

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 site 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).

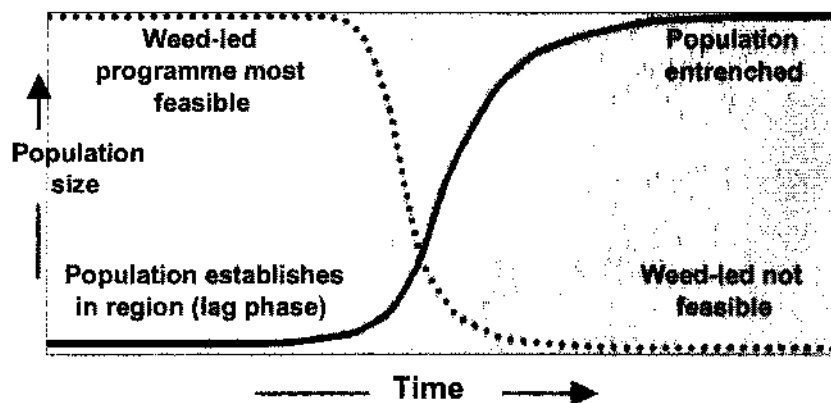


Figure 9.1: Relationship between population growth and the feasibility of a weed-led programme (adapted from Williams 1997).

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).

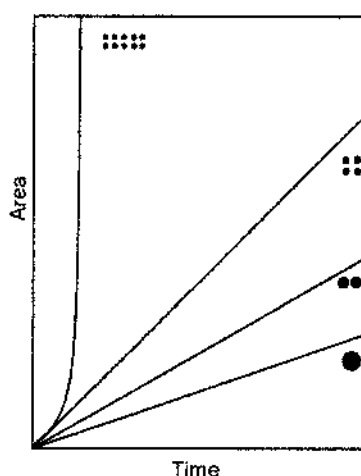


Figure 9.2 Several small infestations have a faster rate of new range occupation than fewer, larger infestations, even if the total area initially occupied and rates of spread are the same. All trajectories in this diagram start with weeds occupying the same area, and assume the same rate of spread (after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

PHASE	WINTER	SPRING	SUMMER	AUTUMN
Initial Control	■	■	■	■
Long Term Initial Control	■	■	■	■
Follow-up Control		■		■
Low density Follow-up Control			■	
Forest Protection			■	

■ unsuitable
■ optimum

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.

12. Bibliography

- Auckland Regional Council. 2002: Auckland Regional Pest Management Strategy. Auckland Regional Council.
- Auckland Regional Council. 2006. Protecting our natural environment: A discussion document for pest management in the Auckland region. Auckland Regional Council.
- Buddenhagen, C.E.; Timmins, S.M.; Owen S.J.; Champion, P.D.; Nelson, W., Reid; V.A. 1998: An Overview of weed impacts and trends. In: Owen, S.J. Department of Conservation Strategic Plan for Managing Invasive Weeds. Department of Conservation, Wellington, New Zealand.
- Denyer, K.; Cutting, M.; Campbell, G.; Green, C.; Hilton, M. 1993: Waitakere Ecological District survey report for the Protected Natural Areas Programme. Auckland Regional Council.
- Esler, A.E. 1987: The naturalisation of plants in urban Auckland, New Zealand. 3. Catalogue of naturalised species. *New Zealand Journal of Botany* 25: 539-558.
- Geritzlehner, J. 2000: The Standard Operating Procedure for Monitoring Weed Control. Internal document sponsored by Southern Regional Office. Department of Conservation, Science and Research Unit, Wellington, QD Code: NH 1234.
- Julian, A.; Davis, A.; Tyrrell, M. 1998: Ecological survey of Waitakere City lowlands, northwestern portion of Tamaki Ecological District: Significant indigenous vegetation and significant habitats of indigenous fauna. Draft report prepared for Waitakere City Council.
- Mack, R.N. 1985: Invading plants: their potential contribution to population biology. *In* Studies on Plant Demography: A Festschrift for John L. Harper. Ed. J. White. Academic Press, London. Pp 127-142.
- Owen, S.J. 1998: Department of Conservation Strategic Plan for Managing Invasive Weeds. Department of Conservation, Wellington. 86p.
- Shaw, W.B. 1994: Botanical rankings for nature conservation. *Science and Research Series No. 72*. Department of Conservation, Wellington. 17p
- Sullivan, J.J, Timmins, S.M and Williams P. A. 2005. Movement of exotic plants into coastal native forests from gardens in northern New Zealand. *New Zealand Journal of Ecology* 29 (1): 1-10.
- Waitakere City Council 1999: Waitakere City Parks Strategy.
- Waitakere City Council 2000: Annual and Strategic Plan 2000/01-2009/10, Our Future Today. Incorporating the Long Term Financial Strategy and Funding Policy Summary.
- Waitakere City Council. 2004, Draft Biodiversity Strategy and Action Plan.
- Williams, P.A. 1997: Ecology and management of invasive weeds. Department of Conservation, Wellington, New Zealand.

