particular relevance to the Weed Management Strategy is recognition of the need to protect and restore the health of the natural and physical environment. Weed management is a key component of this policy, as weeds pose one of the greatest threats to the integrity of the City's native ecosystems.

The aims of both the Annual Plan and Long Term Council Community Plan 2006-2016 have been translated into specific, short to medium term outcomes (termed "Strategic Platforms"), with objectives and targets that determine the Council's implementation programmes. The Annual Plan and Long Term Council Community Plan 2006-2016 also set out the level of service Waitakere City Council will provide to meet the objectives and how this will be funded within the next 10 years. These programmes are tested and adjusted on a yearly basis through the Annual Plan process.

This Weed Management Strategy fits within Waitakere City Council's strategic framework as a mechanism to support the goals and 2020 vision of the Green Network Strategic Platform, which states:

"The Waitakere Ranges will be permanently protected. There will be a network of bush and trees, (the Green Network) from the Ranges, through town centres and suburbs, to the coasts, bringing the natural world into people's everyday lives and filling the streams and forests with life."

The following Green Network ten year goals identify actions and allocate resources for environmental weed management including:

- Ensuring the Ranges and West Coast are permanently protected and maintained. This includes the study and implementation programme for the protection of the Waitakere Ranges with consultation and raising landowners' awareness about Ranges issues.
- Work to create "mainland islands" where pests are eradicated and threatened species are re-introduced.
- Restoring key Green Network corridors from the Ranges to and along the coast. This includes continuation of Project Twin Streams, and providing public access along the coast.
- Work with tangata whenua to find ways to assist them in their kaitiaki or guardianship role.
- Continue to advise, support and work with individuals and groups working to protect and restore the Green Network.
- Protecting and enhancing important landforms, landscapes, range of habitats, plants, wildlife and ecosystems in Waitakere and adjoining harbours and oceans.
- Continue to provide education programmes, cleaner production programmes, public information and events. This includes extending community understanding of and support for environmental protection and inspiring and supporting community involvement in Green Network protection and restoration.
- Amend and update the Council's Regulations and Code of Practice to encourage sustainable management solutions.

1.4 Purpose of the Weed Management Strategy

This Strategy directs Waitakere City Council's approach to the management of environmental weeds and achievement of the Green Network vision. It describes the Council's long-term goal and objectives, and provides a practical framework to guide the Council in carrying out its roles and responsibilities with regard to weed management. These responsibilities include identifying, prioritising and managing land to prevent the spread and limit the distribution of environmental weeds and their potential to impact biodiversity and ecosystem services within the City.

1.5 Using the Weed Management Strategy

This Strategy identifies eight objectives that contribute to the overarching goal of protection of the quality, resilience, biodiversity and ecological integrity of Waitakere's natural habitat from the impacts of environmental weeds. A rationale is given for each objective. Actions that provide the means of achieving the objective are described. Targets are expressed in a measurable form and should be achieved in the specified time period.

2. Goal and Objectives

2.1 Goal

The goal of this Strategy is derived from the objectives of Waitakere City Council's Long Term Council Community Plan 2006-2016:

"Protection of the quality, resilience, biodiversity and ecological integrity of Waitakere City's natural habitat from the impacts of environmental weeds".

2.2 Objectives

The following objectives define the Weed Management Strategy's approach to achieving this goal:

1. Protect priority (high value) areas from the impacts of weeds.
2. Minimise future costs by adopting Best Practice Guidelines (Section 9.0) and undertaking surveillance to detect new weed problems at valuable sites before they become unmanageable and expensive.
3. Support and facilitate community understanding and involvement in the management of weed impacts.
4. Eradicate or contain specific weed species wherever they occur, where this is practical and affordable.
5. Address legal responsibilities under the Regional Pest Management Strategy (RPMS).

2.2.1 Roadside Objectives

Along with the overriding goal and objectives of this Weed Management Strategy, roadside weed management has three specific objectives, all of which strive towards the Green Network vision of restoring native ecosystems by reducing the incidence of invasive weeds, and decreasing weed habitat:

6. Enhance native roadside habitat to create a significant buffer to adjacent sites, protect threatened species and improve water quality of local streams.
7. Ensure optimum health and safety along roadsides by managing vegetation in a way that will reduce the fire risk and maintain site lines.
8. Manage roadside vegetation to facilitate the protection of roadside assets, flood mitigation and stability enhancement.

3. Objective 1: Protect Priority Areas

3.1 Site-Led Programmes

Site-led control of environmental weeds is undertaken for the specific purpose of protecting Waitakere's significant native vegetation and fauna habitat from weed impacts. Sites with the highest ecological values will be the highest priority for weed control. This is in line with the draft Parks and Open Space Strategy 2006. Protection and restoration of significant, representative natural habitats and ecosystems is a focus of the draft Parks Strategy. Protected Natural Areas surveys undertaken for the Waitakere Ranges (Denyer *et al.* 1993) and the Lowlands (Julian *et al.* 1998) provide an inventory of ecologically significant sites in Waitakere.

Most of the environmental weed species that are of concern in Waitakere are widespread throughout both the City and the wider Auckland Region. Eradication is no longer feasible for these weeds; however undertaking weed control in sites with high ecological values can protect these values from weed impacts. This type of weed control has been termed "site-led". Site-led control is an ongoing activity requiring a long-term commitment of management effort and resources. Site-led programmes generally involve an initial period of intensive control (e.g., three years) in the site and associated buffer areas (Section 9.6), followed by a lower level of ongoing control and monitoring for maintenance purposes.

Site-led weed control programmes are undertaken to produce a desired outcome that needs to be easily monitored, such as:

- Increase native seedling regeneration.
- Protect and improve vegetation health by preventing weed species from smothering native vegetation.
- Protect and improve species and habitat diversity at the site by removing dense, mono-specific swards of weeds.

Killing a proportion or quantity of weeds is only the first stage of restoration. It can be considered as an objective; however it is not the overall aim of site-led weed control. Where control targets (such as achieving a zero density weed population at a site) are used as performance indicators, they must only be regarded as *de facto* measures of success. The true outcomes desired revolve around the restoration of the ecosystem.

3.1.1 Summary of Site-led Approach

IDENTIFY PRIORITY SITES

1. Identify sites in order of ecological significance and the Green Network system.
 2. Identify the weeds that threaten each site.
 - Compile an inventory of the weeds present at priority sites.
 - Evaluate the threat that weeds pose to each site's natural values.
 3. Assess the urgency of control.
 - Judge the immediacy of the threat weeds pose to ecological values at each site.
 4. Assess practicality of control.
 - All else being equal, give preference to sites containing small infestations.
 5. Consider the social and cultural importance of sites.
 - Rank sites according to their importance to iwi and other community groups.
6. Rank sites using a combination of ecological and community values and practicalities of weed

control operations.

Rank sites according to relative priority for weed control by considering ecological value, the urgency of control required, the practicalities and/or cost of weed control and the importance given to the area by iwi and the general public when possible.

PLAN WEED CONTROL WITHIN A SITE

1. Determine priority weed infestations for control within the site.
Consider which weeds are priorities for control work at each site.
2. Delineate boundaries of the control area.
Identify buffer areas that should be incorporated into the site's weed control programme.
3. Outline objectives for each site.
Choose and record control objectives (what, where, when and why), including measurable targets.
4. Plan implementation.
Choose an appropriate methodology for the effective and efficient control of weed targets.
5. Plan a monitoring programme.
Choose appropriate monitoring methods and approach to assess whether control objectives are being met.
6. Estimate costs and allocate funds.
Consider the costs and benefits of all potential site-led programmes prior to allocating funding to each.

IMPLEMENT WEED CONTROL

1. Commence monitoring.
Monitor before and after control.
2. Undertake control.
Control work should be done using the standard methods of control and taking into account Best Practice guidelines (Section 9.0).
3. Report on effectiveness.
Monitor and compare with pre-control data to assess programme effectiveness.

3.2 Actions

The following section outlines the approach to choosing, planning, allocating resources and implementing weed control projects. For each site-led weed control programme a Weed Management Plan should form the basis of the planning, implementation and reporting phases of the programme (as specified in Section 3.2.2).

3.2.1 Identifying Priority Sites

1. Identify sites with significant native vegetation and fauna habitat.

Sites with the highest ecological values should be given priority for weed control. Protected Natural Areas surveys for the Waitakere Ranges and Lowlands (Denyer *et al.* 1993; Julian *et al.* 1998, respectively) identify Recommended Areas for Protection (RAPs) and Priority Vegetation Sites (PVS). This information has been incorporated into Waitakere City Council's District Plan, which identifies areas of significant vegetation and fauna habitat within the city. In addition, the District Plan identifies areas that are not regarded as significant at present, but which have potential for restoration or provide an ecological linkage between high value sites. Waitakere City Council administers relatively few reserves that comprise significant natural areas

themselves, but many have potential for restoration or provide an ecological linkage between high value sites.

The following criteria are adapted from the District Plan methodology for assessing significance to enable sites to be ranked in order of ecological value for the purposes of setting priorities for weed control.

Ecological value criteria	
3 (High)	<p>Identified as an area of <i>Outstanding Vegetation/Outstanding Native Fauna Habitat</i> in the District Plan; OR Identified as a <i>Protected Natural Area</i> in the District Plan; OR Contains a significant Green Network component or linkage Contains a threatened vegetation community or population; OR Contains a native vegetation community type that is poorly represented in the City's reserve network; OR Contains a largely unmodified native vegetation community; OR Meets <i>all four</i> of the following criteria for medium ranked sites.</p>
2 (Med)	<p>Contains high biodiversity for its vegetation community type, AND Shows significant change in community composition along an environmental gradient; OR Will maintain or has the potential to maintain its ecological viability through its size, shape, health or restoration; OR Is linked or can be linked to Protected Natural Area sites.</p>
1 (Low)	<p>Has potential but only through restoration; OR Meets only one of the above criteria for medium ranked sites.</p>

2. Identify the weeds that threaten each site.

- Record weeds that are present at priority sites, in surrounding buffers, and seed sources that are nearby, uphill, upwind or upstream. This involves site visits and compilation of a formal inventory of the weeds present. A species list is useful when ascertaining what will be required within each reserve. Contractors can compile a more comprehensive map of weed distributions during weed control operations.
- For each site, evaluate the threat that weeds present pose in terms of 'weediness' i.e., specific characters that contribute to a plant's invasive potential (refer Appendix 1), or in terms of the seriousness of the threat as assessed in the field.
- Consider whether or not the weeds present at a site threaten the particular ecological values of the site.
- In terms of ongoing management of the weed problem, surveillance of valuable or vulnerable sites will be helpful in order to detect new weed problems at sites (refer Objective 2).

3. Assess the urgency of control.

The following criteria will assist in judging the immediacy of the threat the weeds pose to ecological values at a particular site (adapted from Shaw 1994).