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.

PARKS FIVE YEAR WORK PROGRAMME

1.0 Introduction

The work programme proposed in the following sections will help achieve the objectives and targets stated within the Weed Management Strategy.

Objective one of the Strategy is to protect priority (high value) areas from the impacts of weeds. The parks five year work programme helps achieve this by identifying a list of priority sites for site-led weed control. See Appendix A for the list of prioritised reserves and their scores in each category. The prioritisation process includes the identification of reserves with social and cultural importance (see Appendix two). This process helps achieve Objective three of the Strategy, which strives to support and facilitate community understanding and involvement in the management of weed impacts.

Ensuring contractors follow the Best Practice Guidelines and Methodologies described within both the parks work programme and the Weed Management Strategy, this programme will help achieve Objective two of the Weed Management Strategy to minimise future costs via adoption of Best Practice Guidelines and surveillance at priority sites.

2.0 How to use the programme

The following maps provide a practical guide to reserves recommended as priorities for the next five years of ecological restoration work (weed management in particular). The maps represent a practical method of presenting each reserve. Each 'restoration phase' is mapped with a corresponding table of weed species likely to be present (or persisting within the seed bank) in each reserve. In this way weed control technicians can price, plan, programme, prioritise and manage each reserve in a method that will be efficient, cost effective and successful in the long term. For example, tendering for a contract with a large number of reserves can prove difficult for a contractor. Maps depicting the restoration phase(s) of each reserve generally give a better 'overall picture' of the state of current weed populations, therefore requirements for weed control. Parameters such as terrain and access will need to be considered; however over time as contractors build up records of 'average costs per restoration phase' a more accurate pricing regime will develop. Please note that boundaries of all maps must be ground checked, as aerial photos may not always give a true indication of the boundary.

Weed species lists were compiled by a combination of analysis of previous weed distribution maps, data recorded during Te Ngahere's 2004/2005 Environmental Weed Control in Parks Contract (No. PK 04623C) and surveys of the reserves during February and March 2006. Environmental weed seedlings and/or a seedbank may persist within a reserve despite not being observed in 2006; therefore, most species previously mapped (in the last 3-4 years) are recorded in the weed lists below.

Traditional weed distribution maps will no longer be as important as the 'restoration phase' can dictate what methodologies are required for each area and gives an estimate of the relevant densities of current weed species. The species lists are a guide to what species currently infest the different sites and/or species previously controlled in the area, therefore may still persist (in the example of Follow-up Control).

All areas are formed into subsets dependent on their current restoration phase, and the application method required for control. The description of each phase helps contractors assess the state of current weed infestations. The restoration phase sequence will also help in assessing the effectiveness of weed control as areas move down restoration phases towards forest protection where the site is ecologically restored.

The restoration phases used in the following maps are defined in Table 1.0 below:

Table 2.1: Definitions of Restoration Phases as outlined in Restoration Phase Distribution Maps for Priority Parks.