Urgency of control criteria

- | | |
|-----------------|--|
| 4 (High) | A vegetation community, or plant or animal population is known, or is very likely to be, threatened with degradation or local or national extinction because of the impacts of weeds. |
| 3 | Weeds pose a major threat to the site's vegetation or habitat values in the near future, but so far have caused little or no impact. |
| 2 | Weeds are known or are very likely to have already caused substantial degradation to the site's vegetation or habitat values, with further damage to these values expected; OR Weeds pose a medium threat level to the sites vegetation or habitat values in the near future, but so far have caused little or no impact. |
| 1 (Low) | The current suite of environmental weed species at the site is unlikely to affect its vegetation or habitat values. |

4. Assess the practicality of control.

Assessing the practicality of control recognises the benefits of taking action before an infestation becomes a serious problem by allowing preference to be given to sites containing small infestations of weeds.

The following criteria provide a guide to evaluating the practicality of control. Cost needs to be considered relative to the scale of the operation, i.e., a large site will naturally have a higher cost associated with weed control. Costs can also indicate ease of access and conditions on site, which will in turn influence the practicality of control.

Practicality of control criteria

- | | |
|-----------------|---|
| 3 (High) | Control can be achieved at low initial and ongoing annual cost, with work in the first year reducing the infestation to zero density/low impact. |
| 2 (Med) | Control to reduce the infestation to zero density/low impact requires a large initial investment or medium investment over 2-3 years, and subsequent maintenance can be achieved at low annual cost; OR
Control to reduce the infestation to zero density/low impact requires a low initial investment, and subsequent maintenance can be achieved at a moderate annual cost. |
| 1 (Low) | Control to reduce the infestation to zero density/low impact requires a high initial investment, and a high ongoing cost. |

Advantages to this approach include:

- Maintaining areas as relatively weed free.
- Minimising the requirement for future control work, therefore reducing the disturbance created by weed control and its relevant consequences (e.g. soil disturbance, increase in seed bank germination etc.).
- Minimisation of future costs.

In some cases, there is likely to be an argument for targeting control of one or a few weeds that are present in small populations within a site (rather than all species present), in order to minimise future costs. Judicious choice of particular weed species to target is quite valid, provided that such decisions follow the general principle of prioritising sites where ecological values are most imminently threatened. For example specialised techniques may be required for infestations of some species along the roadside (e.g. *Arundo donax* would be targeted separately using a different method than the standard roadside control practice.)

5. Assess the importance of a site from the local communities' perspective.

Public interest in an area is often hard to quantify therefore can often be overlooked. If it is possible to ascertain scores for all areas requiring prioritisation, public and cultural interests should be included in the ultimate score used to prioritise weed control.

Cultural importance can be assessed by determining the location of the area in relation to heritage areas of local iwi. A score may also be given if there is an active community/volunteer group associated with the area. In this way if the area is considered significant to either iwi OR the general public the area can be given a score of one. If these values are absent the score will remain at 0. Further options are detailed below:

Assessing the importance of the site to the local community

- | | |
|------------------|---|
| <p>1.</p> | <p>Is a heritage area of local iwi OR
 Is maintained by an active community/volunteer group OR
 Is easily accessed/clearly visible to the general public OR
 Is deemed an archaeologically significant area.</p> |
| <p>0.</p> | <p>Does not possess any of these qualities.</p> |

By including a social and cultural aspect to these weed control assessments, it creates a more holistic approach to prioritisation and helps differentiate areas, when all other ecological aspects are similar.

6. Rank sites using a combination of ecological and community values and practicalities of weed control operations.

Rank sites according to relative priority for weed control by considering ecological value, the urgency of control required, the practicalities and/or cost of weed control and the importance given to the area by iwi and the general public when possible. This can be done by adding all the relevant scores together to produce a range of values, the site with the highest value becoming the highest priority for weed control.

7. Other considerations.

- Make sure that existing high priority weed control programmes are adequately funded and well planned and managed (including long-term, annual maintenance and monitoring) before funding new programmes.

- Ensure adequate monitoring is in place so that the Council is aware when funding will allow for further areas to be controlled (e.g. reduce weeds to the Forest Restoration Phase (see Section 9.0) in one park, therefore Initial Control can commence in another.)
- Ensure that programmes are complementary, i.e. they all move towards the overarching Green Network vision for ecological restoration.
- Integrate weed control with the management of other threats, such as possum, rat and mustelid control.

3.2.2 Planning Weed Control within a Site

1. Record all relevant information in a Weed Management Plan.

Weed Management Plans should include the following components and follow the processes for planning, implementing and monitoring weed control at a particular site described in this section.

Weed Management Plan Components

1. The overall aim and objectives of any proposed weed control.
2. The weeds present at the site.
3. The priority weeds for control and the ecological, social and cultural values threatened by them.
4. Results and outcome targets.
5. The urgency of control with a proposed timeline.
6. Any possible impact of the weed control and possible mitigation solutions.
7. The cost of controlling the priority weeds.
8. Follow-up weed control and maintenance requirements.
9. Monitoring methods.

2. Determine priority weed infestations for control within the site.

All exotic species on Waitakere City Councils Environmental Weed species list should be priorities for control.

3. Delineate control boundaries.

Control should not necessarily be restricted to the core site that was ranked. Where appropriate, extend objectives to include buffer areas and other areas that might contain propagule sources (see Best Practice Guidelines in Section 9.0). Figure 3.2 outlines the process for identifying areas that should be included and managed as buffers within a weed control programme.

For example, control of environmental weeds along roadsides and railway lines should generally be seen as a priority where control of the weeds provides a buffer for a site-led programme. Other reasons for control of weeds in these areas might be to meet RPMS obligations, to ensure safety and visibility or to protect physical structures.

Note that buffers are not necessarily physically connected to the high value sites they protect; for example, weed control on coastal cliffs can provide a buffer to offshore islands.

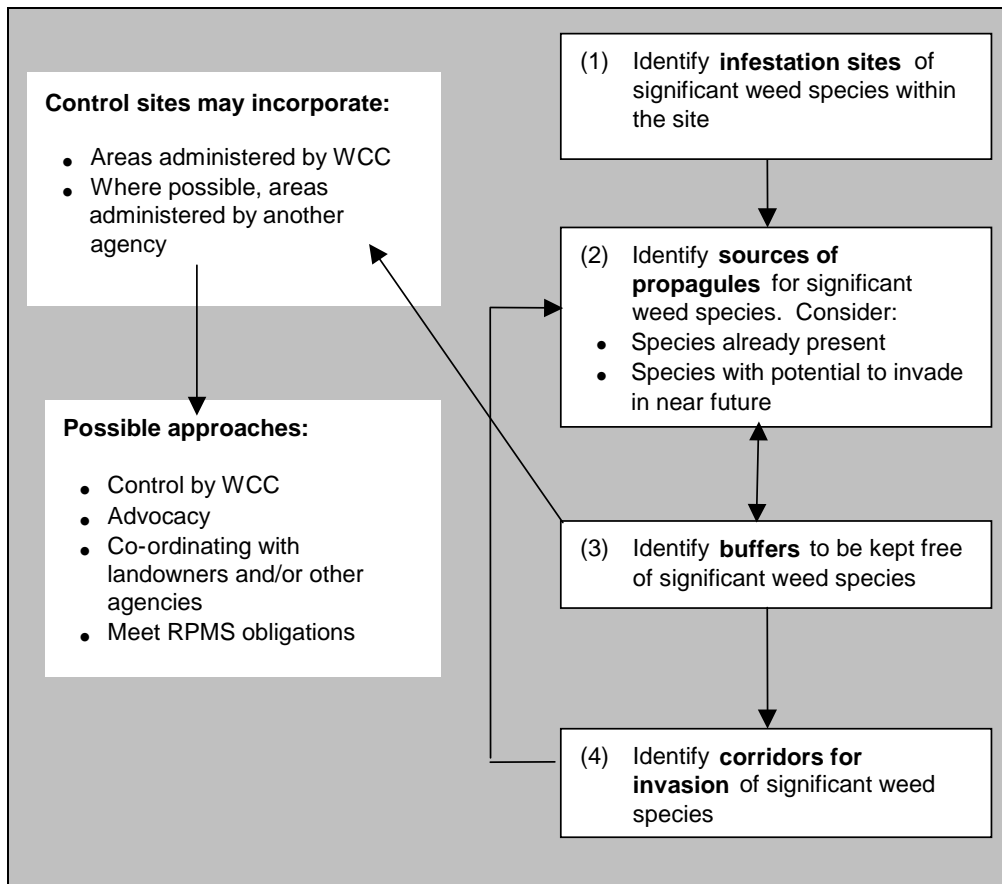


Figure 3.2: Determining buffers for inclusion in a weed control programme (adapted from Owen 1998).

4. Outline objectives for each site.

Clear **objectives** are important to accomplish effective control of weeds. Separate objectives into “result” and “outcome” objectives. A “result objective” is expressed in terms of the desired “result target”, i.e. the abundance of weeds at a site. An “outcome objective” relates to the desired outcome that you are trying to bring about by controlling the weeds at a site e.g., increased seedling regeneration of native canopy species in the under-storey.

- Objectives are essential in guiding the overall format of weed control within a particular site. Objectives should contain the elements what, where, when and why. Typically, objectives are expressed as measurable targets that should be achieved annually. Result targets are useful for setting a benchmark against which progress can be measured.
- Individual weed species can also have separate end objectives. This helps take into account each species unique growth form, ecology and response to control. End objectives can simply indicate the density a species should be at within the site for weed control to be deemed successful.
- As an alternative, species could be grouped into the common methods used to control them. Within this group separate objectives could be described. See Section 9.0. for further explanation of carrying out weed control by restoration phases.
- Objectives also help monitor how effective control has been in achieving the overall goal. Clear objectives will help to determine what to measure when monitoring. Monitoring should be designed to determine whether or not the objectives for a site are being met.

5. Plan a monitoring programme to measure the effectiveness of control operations in achieving objectives.

Monitoring is a useful tool to evaluate whether or not a control programme is effective, the contractor has met the targets set, and control objectives are being achieved (Geritzlehner 2000). Monitoring should measure targets set out in result and outcome objectives. Monitoring is usually undertaken before and after control.

Monitoring methods include:

- Marking and mapping infestations and/or restoration phases.
- Sampling using relocatable and remeasurable transects or plots or belt-transects.
- Photopoints.

6. Estimate costs and allocate funds.

It is helpful to consider the costs associated with all the potential site-led programmes prior to allocating funding to each. Refer to Best Practice Guidelines in Section 9.0 for a discussion on letting contracts and estimating costs.

The cost of the work at priority sites has to be balanced against the perceived return:

- Will a small investment significantly enhance the native ecosystem?
- Will a moderate - large investment this year reduce future costs if weed control is adequately followed up and maintained?
- Will the weed control help to meet other goals, such as the involvement of community groups?

Compare all possible site-led programmes before making a final decision on funding allocation. The prospect of long-term weed control including mapping and monitoring must at all times be considered when allocating funding. Funds need to be long term to accomplish Best Practice Methodologies and ensure weeds are maintained at a low level. If funding is not sustained it can mean that costly Initial control becomes ineffective and expensive with no long-term benefit to the environment.

3.2.3 Implementing Site-Led Weed Control

1. Commence monitoring.

To ensure the effectiveness of weed control can be measured, monitoring should always be carried out before and after control.

2. Undertake control.

Control work should be done using standard control methods and should take into account Best Practice Guidelines (refer to Section 9.0).

As described in Section 9.0, long-term maintenance is required after any Initial control phase. This means weed control must be well planned and environmentally sensitive to ensure any possible negative impacts of control is mitigated. Adhering to a Management Plan should assist

with this process. In most circumstances weed control requires trained professionals to ensure the most efficient and environmentally sensitive means of control is employed.

Reporting is an important component of weed control to assist with monitoring/auditing purposes and ensure control methodologies used are effective. Geographic Information System (GIS) technology can be used to help map infestations during control operations to assist in this process. Furthermore diaries should be completed daily including the methodology used, sites controlled, hours taken per site and herbicide quantities used.

3. Report on effectiveness.

After control, the site needs to be re-monitored and the effectiveness of the control programme assessed. Document weed control measures undertaken, techniques used and their success (the Weed Management Plan format may be used as a guide). It is helpful to keep records of unsuccessful weed control techniques in order to learn from previous mistakes.

If regular reporting and mapping is undertaken (as mentioned above and detailed in Section 9.0), it could be incorporated into a form of monitoring/self-auditing system.

4. Targets

- Identify a list of priority sites (and associated buffers) for a five –year site-led weed control work programme for site-led weed control (2006).
- Include in this five-year work programme the maintenance of sites that are already of low to zero weed density.
- Weed Management Plans will be prepared for any priority sites in the first phase of restoration (i.e. Initial control phase). Where appropriate, plans compiled before 2001 will be reviewed and updated to reflect the present situation. These plans should contain site specific objectives to form the basis of ongoing monitoring/auditing assessing the effectiveness of weed control.
- Produce a brief annual report describing the control results achieved for each site-led weed programme (annually).
- Assess the results of each site-led programme every 2 years (append to the annual report) to determine if outcome and result objectives have been achieved.

4. Objective 2: Minimise Future Costs

4.1 Surveillance at Significant Sites

4.1.1 Issues

The aim of surveillance is to enable detection of potential future problems early in the invasion process. Accepted weed theory states that controlling a weed infestation early will minimise the ecological damage wrought by the weeds and significantly reduce control costs (Williams 1997). Active surveillance to detect species that are new to all or part of the region is the responsibility of the Auckland Regional Council. Waitakere City Council will assist the Auckland Regional Council by reporting new sightings of species within its jurisdiction. Where such weeds are detected the Auckland Regional Council may initiate a weed-led eradication programme and may request the support of Waitakere City Council.

The focus of Waitakere City Council's own surveillance operations is to detect new infestations at ecologically significant sites administered by the Council. Targets include detection of weeds that are new or uncommon in Waitakere, as well as infestations of species that are generally widespread but were hitherto unknown from the particular site.

Surveillance will enable Waitakere City Council to take advantage of opportunities to detect and respond to new infestations before they become widespread, in line with Best Practice Guidelines i.e., control of weeds during the "lag-phase" (Section 9.1) and control of outliers (Section 9.2).

4.1.2 Actions

Key actions for surveillance of weed threats at significant sites include the following:

1. Keep an up to date record of weed infestations at ecologically significant sites, along with estimates of abundance and distribution whenever practical. This can be as simple as contractors marking points on an aerial photograph that is overlain with a grid of eastings and northings.
2. Establish a system for reporting weed sightings, and publicise the need to report new weed incursions. Useful informants include Waitakere City Council staff and contractors, amateur and professional botanists (particularly the Botanical Society), tertiary institutions and community groups.
3. Where new species are detected that are not well known in Waitakere, check with other agencies and databases (herbaria - museum, Auckland Regional Council, other local authorities, Landcare Research, Department of Conservation) to determine whether they are a problem elsewhere in the country or overseas.
4. Where a species is known to be a problem elsewhere, or exhibits signs of being an aggressive invader, removal of the infestation should be made a priority, and a survey of the surrounding area should be undertaken to identify additional infestations.

4.1.3 Targets

- Set up a system for recording new weed sightings made by the public or by Council staff, and reporting these to the Auckland Regional Council. Develop a simple database to collate weed distributions that is compatible with the Auckland Regional Council's weed

database, and allocate responsibility for keeping it up to date. This should include contractors actively surveying as they undertake weed control operations. In particular, RPMS Total Control and Research species should be the target of such surveillance.

- Undertake active surveillance in one third of the significant areas administered by the Council (annually). This should include contractors actively surveying as they undertake weed control operations.
- Control infestations identified as a priority within one year of detection.

4.2 Best Practice for Weed Management in Council Operations.

4.2.1 Issues

Effective weed management extends beyond control initiatives. Though sites of high ecological value are the highest priority for weed control, the greatest proportion of Waitakere's weed infestations occurs outside these sites, i.e. roadsides, pipelines, transit corridors (i.e., train track edges), stream margins and esplanade reserves. Such areas are vulnerable to weed invasions because they are largely "edge", with associated high levels of disturbance and light, and frequent arrivals of weed propagules, in comparison to conditions in a forest interior.

Several operational sections of the Council coordinate and undertake weed control for reasons other than the protection of ecological values, such as for health, safety or amenity reasons. In addition, a number of Council-managed operations such as, subdivision and other planning approvals, earthworks, roadside maintenance and rubbish collection, are not specifically concerned with vegetation removal or weed control, but can still influence the potential distribution and rate of spread of environmental weeds.

The different weed control projects within Council regardless of their immediate purpose or function, must all relate back to the overall aim of the Weed Management Strategy to ecologically restore Waitakere and return or maintain vital ecosystem services the natural environment provides. Without this guiding principle providing a common direction to weed control, different projects could potentially impede the progress of other ecological restoration efforts.

Promoting awareness of weed issues and commitment to Best Practice Guidelines (refer Section 9.0) throughout the Council will contribute significantly to effective management of weeds within the City. In order to facilitate this, the Code of Practice; should wherever appropriate contain reference to the Best Practice Guidelines and this Weed Management Strategy. In particular, key operational areas that can adopt Best Practice Guidelines pertaining to weeds include:

- Co-ordination of restoration and other community projects.
- Roadside maintenance.
- Management of transit corridors (Waitakere City Council need to work with Auckland Regional Council to inform and where necessary, enforce the relevant landowners to control pest populations on their land).
- Parks maintenance.
- Stormwater management.
- Rubbish collection and disposal.

- Coordination of educational material.
- Coordination and approval of subdivision, creation of new parks and other developments.

Best Practice Methodologies need to be utilised while undertaking weed control operations to help minimise future costs. Operations have to be timed well, and carried out efficiently and effectively using the 'Best Practice' Methodology to allow for long-term management that maintains weed levels to a low density. By maintaining regular Follow-up control, costs will be kept low until minimal levels of maintenance are required at a site.

4.2.2 Targets

- Ensure that all staff working in the operational and contractual areas that have involvement with weed work are familiar with Best Practice Guidelines.
- Include in the Code of Practice reference to this Weed Management Strategy and the Best Practice Guidelines contained in it.
- Ensure long term planning and budgeting is maintained for weed control and restoration projects.

5. Objective 3: Support and Facilitate Community Involvement

5.1 Issues

Weed management initiatives are more likely to succeed if they have the support of the local community. Ecological restoration is required throughout Waitakere, not just Council land, therefore understanding and awareness are essential to ensure that environmental weeds are regarded as a priority issue that can and must be addressed. Better information and improved public awareness are fundamental to preventing and controlling the establishment and spread of weeds. During this process the outcomes sought need to be clearly articulated and widely supported.

In a similar manner relationships can be forged between experienced contractors and community groups to enhance the outcome for both parties. The assistance from experienced weed control technicians means volunteers shouldn't become overwhelmed with large weed management projects and can be assisted with tasks requiring significant hours of work and/or herbicide application. In turn this should create a positive, educational environment for volunteers to work in whilst successfully restoring an area.

The nationwide multi-agency community programme called Weedbusters has been running in New Zealand since 2003. Weedbusters is about communicating weed issues and educating people about how to manage the growing weed problem. The vision of Weedbusters is that "New Zealanders are aware of and taking action to reduce the impact of weeds on the environment, economy and human health". The Auckland Regional Council is currently developing a regional strategy for Weedbusters that could support the Waitakere City Council Green Network Community Assistance Programme and community work through regional networking. This would maximise the respective strengths of both agencies and prevent duplication of work.

5.2 Actions

1. Develop advocacy measures to limit the spread of environmental weeds.

- Identify specific interests and roles of relevant sectors of the community with respect to weed issues. Target groups include (but are not limited to):
 - General public.
 - Private landowners.
 - Community groups (e.g., Weedfree Waitakere Trust, Waitakere Ranges Protection Society, Keep Waitakere Beautiful, Toxin Action Group, Royal New Zealand Forest & Bird Society).
 - Existing Weedbuster groups (Friends of the Whau, Friends of Three Streams & Kauri Grove, Karekare Landcare Group, Laingholm School).
 - Schools.
 - Relevant industries and retailers (e.g., landscape gardeners, plant nurseries, tourism operators and developers).
 - Tangata whenua
- Investigate the actions and attitudes of the general public that facilitates the spread of environmental weeds.

- Work with the Auckland Regional Council and other weedbuster organisations to develop advocacy measures to limit the spread of environmental weeds.
- Develop specific communication strategies for each target group, and target them with appropriate information and recommended actions.
- Make easily accessible, current and accurate information widely available via a range of media, including electronic form, manuals, databases, technical documents and popular publications.
- Promote Best Practice Guidelines (described in Section 9.0), ensuring that the community is aware of the theory behind weed control recommendations so they are able to make informed decisions.

2. Continue the use of non-regulatory approaches to minimise threats from weeds on privately owned land.

In addition to raising public awareness, the most effective measure to facilitate weed management by private landowners is the provision of incentives and education by the Council. Existing non-regulatory initiatives (offered under the banner of the Green Network Community Assistance Programme) should continue. These include:

- Provision of weed disposal bins
- Provision of herbicide.
- Provision of non-invasive native plants.
- Provision of information and advice on environmental weed issues.
- Providing Management Plans in priority areas.
- Encourage the development of neighbourhoods with low to zero weed density zones:
 - Attempt to connect different communities maintaining low weed densities both physically through vegetation corridors, and while planning management programmes.
 - Use promotional material (e.g. weed free signage) to promote sites with low weed densities to help encourage community pride in the state of their local native ecosystems.
- Working with community groups, for example:
 - Piha Beachcare
 - Ark in the Park
 - Karekare Landcare Group
 - Waitakere Rivercare
 - Whau River Group
 - Various Residents and Ratepayer groups

3. Prioritise and manage response to weed management issues raised by members of the public.

Ad hoc weed control may be undertaken to meet the concerns of the public, particularly in cases where members of the community draw attention to issues that match the priorities set out in this Strategy. In some instances, it may be worthwhile to provide a "one-off" response, for example, to meet good neighbour responsibilities, or to provide a positive response to a public

awareness campaign. However, such work is not generally regarded as strategic, hence the level of resources allocated to unplanned weed control should be limited, and should weigh costs against the likely long-term benefits. Actions include:

- Set an annual budget for responses to public concerns that cannot appropriately be incorporated into weed-led or site-led initiatives detailed in Objectives 1 and 2.
- Target concerns that contribute to this Strategy's goals for weed management. Consider whether requested actions:
 - Contribute to Green Network objectives.
 - Are located within or adjacent to areas of high ecological value.
 - Have a high public profile and hence are useful for education and public awareness.
 - Can be incorporated into an existing or proposed community project.
- Record concerns raised by members of the public in a database for audit and surveillance purposes. If the budget allows, the database could be used to follow up previous control efforts. This would also help increase public awareness of the importance of ongoing weed control as opposed to ad hoc attempts at managing weeds, while increasing the value of one-off attempts.