Restoration Phase	Procedure	Weed control methodologies
<i>Initial Control Phase</i>	<ul style="list-style-type: none"> • Environmental weed species are often at high – medium densities through this phase, and commonly weed control has not been implemented recently (>3 years). • Initial focus 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 year. 	<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 and minimised targets for consequential 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 plant pests. • 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 and minimised targets for consequential 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 following an initial control phase. • Follow-up control targets plant pests during the “spring flush” and pre winter before growth slows down. 	<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).
<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. Follow-up control is necessary to target the plant pest seedbank remaining in the soil. 	<ul style="list-style-type: none"> • These areas need to be comprehensively searched in summer until the seedbank 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. • A thorough work ethic is required during this phase

Restoration Phase	Procedure	Weed control methodologies
<i>Forest Protection Phase</i>	<ul style="list-style-type: none"> • Areas enter this phase when internal plant pest 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. 	<ul style="list-style-type: none"> • It is recommended that the entire area is 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 these restoration phases 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 previously mentioned, 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. This process should be used to continually adapt restoration phase maps for each reserve as control is carried out. It is important that restoration phase maps remain current so that the appropriate timing and frequency of control within each site is optimised.

2.1 Monitoring

The restoration phases 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 in approach within different sites, an average price per hectare can be established to allow for simpler costing of work by contractors and the Council. It should be noted however that parameters such as terrain, density of bush and site accessibility need to be considered in addition to this rate per hectare. 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. 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.

Planning by both Council management and contractors can use the same rates per hectare to help predict when a site can be restored to relatively low weed densities. Extrapolating data and costs can in turn help management predict when costs will stabilise for a given site (i.e. when forest protection will be achieved). If the Council can predict when minimal maintenance is required within current sites; this will allow for the planning for weed control in additional sites within the same budget.

To monitor long-term progress of weed control in a reserve, details such as hours worked, herbicide amounts, volume used and targets controlled 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 after initial control down to a low level once a reserve is within low density follow up control and forest protection phases. Herbicide use will be 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. Such monitoring practices should be established within all projects if Best Practice Guidelines are to be followed.

2.2 Optimal timing for weed control

The proposed timing of weed control within each restoration phase is summarised in Figure 1.0 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 2.1: Optimal timing for weed control applications.

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

Initial control:

Initial control can be undertaken all year round. This phase should become follow up control after one year of initial control operations.

Long term Initial Control:

Long-term 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.

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 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, 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.

The lists below recommend reserves to be controlled within the first two years of this work programme and beyond (note that a reserve is repeated within the same restoration phase when the area is not contiguous due to portions of grass, the twin stream buffer zone or a different restoration phase area):

3.0 Prioritisation

As described within the Weed Management Strategy, areas were prioritised according to:

- Ecological significance
- Urgency of control
- Practicality of control
- Whether the area is classed as an outstanding or significant natural area within the District Plan
- Whether an area already had a management plan
- Whether the site was regarded as an area of cultural significance.

See Appendix B for more details. Priority was then given to areas already subject to control operations over the last three years (i.e. during 05/06 and 04/05 weed control contracts).

The maps and tables below illustrate the different areas and their designated restoration phase(s): Initial control, Long term initial control, Follow-up control, Low density follow-up and Forest protection.

YEAR ONE: 2006/2007**Initial Control**

WARD	SITE	PHASE	HECTARES
Waitakere	Crows Reserve	Initial Control	6.99
	Te Henga Park	Initial Control	32.19
Henderson	Harbourview Lowland reserve	Initial Control	57.96
Total			97.14

Long term Initial Control

WARD	SITE	PHASE	HECTARES
Henderson	Akatea Park	Long Term Initial Control	1.10
Waitakere	Armour Bay Reserve	Long Term Initial Control	0.95
New Lynn	Inaka Esplanade	Long Term Initial Control	1.40
Total			3.45