4. Prioritise and implement community projects and education initiatives.

There is considerable value in facilitating the involvement of community groups in weed control projects. Such groups can contribute enormous resources and long-term commitment to projects, and these projects can have substantial benefits, both in terms of ecological benefit and public awareness. In developing strategic partnerships with community groups however, Waitakere City Council must retain the ability to make funding and strategic decisions. In particular, the Council's core work priorities should not be redirected solely on the basis of a group's willingness to contribute to the management of a particular area.

In cases where it is considered appropriate for community groups to undertake Waitakere City Council's priority weed control work, the aim must remain the cost effective management of weed problems. Where weed control is undertaken by community groups and funded by Waitakere City Council, any ongoing funding should still be dependent on performance.

It is useful to differentiate (and separately fund) projects undertaken primarily for protection of natural values from projects that aim to raise public support and awareness. These latter projects can include quite different objectives, such as the involvement of a target number of local residents.

As previously mentioned it is important for community groups to have professionals supporting their work, i.e. when weeds get too dense, when herbicide is required and when expert advice is needed.

- Maintain the annual budget for community and other weed control projects that do not form part of core priorities detailed in Objective one and two.
- Give preference to projects that:
 - Have clear objectives.
 - Have strong, long term community support.
 - Have a high public profile and hence are useful for education and public awareness.

- Contribute to Green Network objectives.
- Provide benefits to sites of significance, i.e., support the Council's existing weed control programmes.
- Have professional contractors already working towards the restoration of the site.
- Can obtain financial support from other agencies (e.g., industry).
- Outline a robust monitoring programme to demonstrate their effectiveness.

5. Develop and maintain supportive partnerships with stakeholders.

Supportive partnerships are a key aspect of weed management in Waitakere, as most significant natural areas are owned or managed by agencies other than Waitakere City Council. Many weed infestations occur on land not administered by the Council.

In particular, the following organisations or groups are stakeholders in weed management initiatives:

- Community groups.
- Auckland Regional Council.
- DOC.
- Watercare.
- Transit New Zealand.
- ONTRACK
- Te Kawerau a Maki
- Ngati Whatua
- Rodney District Council
- Auckland City Council

For each of these agencies:

- Develop effective communication and facilitate exchange of information between agencies, including easy access to databases and documentation of weed management initiatives undertaken by Waitakere City Council.
- Develop stakeholder agreements to clarify relationships. Identify common goals and responsibilities (e.g., RPMS), and complementary skills and resources.
- Promote adoption of Best Practice Guidelines (as described in Section 9.0).
- Facilitate and participate in cooperative initiatives to undertake weed-led and surveillance programmes.
- Facilitate and participate in site-led control where biodiversity values span landownership boundaries.

5.3 Targets

- Develop and maintain supportive partnerships with stakeholders. Supportive partnerships are a key aspect of weed management in Waitakere, as most significant natural areas are owned or managed by agencies other than Waitakere City Council. For ecological restoration of the entire city, all restoration efforts need to be coordinated towards one vision (e.g. to restore the Green Network).
- Coordinate ecological restoration priorities and work programmes with Auckland Regional Council to help clarify roles and responsibilities of the different Council
- Maintain community incentive, participation and education project funding.
- Develop relationships whereby community groups and their projects are aligned with suitably qualified staff and/or contractors to assist in the control of weeds (i.e. when infestations become too big a task for volunteers contractors can assist e.g. Green Network – community planting in parks).
- Work with Auckland Regional Council to create a Weedbuster Regional Strategy that will develop stakeholder agreements with other agencies (year 1 & 2).
- Encourage community groups where restoration has already begun, and management is ongoing to facilitate the success of volunteers.
- Support and facilitate partnerships with tangata whenua in restoration projects.
- Investigate the actions and attitudes of the general public that facilitates the spread of environmental weeds.
- Encourage the development of neighbourhoods with low to zero weed density zones.
- Provide educational material to the wider community and advocate the participation in the restoration of local neighbourhoods.
- Include theoretical knowledge on the invasion and spread of environmental weeds in educational material.

6. Objective 4: Eradicate or Contain Specific Weeds

6.1 Weed-Led Programmes

The objective of a “weed-led” control programme is to **eradicate** or **contain** the distribution of a particular, new invasive weed species in order to minimise future problems. Controlling a weed infestation early will minimise the ecological damage wrought by the weed and significantly reduce future control costs.

To be effective, the target weed species in a weed-led programme must be controlled wherever it occurs. The location at which the plant occurs is irrelevant, because the object is to destroy all infestations to prevent future problems. Weed-led control should only begin on a species that has not yet become a serious weed but has the potential to do so. Figure. 6.1 provides a flow chart for evaluating whether a weed-led approach is suitable for a particular species.

For eradication or containment to be feasible ensure that all the infestations of the target weed species are known. There is a risk that someone could find other infestations during the course of the weed-led control programme. This would affect the feasibility, practicality and cost of the control programme. Due to the importance of knowing all existing locations maps should be created of the entire distribution of target weed species. Maps should be updated each time a site is visited.

For example, smilax (*Asparagus asparagoides*) is a Containment pest plant in the Waitakere Ranges area (as defined in Auckland Regional Council's RPMS). This plant is widely distributed in urban areas of central Auckland and throughout South Auckland, but it is currently uncommon within the Waitakere Ranges. Hence this weed is a good candidate for weed-led control within the Waitakere Ranges area.

Where eradication is feasible and practical, it should be viewed as a priority over site-led control of more widespread species. However in reality, opportunities for Waitakere City Council to successfully undertake eradication programmes are rare, as Waitakere City Council can only effectively survey and manage land it administers, and cannot compel other landowners to undertake weed control on their properties (Refer to Objective five (Section 7.0). for ways of facilitating cooperation from the public). Eradication or containment should follow a proven successful process of weed management adequate to allow for eradication in known sites over 5 years, or successful containment/gradual reduction of infestations where appropriate. This may require the preparation of plans covering species-specific methodologies, for eradication species in particular.

Detecting and initiating action against new weed threats is primarily the responsibility of Auckland Regional Council (under section 100 of the Biosecurity Act). All Total Control Pest Plants by definition within the RPMS should be subject to weed – led programmes. Total Control Pest Plants are those pest plants that are “*of limited distribution or density within the Auckland region, or defined areas of the region, for which the Auckland Regional Council shall assume responsibility for funding and implementing appropriate management programmes.*” Waitakere City Council can assist the Auckland Regional Council by ensuring contractors report on any Total Control Pest Plants infestations, including maps, and any control methodologies utilised.

The following chart details when a ‘weed led’ programme should be initiated:

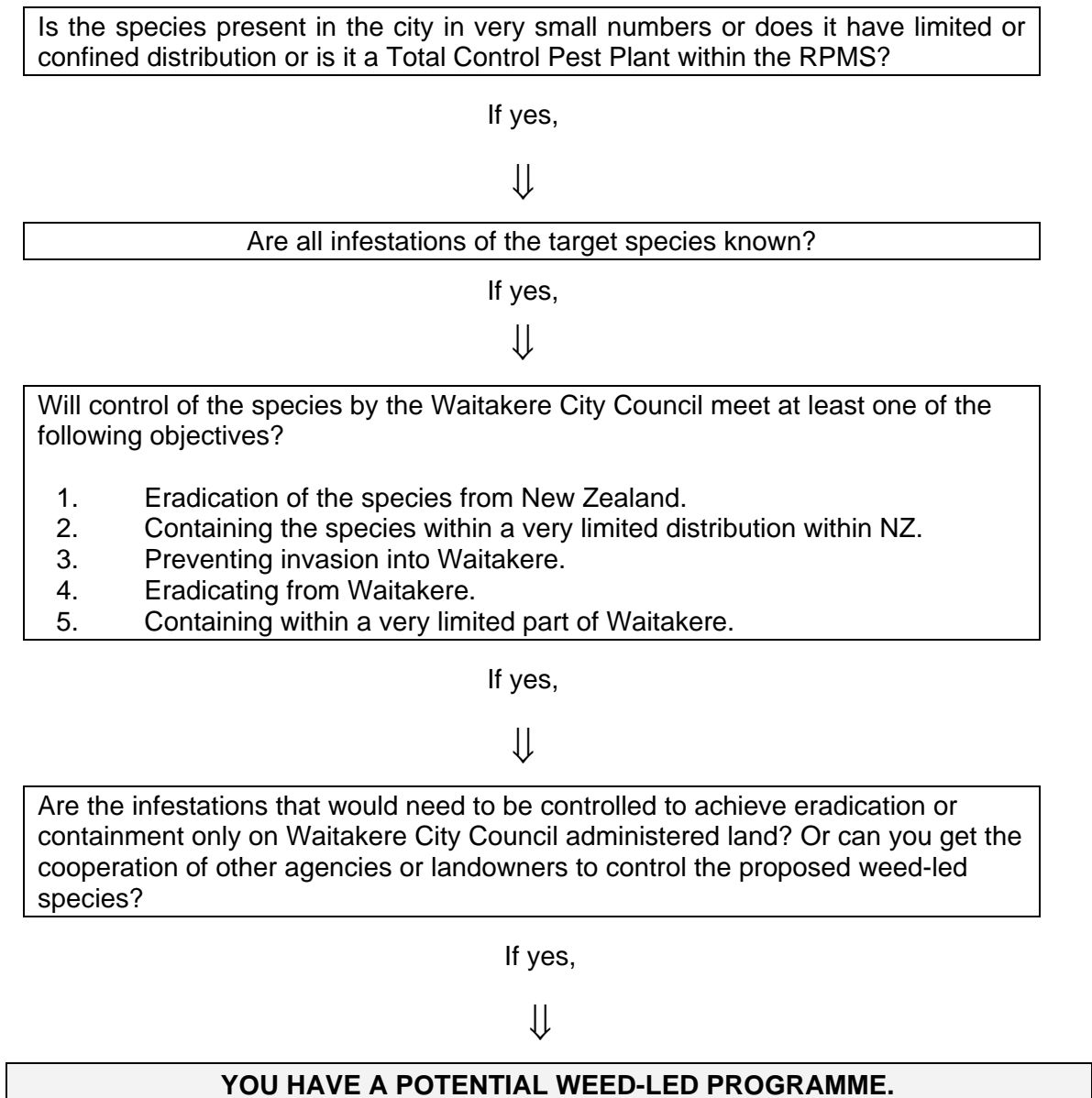


Figure 6.1: Flow chart for evaluating the feasibility of successfully implementing a weed-led programme.

To help determine whether eradication or containment is being achieved, quantitative mapping will be necessary. This will help illustrate the extent to which infestations are spreading, being contained or successfully reduced. The mapping of weed distributions will also help assess the invasive characteristics of new weed species. This would not only assist with weed control operations, but also provide useful information when compiling submissions on the RPMS regarding feasibility and practicality of control.

6.2 Actions

Waitakere City Council's involvement in weed-led programmes will generally involve:

- Compliance with legal obligations under the RPMS. (That is to 'treat containment pest plants whenever they appear on Waitakere City Council's land, - either to completely remove the pest plant or maintain clearance to an appropriate distance as specified for each species.
- Collaborative programmes between Auckland Regional Council and the Council in response to the appearance of a new weed.
- Collaborate with the Auckland Regional Council regarding the distribution of target pest plant species.
- Addressing new weed infestations requiring urgent control.

6.2.1 The Management of Gorse

Gorse is a high profile exotic species that is an aggressive weed of pastoral land, yet considered a lower priority environmental weed within native vegetation throughout Auckland. The main difference arises from the fact that gorse is generally not considered an environmental weed as it is likely to be shaded out in most environments therefore its long-term impact on the natural environment is not significant. Gorse is, in some situations, an effective nurse crop for establishing native seedlings. However gorse can result in a different suite of native species than that found under native regeneration. Gorse can also act as a nurse crop for other exotic species such as woolly nightshade and make it more difficult to access and control these weeds.

Where there is no shade, and gorse will not be overgrown, the weed becomes a problem. The solution is not as simple as controlling all gorse plants as it has been estimated to cost approximately \$100,000.00 per annum to control gorse plants throughout Waitakere. This would mean leaving infestations of higher priority weeds unchecked. It is therefore more effective to control high priority weeds than low priority weeds. Gorse is selectively being controlled.

Recommendations for the management of gorse are proposed below:

- Waitakere City Council owned parks, reserves and roadsides with existing vegetation (i.e. native *and exotic*): Gorse within these sites should not be controlled. This will assist in the regeneration of native plant species, prevent the establishment of more threatening invasive weed species and allow funds to be spent on more serious weed threats to Waitakere's native ecosystems.
- Roadsides not adjacent to native vegetated areas: Do not control gorse. As above, control can exacerbate weed problems within that site and potentially destabilise roadside verges and accelerate erosion. The exception to this rule is urban areas. Gorse should be controlled along urban roadsides.
- Areas susceptible to invasion by gorse (e.g. arid habitats, wetland margins and some riparian margins): Assessments should be made on a site-by-site basis. The Piha Road Gorse Management Plan should be used as an example of a Management Plan to provide the best solutions for each site. In general it is recommended to maintain gorse whenever possible as the consequence of removal is usually more damaging to the environment than maintaining the cover of gorse.

- The exception to the three points above is when gorse dominates more than 80% of vegetation present. When gorse reaches this point it should be controlled to manage the fire risk.
- Continued education for the public on the benefits of retaining gorse infestations in native bush environments is required. Once the costs and benefits of gorse removal is realised by the general public, there may be better understanding of this weed management decision.
- Rural sites and urban residential areas: Meet RPMS obligations. That is remove gorse to create a 20m buffer from all boundaries of land that have no gorse to reduce the impact of gorse infestations on agricultural land and urban residential areas.
- At roadside sites, not in urban residential areas or rural areas (as defined in Appendix 3 of the RPMS) and that are not adjacent to native vegetated areas, there is no requirement to control gorse. As above control will exacerbate weed problems within that site and potentially destabilise roadside verges and accelerate erosion. However gorse control will be required for water table, visibility and traffic safety management.
- Gorse should be controlled in important native vegetation communities (e.g. gumlands with low vegetation), where the presence of gorse would change or alter the environment and lead to the loss of the native vegetation.

6.3 Targets

- Waitakere City Council will make submissions on all new potential weed-led programmes proposed for inclusion in Auckland Regional Council's RPMS. Submissions will take into account the principles of feasibility and practicality of undertaking the proposed programme, and suggest a site-led approach if appropriate.
- Further discussion regarding fulfilment of RPMS obligations is provided under Objective 5 (Section 7.0).
- Allocate funding for contractors to carry out quantitative mapping of weed species subject to weed-led programmes.
- If it has been determined that a weed-led programme is feasible in Waitakere, compile Management Plans to a) allow for eradication of qualifying species from known sites in 5 years or b) allow for a gradual reduction of infestations of qualifying species in 5 years.

7. Objective 5: Address Legal Responsibilities under the Regional Pest Management Strategy

7.1 Issues

Pest Management Strategies developed in accordance with section 76 of the Biosecurity Act (1993) provide the main avenue for pursuing enforceable plant control in New Zealand. Biosecurity New Zealand may also enforce control of 'Unwanted Organisms' not listed in a Pest Management Strategy. Auckland Regional Council has developed an Auckland Regional Pest Management Strategy, 2002-2007 (RPMS). The RPMS is currently undergoing a review process so that a new Strategy will be operative by July 2007. The purpose of the current RPMS is to '*provide a strategic and statutory framework for efficient and effective management of plant and animal pests in the Auckland region.*'

The scope of the RPMS for the Auckland Region is broader than this current Weed Management Strategy. The RPMS is not purely an ecological document, but is based on political, economic and social issues and incorporates the protection of recreational, scenic, social, historic, agricultural, health and safety values as well as natural values.

Under the RPMS, Auckland Regional Council is responsible for all strategic weed management decisions in the Auckland Region. Provisions of the RPMS bind Waitakere City Council, in that it has occupier responsibility to control weeds on land it administers, "in the manner and to the standards prescribed in the RPMS". Containment pest plants within Waitakere City Council's jurisdiction are currently controlled under contract to meet the Council's obligations within the RPMS. In the event that widespread and abundant weed species are incorporated into the RPMS and not regarded as feasible or the best use of resources, this Strategy advocates a targeted approach whereby control of widespread legally declared pest plants is focused towards protecting the values of ecologically significant sites. On analysis of the current discussion document (Auckland Regional Council, 2006) proposing changes to containment pest plants it is likely that Waitakere City Council will be able to fulfil their obligations if these proposals are made operative.

7.2 Actions to be maintained

1. Continue liaisons with Auckland Regional Council to determine their RPMS priorities and concerns.
2. Continue to coordinate RPMS weed control efforts with Auckland Regional Council for the most efficient management of the environment.
3. Retain the annual budget for undertaking weed control to meet RPMS obligations.
4. Advocate adoption of Best Practice Guidelines (Section 9.0) into future RPMS strategies.

7.3 Targets

- Report annually to Council and Auckland Regional Council the amount of work undertaken to meet RPMS obligations including distribution maps, timing of visits and methodologies used.
- Meet obligations under the RPMS and the Biosecurity Act to the highest standard possible within the limits of resources allocated.

8. Roadside Objectives

Roads are traditionally a significant pathway for the distribution of weeds. This is often facilitated by the movement of people, water and wind (through water channelling and wind funnelling). The problem is exacerbated by the large amounts of desirable open habitat available for the establishment of weeds along roadsides. Road works often create such favourable open habitat.

Roadsides are treated by society as 'highly managed wastelands'. This results in high levels of disturbance but very little care and/or management. This leads to the formation of attitudes and actions that result in poor weed hygiene, and dumping, etc. What is not often realised is that roadside vegetation plays an important role in a number of ecosystem functions. Roadside reserves are home to threatened species, and roadside vegetation has a major role in silt reduction and water quality, edge protection for neighbouring native bush, ground stability for roads and in providing a buffer zone for bush areas neighbouring the road.

The following objectives are specific to roadside weed control. At all times Best Practice Methodologies should be used, while also achieving the previous 5 objectives within this Weed Management Strategy.

For the following objectives to be realised they must be incorporated into appropriate specifications in the Roadside Weed Control Contract, and other contracts which involve physical works on roadsides.

8.1 Objective 6: Enhance native roadside habitat

8.1.1 Issues

Waitakere City Councils focus since 1999 has been to increase the value of the roadside asset through managing roadsides in a way that increases the natural health of the land. This can be achieved by:

- Making progressive changes (in order to stay within the existing budgets)
- Employing techniques that reduce the habitat available for the invasion of weeds
- Maximising the habitat and regenerative capacity of native vegetation.

This should in turn result in substantial natural regeneration of native vegetation that assists in ground stabilisation, reducing the quantity of herbicide required, improving ecological values, improving water quality in neighbouring streams, improving visual amenity and decreasing threats to surrounding natural areas while enhancing the composition of native fauna and flora.

Good vegetation buffers can enhance native flora and fauna by creating good vegetation corridors for the movement of native lizards, invertebrates and birds and dispersal of native plants, while decreasing the availability of suitable open substrate for the infestation of weed species.

Reducing the amount of habitat available for weed infestations by planting and maintaining a good edge structure will help inhibit the amount of weeds coming into the roadside area. In time, this should help minimise the need to carry out such regular weed control and assist in moving towards minimal interference management.

Water quality can be improved within local streams by reducing silt and pollution carried by stormwater. This is largely achieved by vegetation slowing the water to a point where it can be filtered by roadside vegetation. As the water slows, pollutant-laden sediment is allowed to settle out, reducing the level of heavy metals within the runoff.

Improved water quality enhances the freshwater habitat available for native freshwater macro-invertebrates and fish.

8.1.2 Actions:

- Create significant buffers to adjacent natural areas to prevent the reinvasion of weeds and protect surrounding native environments from edge effects (e.g. increased exposure to wind, higher temperatures and salt spray).
- Extreme care must be taken when applying herbicide near threatened plants and to protect threatened species and the habitat they require.
- Improve water quality of local streams through facilitating the regeneration of native vegetation to slow the flow of water and prevent pollutant-laden sediment, rubbish, oil and other impurities from entering waterways.

8.1.3 Targets:

- Control all environmental weeds as specified within the 5-year roadside work programme. Where herbicides are used ensure the most selective herbicide is used and at the time of year where it will be most effective.
- Ensure all contractors are aware of, and can identify (with assistance if necessary) threatened plants located along roadsides and are aware of any known locations of threatened plant species.
- Compile guidelines that dictate when it is appropriate to revegetate roadsides.
- Avoid unnecessary clearance of vegetation along waterways.

8.2 Objective 7: Health and Safety along roadsides

8.2.1 Issues

The health and safety of road users must be considered at all times when maintaining roadside vegetation. Overhanging plants need to be cut where plants or growth patterns cause safety to be compromised for pedestrians or drivers. A line of sight should be maintained at all times. Any removal of native species must be carried out with appropriate consent and with as little impact to the native plant as possible. Environmental weeds and exotic species should always be a priority for removal when maintaining roadsides.

Another safety concern is the risk of fire. Roadside vegetation is exposed to high levels of sunlight, drying winds and high temperatures, therefore in the height of summer presents a high risk. Of particular concern are areas dominated by long dry grass, pampas and/or gorse (see Section 3.2.1 for further discussion on the management of gorse). Roadsides are vectors for the spread of fire therefore management of areas dominated by high risk species is required to manage the fire risk.

8.2.2 Actions:

- Ensure the optimum safety of all road-users by maintaining sight lines.
- Manage the fire risk along roadsides by managing flammable vegetation.

8.2.3 Targets:

- Cut or graze long dry grass along roadsides to reduce the fire risk.
- Control gorse when it is the dominant vegetation cover (i.e. in areas where it becomes greater than 80% of the vegetation cover along the roadside).
- Control all pampas along total control roads (as per the 5-year work programme).
- Control pampas when it is greater than 80% of the vegetation cover (i.e. greater than 80% of the vegetation cover along the roadside).
- Continue maintaining sightlines for all road users along roadsides
- Prioritise environmental weeds and other exotic species when removing vegetation for health and safety reasons.