Follow -up Control

WARD	SITE	PHASE	HECTARES
New Lynn	Bishop Park	Follow up	5.98
	Kaurimu Park	Follow up	0.88
	Kowhai Park	Follow up	5.07
	Little Muddy Creek Esplanade Reserve	Follow up	1.93
	Rahui Kahika Reserve	Follow up	12.07
	Wirihihana Park	Follow up	1.68
	Henderson	Chapman Strand	Follow up
Coletta Esplanade		Follow up	1.22
Cranwell Esplanade		Follow up	0.29
Cranwell Esplanade		Follow up	0.05
Cranwell Esplanade		Follow up	0.01
Dawnhaven Esplanade		Follow up	2.10
Falls Park		Follow up	0.05
Henderson Park		Follow up	2.42
Kelvin Strand		Follow up	2.18
Opanuku Reserve		Follow up	0.81
Plummer Domain		Follow up	0.22
Plummer Domain		Follow up	0.14
Plummer Domain		Follow up	0.02
Plummer Domain		Follow up	0.26
Spinnaker Strand		Follow up	3.87
Spinnaker Strand		Follow up	3.87
Massey	Epping Esplanade	Follow up	1.76
	Manutawhau Reserve/ Walk	Follow up	0.77
	Manutawhau Reserve/ Walk	Follow up	0.49
	Manutawhau Reserve/ Walk	Follow up	3.23
	Moire Park	Follow up	20.09
	Moire Park	Follow up	3.21
	West Harbour Esplanade	Follow up	6.61
Waitakere	Fawcett Esplanade	Follow up	0.07
	Fawcett Scenic Reserve	Follow up	0.06
	Henderson Valley Park	Follow up	0.96
	Henderson Valley Park	Follow up	0.21

Henderson Valley Park	Follow up	0.08
Henderson Valley Park	Follow up	0.11
Henderson Valley Park	Follow up	0.22
Henderson Valley Scenic Reserve	Follow up	0.48
Henderson Valley Scenic Reserve	Follow up	3.01
Kay Road Bale Fill	Follow up	50.79
Laingholm Scenic Reserve	Follow up	0.21
Laingholm Scenic Reserve	Follow up	1.36
Laingholm Scenic Reserve	Follow up	0.19
Laingholm Scenic Reserve	Follow up	0.18
Laings Esplanade	Follow up	0.73
Les Waygood Park	Follow up	6.06
North Piha Esplanade	Follow up	2.79
North Piha Strand	Follow up	4.15
Palamino Reserve	Follow up	4.56
Piha Domain	Follow up	4.44
Piha Domain	Follow up	0.39
Piha Esplanade Reserve	Follow up	1.72
Piha South Road Reserve	Follow up	0.63
Seibel Scenic Reserve	Follow up	1.83
Shona Esplanade Reserve	Follow up	6.37
Shona Esplanade Reserve	Follow up	0.11
Tane Reserve	Follow up	0.10
Tane Walk	Follow up	0.23
Tasman View Esplanade	Follow up	0.26
Te Henga Park	Follow up	10.72
Waitakere Quarry	Follow up	25.21
Waitakere Quarry	Follow up	57.37
Wekatahi Reserve	Follow up	0.71
Total		269.14

Low density Follow-up

WARD	SITE	PHASE	HECTARES
New Lynn	Beverly Hills Scenic Reserve	Low Density Follow-up	1.12
	Daffodil Scenic Reserve	Low Density Follow-up	0.67
	Little Muddy Creek Esplanade Reserve	Low Density Follow-up	3.30
	Tainui Reserve	Low Density Follow-up	1.68
Waitakere	Cascade Reserve	Low Density Follow-up	1.67
	Claude Able Reserve	Low Density Follow-up	2.26
	Driving Esplanade	Low Density Follow-up	2.13
	Kauri Reserve	Low Density Follow-up	7.23
	Laingholm Drive Esplanade Reserve	Low Density Follow-up	2.03
	Laingholm Scenic Reserve	Low Density Follow-up	4.94
	Raroa Park	Low Density Follow-up	0.37
	Ruru Reserve	Low Density Follow-up	0.31
	Taumata Scenic Reserve	Low Density Follow-up	1.22
	Waatarua Reserve	Low Density Follow-up	0.32
	Waatarua Reserve	Low Density Follow-up	0.12