8.3 Objective 8: Manage roadside assets

8.3.1 Issues

If left unmanaged, plants can cause damage to the seal, footpaths, kerb and other features or furniture of the road edge or berm. Erosion following weed control can also undermine these features. Asset protection is part of this Strategy so it can be coordinated with other vegetation management measures and whenever possible strive towards achieving the Green Network vision. All vegetation maintenance, regardless of its primary function, should be aligned with the principles and objectives within this Strategy. An example of this could be in choosing the appropriate vegetation to remove in order to conserve a particular roadside asset. Priority should always be given to environmental weeds and/or exotic species to help restore the local area and contribute towards the enhancement of roadside habitat (see objective six).

Vegetation needs to be cleared from drainage systems to prevent blockages in channels that carry stormwater. Blockages can in turn create flooding that can have negative social, ecological and cultural impacts on the surrounding environment.

Vegetation clearance, whether through environmental weed control or maintenance of drains etc can destabilise the surrounding substrate. Revegetation with the appropriate native species can effectively reduce erosion and slips. Plant roots help bind the substrate together while reducing the velocity of water hitting the soil, and moving through the area. Revegetating cleared areas will also decrease the amount of habitat available for the invasion of weed species.

A number of factors must be considered when assessing the revegetation of roadsides. A significant amount of planning is involved; therefore when appropriate a revegetation plan should be compiled.

Some factors to consider are listed below:

- Timing of planting
- Appropriate species for the area
- Ecosourcing
- The presence of threatened species
- Exotic species that should be retained on site
- The amount of weed control required before the site can be revegetated
- How plantings will be maintained
- Why the site needs to be planted
- Aesthetics of the area
- Public safety
- Public advocacy and awareness
- Relevance of the site to local iwi
- Weed reinvasion threats from surrounding areas.
- Habitat and diet requirements of local native fauna.
- Visibility and view issues.

8.3.2 Actions:

- Ensure weed control is carried out in a manner that maintains the stability of the surrounding substrate. Where this is not possible steps need to be taken (i.e. planting) to help mitigate any consequential erosion.

- In some cases native vegetation may need to be pruned or removed. This must be done with appropriate resource consent and with the smallest impact on the health of the native vegetation.
- Manage vegetation to allow for the unimpeded movement of water through drainage systems.
- Reduce the potential for erosion and slips by minimising vegetation clearance whenever possible (i.e. reducing the amount of ground exposed).
- Revegetate exposed sites with native species to help reduce the risk of erosion and slips.

8.3.3 Targets:

- Prioritise environmental weeds and exotic species when clearing vegetation to protect the roadside asset.
- Prioritise environmental weeds and exotic species when clearing channels that carry stormwater.
- Plant native species in areas that have been cleared of vegetation to prevent erosion and slips.
- Manage vegetation along drainage systems to allow for the unimpeded movement of water.
- Comply with resource consent requirements when pruning or removing any vegetation.

9. Best Practice Guidelines

A substantial amount of theory is available on the infestation of weeds and how weeds may spread and how this might be used to assist in the control of weeds. It is important to note that the relationship between theory and the actions of weed control should be dynamic. That is that theory should always be referred to and interpreted appropriately during the planning phase of weed control. This is especially important as theories develop and evolve depending on new information and technological advancements. The following is a description of some well established theories and how they can be utilised to achieve effective and efficient weed control.

9.1 Control of Weeds During “Lag-Phase”

Invasive plants are generally present in an area for some time before they develop into serious infestations. The “**lag-phase**” refers to a period early in the invasion process during which the density and total population size of a weed is low, and the rate of spread is comparatively slow.

This happens because the expansion rate of weeds is roughly exponential. Even if an invasive plant population has a high reproductive rate, the total number and density of plants will be quite low for some time, but following a period of little apparent change, the population reaches a critical point where rapid expansion and related impacts become obvious.

Weeds will often persist at low densities in gardens and in small wild populations until an event, such as a change in climatic conditions or a large-scale disturbance, facilitates their spread. For example, *Agapanthus praecox* (a common weed in Waitakere) was observed to naturalise in Wanganui after an unseasonably warm winter (Colin Ogle pers. comm.).

Weed control, and in particular eradication is likely to be most successful when started during the lag-phase (Williams 1997), as the best opportunities for eradicating or containing a weed are in the early stages of invasion when weed populations are small and localised (Figure 9.1). If control is not carried out during the lag phase the graph clearly shows that the situation is likely to get worse (i.e. the infestation will increase and spread).

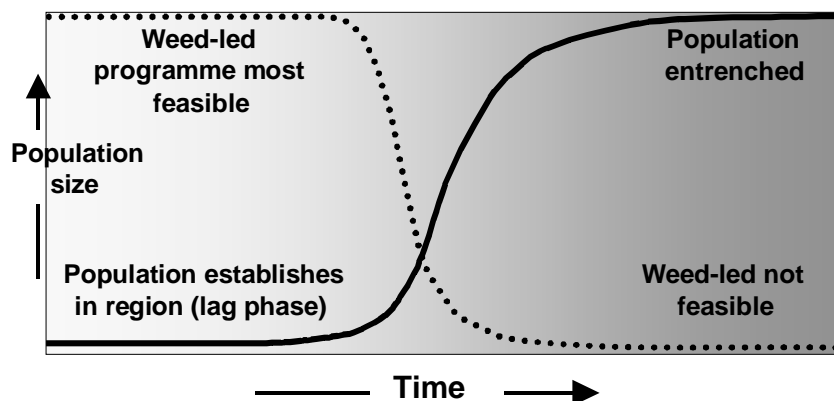


Figure 9.1: Relationship between population growth and the feasibility of a weed-led programme (adapted from Williams 1997).

9.1.1 Principles of achieving eradication

- Early detection of new introductions, together with the capacity to take rapid action, provide the key to successful and cost-effective eradication of invasive weeds.
- Early detection will be possible in current prioritised parks with comprehensive surveys during weed control operations.
- Lack of scientific or economic certainty about the implications of a potential weed should not be used as a reason for postponing eradication, containment or other control measures.
- Eradication of new or existing weeds at an early stage in the invasion process is more cost effective than long-term control, but should not be attempted unless it is ecologically feasible and has the necessary financial and political commitment to be completed. Location and removal of individuals becomes progressively more difficult and costly at low densities.

9.2 Control of outliers

Control of outlier populations, i.e., scattered individuals or small clumps of weeds, is a priority over large, well-established, high-density infestations for the following reasons:

- The spread of a weed from numerous, widely spread infestations will be more rapid than from one large infestation (Fig. 8.2).

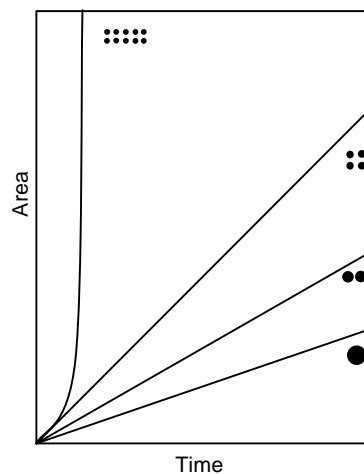


Figure 9.2 Several small infestations have a faster rate of new range occupation than fewer, larger infestations, even if the total area initially occupied and rates of spread are the same. All trajectories in this diagram start with weeds occupying the same area, and assume the same rate of spread (after Mack 1985).

- Outlier populations represent the invasion front. Most new plants establish in close proximity to the parent plant, and dispersal over long distances is relatively infrequent. Removal of outliers limits dispersal and prevents further expansion of the population.
- For example, relatively few large infestations of *Eleagnus x reflexa* are present within Waitakere City Council parks, but many small populations are scattered over a much

wider area. Each of these small populations has the capacity to become a serious problem if left unmanaged, and also provides a seed source to uninfested areas.

- Control causes disturbance that provides further opportunities for weeds to establish. The larger the disturbance the more likely it is that weeds will establish following control. Therefore control of the outlier weed populations is less likely to exacerbate the problem. It should be noted however that Follow-up weed control is generally required post-Initial control operations.
- The soil beneath sizeable, well-established infestations of seed-producing weeds often contains a large seed bank. Removal of aboveground vegetation will simply release the seed bank. In contrast, recently established outlier populations have small seed banks. Note that a seed bank will quickly develop if the infestation is not controlled.

9.3 Buffers

Controlling weeds in buffers is an important part of site-led control. Buffers are areas of vegetation surrounding core high-value sites that are not necessarily of high value themselves. A well-maintained buffer protects the core site by capturing a large proportion of weed propagules. However a poorly maintained buffer is a liability, as it harbours a weed source in close proximity to the high value site.

The aim of weed control in buffers is to minimise the supply of weed propagules from which the core site can be invaded. This would include infestations upwind or upstream, or infestations on neighbouring properties. These infestations might be on land administered by the Council, other agencies or privately owned land, therefore coordination of the relevant stakeholders is required. Buffer areas are likely to include roadsides, transit corridors, private property, and adjacent parks of lower priority. Control in buffer areas can reduce the cost of ongoing maintenance control and Follow-up. Control of environmental weeds in transit corridors (railway tracks), streams, pipelines and along roadsides will generally be undertaken to provide a buffer for a site-led control programme (or to meet RPMS obligations).

The size of a buffer will largely depend on the site, ownership of the adjacent land; if it is contiguous with the focal site and whether current weed threats are dispersed by wind, birds, gravity or water.

9.4 Best Practice Methodologies

The following restoration phase model presents a practical guide to the restoration of reserves and roadsides within Waitakere. If weed management is carried out in this manner, weed control will not only be more effective and efficient but weed control technicians will be able to price, plan, programme, prioritise and manage each reserve in a method that is efficient, cost effective and successful in the long term.

Areas in a park are classified into subsets dependent on their current restoration phase, and the application method required for control. The restoration phases used are defined in Table 9.1.

Table 9.1: Definitions of Restoration Phases.

Restoration Phase	Procedure	Weed control methodologies
<i>Initial Control Phase</i>	<ul style="list-style-type: none"> • Environmental weed species are often at high (65% - 100% coverage) or medium (20% - 65% coverage) densities through this phase, and commonly weed control has not been implemented recently (>3 years). • Initial focus is on limiting further seeding by removing the mature individuals, although where practical all individuals and all weed species should be targeted. • Improves access through the site. • Initial control can be carried out at any time of the year. <p>Target: Removal of all adult target weed species.</p>	<ul style="list-style-type: none"> • Initially targets cut stump applications and the release of vine species, providing immediate positive effects on the ecosystem. • Releasing vines during cut stump applications allows for clearly defined targets for foliar spraying. Placing cut vines in a suitable position also helps reduce overspray.
<i>Long Term Initial Control Phase</i>	<ul style="list-style-type: none"> • Planned slow removal of pest plants (e.g. the gradual removal of a tree privet canopy over 3 to 5 years). • This phase of control becomes necessary when removal of all pests would have a detrimental effect on the environment. • Long-term initial control can be carried out at any time of year. 	<ul style="list-style-type: none"> • Long-term initial control generally requires cut stump applications. • Releasing vines during cut stump applications allows for clearly defined targets for foliar spraying. Placing cut vines in a suitable position also helps reduce overspray. • Any foliar spraying of vine species should be carried out during spring and/or autumn once regrowing foliage is clearly visible.
<i>Follow-up Control Phase</i>	<ul style="list-style-type: none"> • Environmental weed species are often at levels of medium density (20% - 65% coverage) following an Initial control phase. • Follow-up control targets pest plants during the “spring flush” and pre winter before growth slows down. <p>Target: Remove all target weed species greater than one years growth.</p>	<ul style="list-style-type: none"> • The required methodology is commonly foliar spraying and is implemented in 2 cycles per spray season (once in spring and once in autumn).

Restoration Phase	Procedure	Weed control methodologies
<i>Low Density Follow-up Control Phase</i>	<ul style="list-style-type: none"> • Areas enter this phase of restoration when the original population of weed pests have been eliminated and/or are at very low density (1% - 20% coverage). Follow-up control is necessary to target the pest plant seed bank remaining in the soil. <p>Target:</p>	<ul style="list-style-type: none"> • These areas need to be comprehensively searched in summer until the seed bank is exhausted. • Foliar spraying is the common methodology during this control phase. Spot spraying should be carried out in summer when most seedlings have germinated and are easier to detect.
<i>Forest Protection Phase</i>	<ul style="list-style-type: none"> • Areas enter this phase when internal pest plant sources are essentially eliminated. Sites prone to reinvasion by weed pests should be checked annually (e.g. reserve edges and tracks). • This is the most skilful yet rewarding phase of ecological restoration. • Areas in the Forest protection phase should always be considered high priorities when programming weed control. 	<ul style="list-style-type: none"> • It is recommended that the entire area be thoroughly searched annually during summer. • Spot spraying or the manual removal of seedlings where appropriate should be the only methodologies required during the restoration phase.

Adopting this restoration phase model is more practical for on the ground weed control when compared with more traditional weed distribution maps and weed control methodologies. This is not to say that mapping weed distributions do not have benefits. As mentioned a number of times within this Strategy, weed control technicians can map weed distributions as they carry out weed control operations to help illustrate the extent of infestations and success of weed control operations.

The Best Practice Methodology described here takes some of the dependence away from more traditional maps and thorough surveying and weed control practices. Restoration phases can dictate what methodologies are required for each area and the general density of weed species within a site. Due to the relative consistency of restoration phases within different sites, an average price per hectare can be established to allow for simpler costing of work.

It should be noted however that parameters such as terrain, density of bush and site accessibility need to be considered. This information is normally collected by the contractor during normal work operations and would need to be provided in a common format to Waitakere City Council for analysis to provide long-term information on the weed control carried out.

Rates per hectare can also be used to establish monitoring practices regarding herbicide rates, amount of work completed and time taken to evolve into the next phase. Monitoring should be established within all projects if Best Practice methodologies are to be followed.

Extrapolating data and costs can in turn help management predict when costs for a particular site become minimal. Alternatively, one can predict when minimal maintenance is required within current sites; therefore when additional sites can be managed within the same budget.

9.5 Follow-up

The Best Practice Methodologies outlined in Section 9.4, illustrate how ongoing effort and investment is required for any weed control programme to ensure the achievement of goals (i.e. protection of ecological values from the impacts of weeds).

After Initial control weeds will often resprout from fragments, seeds will germinate, new seeds or other propagules will disperse into the site, and in some cases treated plants are simply resistant to treatments. Weed control creates gaps in the vegetation, providing further opportunities for weed establishment. Follow-Up, Low Density Follow Up and finally Forest Protection are required as long as there are weed sources in the vicinity of the restored site. The level of ongoing effort needed will be relatively low if the restoration phase process has been followed. At the Forest Protection Phase, searching for and finding weeds that have become rare at a site should take more of the weeder's time and concentration than the actual control effort. This phase requires experienced and skilled weed control technicians.

Ideally by the Low-density follow-up phase, desirable species released from the competitive pressure created by the weeds will become more dominant, thereby reducing the ability of any weeds to re-establish. If the restoration phase sequence is not followed within the appropriate timeframes, weed species will re-establish and the outcomes sought will require more time and money than would otherwise be necessary.

9.6 Optimal timing for weed control

The proposed timing of weed control within each restoration phase is summarised in Figure 9.3 below. The success of this programme depends on contractors undertaking control within these time frames and recommended frequencies. They have been trailed and proven successful and cost effective through years of experience and knowledge of the behaviour and growth patterns of environmental weed species in Auckland.



Figure 9.3: Optimal timing for weed control applications.

For successful and effective weed control the timing of weed management should follow figure 9.3 and the cycles listed below for each restoration phase.

Long term Initial Control:

Long-term initial control becomes necessary when removal of all pests would have a detrimental effect on the environment. It can be carried all year round. On site conditions will dictate the length of time required before the area moves into the Follow-up restoration phase. It is often three years or more.

Initial control:

Initial control can be undertaken all year round. These areas should become Follow-up control after one year of Initial control operations

Follow-up control:

Control must be undertaken twice a year, once in spring and once in autumn to enable the area to move into the Low density follow-up control phase.

Low density follow-up control:

Low-density follow-up control is generally controlling germinating weed seedlings. Control should be undertaken once a year in summer to allow seeds within the soil to germinate. The time taken to move into the Forest protection phase will depend on the quantity of seeds and species present within the seed bank. Some seeds can persist for a number of years within the soil.

Forest protection:

Control should occur once a year in summer. As long as the frequency and timing of recommended control is upheld the area should remain within a Forest protection phase requiring minimal management therefore largely reduced costs.

With ongoing effective weed control, (with the exception of long term initial control sites), the costs within specific areas should dramatically reduce within the first two years of weed control, and level out to a constant low maintenance level.

9.7 Recording and Monitoring

The main purpose of monitoring work programmes and contracts is to see if objectives and targets have been met. In the case of this Weed Management Strategy monitoring can be used to determine the progress made in ecologically restoring Waitakere. Monitoring can be a measurement of change in weed abundance or of the native plant community following weed control. Monitoring is useful in any evaluation of the effectiveness of individual weed control programmes and of this Strategy. Fundamentally a field exercise, monitoring takes time and costs money, but without it, it is hard to justify, measure and evaluate effectiveness of the City's ongoing investment into weed control.

To make the most of the new restoration phase model and the information that can come from it, the contractor must keep daily records. Data recorded should include:

- Exotic species present (i.e. non-target species)
- Weed species controlled
- Amounts and types of herbicide used
- Control techniques
- Hours spent in each area/ per phase
- The number of technicians controlling weeds within that area

This is a simple way to assimilate a range of extremely useful information. For example when recording species controlled, it would soon become apparent if a new weed is spreading through different areas, as it would repeatedly appear in control records, within different areas where it was previously not controlled.

Monitoring should be done utilising information provided by the contractor. Spray diaries and a record of total hours spent in each reserve provide valuable information that is generally required from contractors but underutilised as a monitoring tool.

This information is normally collected by the contractor during normal work operations and needs to be provided in a common format to Waitakere City Council for analysis and to provide long-term information on the weed control carried out.

To monitor long-term progress of weed control in a reserve, details recorded by the contractor can be used to build up a picture of effectiveness. Records should be collected for each restoration phase per reserve. Where a reserve is divided into more than one restoration phase, records should be separated into the different phases. Records collected for each reserve and/or restoration phase can be used to determine:

- Whether work hours are increasing or decreasing within the given area. Successful weed control should cause work hours to drop dramatically after Initial control and over time down to a level consistent with the searching time required over the size of the area.
- Whether herbicide amounts, types and volumes are increasing or decreasing within the given area. Successful weed control should cause herbicide use to drop dramatically after initial control down to a low level consistent with the seedbank present or level of reinvasion pressure (such as boundary issues or bird introduced species).
- What target species were present at each stage of control? This can show which species are persisting, and any new introductions can be identified.
- Records collected can be used as the monitoring regime, supported by random audits to assess the effectiveness of weed control.
- Over time this information will greatly assist in estimating and projecting the costs required for weed control in each given area.
- This information can be used to determine when a given area can be reclassified into the next restoration phase.

Data could be provided either digitally or in paper form. What is important is that the data is collected for a known spatial area so that future comparisons can be made.

More traditional means of monitoring include:

- Sampling using relocatable and remeasurable transects and plots or belt-transects. These measures can collect substantial amounts of quantitative data, but can be time consuming and subjective, depending on the parameters recorded.
- Permanent Photopoints, where a series of photos are taken from the same location through time, are an effective and inexpensive way of displaying the result of weed control efforts.

9.8 Estimating Costs for Control and Letting Contracts

Consistent adherence to a set of standards and a predefined process for letting contracts is useful in order to minimise risks and enable effective evaluation of results. The following key points should be considered in the development of a standard process for letting weed control contracts and estimating costs:

- Provide the contractor with the most accurate information possible on which to base their tender. Information on the distribution of weed species is not always available or is costly to survey. A much more cost-effective means is to present a contractor with maps of the different restoration phases for each site. This can quickly be established by a walk through of each site. The contractor can then be provided with adequate information to compile their price.

- To ensure objectives are clear, reasonable targets and timeframes (in relation to the guidelines for restoration phases in Section 9.4) should also be provided. If necessary timeframes need to extend beyond Council financial year (i.e. beyond June 30th), to ensure the most efficient means of weed control can be employed. Contractors should be entitled to some input into control methods if they have prior knowledge of the control required.
- Outline how contractors' performance will be monitored or measured and the relevance of meeting these targets in terms of payment. This should include retention of a bond to be paid on successful completion of work e.g. progression of site to Follow-up Phase in the first year of control OR eradication of all mature (i.e. flowering) plants from Low-density follow-up areas.
- Where practical, contracts should include deadlines for the completion of different restoration phases (e.g. follow-up is to be carried out from 1st September – 30th November and from 1st March – May 31st) see Section 9.6.
- Inform the local community that work is being undertaken.
- Obtain an exit report including an outline of any problems encountered, particularly in relation to efficacy of herbicide.
- Close supervision of contracts will ensure that:
 - Health and safety obligations are met.
 - Contractors meet their contractual targets.
- Other considerations:
 - Market rates and the relative value that different contractors provide including their experience, training and ability to carry out weed control in sensitive environments.
 - The ability of contractors to follow Best Practice Methodologies (i.e. restoration phases).
 - Costs of herbicides and other materials.
 - Accessibility of the site and how this might impact costs.
 - Appropriate methodology for control of each weed species present and how this might affect the time taken to complete the work.
 - The requirement for the contractor to search for weeds vs. treating known infestations, and the consequent time needed to undertake the work.

9.9 Minimising the Spread of Weeds

The following measures should be encouraged to prevent human activities facilitating the spread of weeds.

- Weed hygiene:
 - Dispose of any vegetation removed appropriately (e.g. bring to a transfer station that composts green waste in a manner that eliminates any viable seed (i.e. leaves the vegetation in piles whereby heat will destroy any seed), or dispose of as landfill.)
 - When controlling weeds consider how to minimise spread on personnel, machinery or other equipment. Many weeds are easily transported via seed or fragments.

Examples of good weed hygiene include transporting weed vegetation in a covered trailer and cleaning boots after working in infested sites.

- When clearing weed species that spread vegetatively via fragments, use control methods that kill plants in situ prior to removing them. For example, use drill and inject methods to kill willows, rather than felling, to prevent spread via fragments.
- Minimise disturbance to existing vegetation and soil where possible.
- Kill weeds prior to flowering or remove flowers, fruit or other sources of propagules. This is often not practical, especially in highly infested areas. The focus in this case should then be to target young seedlings before they flower/fruit during Follow-up phases.
- Dispose of unwanted weed material and garden rubbish in appropriate places such as the vertical composting unit or to landfill via the Transfer Station.
- Prepare a vegetation and soil removal/disposal code of practice.
- Do not attempt to compost weed material unless suitable facilities are available.
- Educate the public on the conservation value of roadside vegetation and the roles of roads as weed vectors within the landscape
- Promote native planting programmes, to help minimise the amount of weed, or potential weed species planted in private gardens.

9.10 Weed Suppression

Revegetation can be effective in preventing the re-establishment of weeds following control. Where practical, revegetate disturbed sites in order to exclude further weed establishment. Where revegetation is employed as a method to prevent further weed invasion, the aim should be to rapidly produce 100% native plant cover. It is only once ground and/or canopy cover is complete that the full potential of weed suppression is realised and weed maintenance requirements are kept to a minimum.

Revegetation is ideal in situations of large-scale weed clearance that leaves significant areas open. Where ground and/or canopy cover is maintained, active revegetation becomes less important as the retained vegetation helps suppress germinating weed species.

To ensure optimum survival of plantings, weeds should be controlled to a low to zero density before revegetating the site.

Revegetation for weed control is not appropriate in all cases. In natural areas it can be preferable to allow regeneration to occur naturally. Alternatively, planting may be undertaken for the purpose of enhancing natural regeneration where a seed source is not available, e.g., establishment of kahikatea saplings beneath a kanuka canopy adjacent to a stream margin. This type of revegetation will not assist with weed suppression, as it will not produce rapid, complete cover. The amount of plants required for revegetation will be decided by the objectives of the revegetation plan.

There are many other methods of weed suppression. The variety of methods available however can prevent, or impede a number of processes in the ecosystem. For example bark mulch can severely compromise the bacteria communities within the soil. As restoring sites to a *functioning* ecosystem is the goal of this Weed Management Strategy in line with the vision of the Green Network, mulching is not recommended as a tool for weed suppression.

9.11 Herbicide Use

Waitakere City Council's current approach to the management of herbicide use for weed control in parks and roadsides includes:

- A list of approved (low toxicity) chemicals to be used for Council works. The Council's Engineer to the contract must first approve the use of any other herbicides. In addition, resource consent may be required from the Regional Council for use of herbicides other than low toxicity products.
- A 'no spray' register for roadside and park boundary areas and where local residents do not wish herbicides to be used.
- Public notification of herbicide use prior to commencing application and a timetable for spraying is available through the Council's Call Centre.
- Contractors are required to conform to current Best Practice when applying herbicide for weed control.
- The draft Herbicide Reduction Policy which aims to *“reduce the impacts of herbicides used by the Council on health (ecological and human) while maintaining effective weed control through selection of methods, timing and clean practices”*.

Control methods should be socially, culturally and ethically acceptable, efficient, non-polluting, should not adversely affect native flora and fauna, human health and well-being, domestic animals, or crops. While adherence to these standards may at times be difficult to achieve, these should be regarded as appropriate goals when balancing the costs and benefits of control against the target outcomes. The following are general guidelines for the choosing a herbicide and application method:

- Ensure staff are Growsafe trained and aware of environmentally sensitive applications of herbicides.
- Use chemicals that are as species-specific as possible, while ensuring the herbicide applied is the most effective herbicide at controlling the plant while maintaining environmental sensitivity.
- Use a low concentration of herbicide while still being effective.
- Use chemicals that are non-persistent and non-accumulative in the food chain where possible.
- Employ direct application methods (e.g., cut and stump painting, spot spraying, drill and inject) wherever possible to minimise the volume of herbicide used and non-target effects.
- Only control invasive weed species along roadsides and in parks (i.e. do not spray non-invasive annuals and herbaceous weeds). The exception to this guideline may be when herbaceous/non-invasive weeds are controlled along footpaths to protect the asset and aesthetic reasons.
- Physical control methods may be a viable option for some weeds, however this is dependent on the weed species, the labour force available (and its cost), and the size and spread of the infestation. For example, physical methods are effective at controlling small infestations of some weed species (such as you might find in a cottage garden)

with regular Follow-up (weeks or months). However, herbicides are substantially more cost effective for larger areas and require less frequent follow-up.

- Manual control is likely to require more frequent follow-up than herbicide treatment, hence it is important to ensure that the labour force is available for both Initial control and ongoing maintenance.
- At all times the (draft) Waitakere City Council herbicide reduction policy should be followed:
 - Prevent the need for weed control (through preventing the formation of weed habitat, strategic control of weeds, quick response to weed reports and good weed hygiene);
 - Continue to select herbicides that are the most effective but least toxic for the control of weeds and minimise the amount sprayed to help reduce any possible effects on the surrounding environment.
 - Respond to public concern and requests to participate (e.g. No Spray Register, Green Network Community Assistance Programme, etc).

10. Funding Allocation and Priorities

Priority should be given to weed control that directly supports the goal of this Strategy: *"Protection of the quality, resilience, biodiversity and ecological integrity of Waitakere's natural habitat from the impacts of environmental weeds"*.

This is best achieved by:

1. Using a site-led approach to weed control.
2. Continuing to meet statutory obligations under the RPMS while emphasising valuable sites and the goal of the Strategy.
3. Ensuring that the public understands where weeds come from, how they impact the environment, and what they might do about them. Ongoing public support is essential.

In order to maximise the value of the money spent towards achieving this goal the City Council must ensure adherence to Best Practice Guidelines. These are designed to minimise wasted effort by targeting effort where and when it is needed most. In addition, setting targets and monitoring weed control activities will allow the Council to report on their effectiveness. Without adherence to "Best Practice" weed control will not be effective in the long term.

11. Definitions

ARC	Auckland Regional Council
Biodiversity	Refers to the numbers of species and the variety of life and habitat types in a community, as well as the amount of genetic variation within a single species.
Buffer	An area, not necessarily of high natural value, from which weeds may invade the core high value site that is the focus of a site-led programme. Control is undertaken in the buffer area to lessen the probability of reinfestation of the core site.
Containment	Limiting the spread of a weed allowing it to be contained within defined geographical boundaries.
DOC	Department of Conservation
Eradication	The complete removal of a weed species from New Zealand, a large region, or from the city. Eradication is one of the possible objectives of a weed-led control programme.
Monitoring	Is the measurement of change. In terms of this Strategy, it relates to measuring change in the abundance and condition of weed and native plant populations over time as a result of weed control.
Outcome objective	Expressed in terms of the values that one is trying to protect by doing weed control (e.g., why you are doing the weed control: to protect biodiversity). It describes the objective of the control as a measurable target that must be met in order to demonstrate efficacy. Outcomes targets can only be set and measured in site-led control programmes.
Practicality	Describes whether it is practical to achieve containment or eradication in a reasonable time and cost.
Programme objective	Describes measurable result and outcome targets for a control programme.
Result objective	Expressed in terms of the target weed(s) , it describes the objective of the control and a measurable target that must be met in order to demonstrate efficacy. These objectives and targets are used in the context of monitoring the means by which the outcomes are achieved. For weed-led programmes we are only interested in results.
Site-led	Site-led control of environmental weeds is for the specific purpose of protecting high value sites from weed impacts. Any weed species that impacts the values at the site may be the focus of control. A site-led programme involves ongoing control at the core high value site and associated buffers .
Urgency	Relates to the immediacy of the threat posed by weed(s) to a site and its values, however, at an early stage of invasion the practicality of control may mean that despite a small immediate threat, control now would reduce any future threat. Criteria for assessing urgency are given under

Objective 1 (site-led control).

WCC	Waitakere City Council
Weed	An invasive plant that has an actual or potential impact on natural areas
Weediness	An assessment of the relative threat a weed species poses (compared to other species), in terms of its biological successfulness and its impact on the environment.
Weed-led	The objective of a “ weed-led ” control programme is to eradicate or contain the distribution of significant new invasive weeds where this is feasible, in order to minimise future problems. “Weed-led” was coined because the objective of eradication or containment relates to a particular weed species. Weed-led programmes necessarily span arbitrary boundaries. The target weed species is controlled wherever it occurs. Site values are irrelevant.

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Appendix 1: Weediness Criteria

A] Criteria for Establishing “Effect on System” (EoS) Scores

CRITERION	SCORE			
	0	1	2	3
Capable of significantly changing the composition or structure of habitat.	Does not affect structurally dominant species*	Minor change in composition of dominant species* Little change to basic structure*	Medium effect on composition of dominant vegetation. Some impact on structure*	Major changes to composition of dominant species* (e.g., sycamore replacing podocarp forest): <u>OR</u> major or complete changes to structure* of habitat (e.g., tussock land changes to scrubland)
Significant change (aquatic species)	No significant effect on native species or water quality or movement	Minor effect on native species, water quality or movement.	Moderate effect on native species or water quality or movement.	One or more of: water courses covered; restricts free flow of water; major increase in sedimentation; completely suppresses native vegetation.
Suppress regeneration	No significant effect	Some effect on limited component of systems regeneration	Major effect on limited component of system; <u>OR</u> some effect on composition of dominant species*	Major effect on many native species or on the composition or density of dominant species*
Plant's persistence over time		A plant's lifespan is less than 5 years	A plant's lifespan 5-50 years.	Individual plant's lifespan of over 50 years; <u>OR</u> species forms self-sustaining monoculture

B] Criteria for Establishing “Biological Success Rating” (BSR) Scores

CRITERION	SCORE			
	0	1	2	3
Maturation Rate		Sets seed only after 3 or more years; <u>OR</u> very slow vegetative growth	Sets seed within 2-3 years <u>OR</u> moderate vegetative growth	Sets seed within first year <u>OR</u> has very rapid vegetative growth
Seeding ability	No seed	Low seed set	100-1000 seeds per plant	More than 1000 seeds per plant
Persistence of seedbank	No seed	Seed is viable for less than one year	Seed has an estimated viability of 1-5 years	Seed has an estimated viability of over 5 years
Effectiveness of dispersal		Propagules spread by gravity or human introduction (e.g., garden waste dumping, vegetative escape from planted hedge, etc)	Propagules spread by wind or water	Propagules spread by birds, feral animals or very light wind
Establishment/ growth rate		Poor establishment and slow growth	Poor establishment and fast growth <u>OR</u> good establishment, slow growth	Good establishment and fast growth
Vegetative reproduction	No asexual spread	Minor importance	Moderate importance (e.g., stem layering, suckering)	Plant spread freely by stolons, rhizomes, bulbils or other asexual means
Habitat Requirements		Have specific habitat requirements.	Is able to tolerate a moderate range of environmental conditions.	Has a wide tolerance range of a number of habitat parameters.