	Waiatarua Reserve	Low Density Follow-up	0.58
	Warner Park	Low Density Follow-up	0.53
Henderson	Taipari Strand	Low Density Follow-up	14.30
Total			44.78

Forest Protection

WARD	SITE	PHASE	HECTARES
Waitakere	Bendalls Esplanade	Forest Protection	0.42
	Cascade Reserve	Forest Protection	4.20
	Douglas Scenic Reserve	Forest Protection	4.65
	Henderson Valley Scenic Reserve	Forest Protection	13.82
	Kauri Reserve	Forest Protection	17.73
	Ruru Reserve	Forest Protection	3.43
	Seibel Scenic Reserve	Forest Protection	9.66
	Waiatarua Reserve	Forest Protection	2.40
New Lynn	Rimu Esplanade	Forest Protection	6.06
Total	Total		62.37

Note that once a reserve is at the forest protection phase the source of weed infestations is generally from outside the boundaries of the reserve. At this stage Waitakere City Council should target neighbouring properties of these parks in an attempt to widen the area of ecological restoration as per the Green Network principles. Education and community assistance will become important tools in connecting the restored areas to form a more holistic approach to the ecological restoration of the City. It is likely that most surrounding properties under private ownership will begin the restoration phase process at the initial control phase.

YEAR TWO: 2007/2008

Continue with all weed control from year one. If processes have been followed areas of initial control should progress to the Follow-up restoration phase. Follow-up should now become Low density follow up. It is anticipated that Long term initial control, Low density follow up and Forest protection phases will remain constant. Areas classed as Low density follow up will not progress to the Forest protection phase until the entire environmental weed seedbank within the soil has germinated and subsequently been controlled. The timeframe for this process depends on the species present however it is likely to take at least three years.

Areas regarded as a high priority for weed control should now be included in Initial control operations within year two.

Initial Control

WARD	SITE	PHASE	HECTARES	
Waitakere	Armour Bay Reserve	Initial Control	6.14	
	Armour Bay Reserve	Initial Control	1.36	
	Big Muddy Creek Esplanade	Initial Control	3.72	
	Big Muddy Creek Landing	Initial Control	0.54	
	Pendrell Reserve	Initial Control	0.30	
	Seaview Road Plant Reserve - 1	Initial Control	0.02	
	Seaview Road Plant Reserve - 2	Initial Control	0.25	
	Massey	Chorley Reserve	Initial Control	2.02
		Colwill Esplanade	Initial Control	1.12
Colwill Esplanade		Initial Control	0.12	
Colwill Esplanade		Initial Control	0.17	
Colwill Esplanade		Initial Control	0.17	
Colwill Esplanade		Initial Control	0.62	
Lowtherhurst Reserve		Initial Control	0.79	
Lowtherhurst Reserve		Initial Control	0.05	
Lowtherhurst Reserve		Initial Control	3.90	
Sunline Esplanade		Initial Control	2.10	
Sunline Park		Initial Control	1.06	
Zita Maria Park		Initial Control	4.83	
New Lynn		Karaka Park	Initial Control	1.33
	Manukau Margin Reserve	Initial Control	0.54	
	Swanson Scenic Reserve	Initial Control	5.90	
	Swanson Scenic Reserve	Initial Control	0.63	
Total			37.68	

Long term Initial Control

WARD	SITE	PHASE	HECTARES
Henderson	Akatea Park	Long Term Initial Control	1.10
Waitakere	Armour Bay Reserve	Long Term Initial Control	0.95
New Lynn	Inaka Esplanade	Long Term Initial Control	1.40
Total			3.45

Follow-up control

WARD	SITE	PHASE	HECTARES
Waitakere	Crows Reserve	Follow-up control	6.99
	Te Henga Park	Follow-up control	32.19
Henderson	Harbourview Lowland reserve	Follow-up control	57.96
Total			97.14

Low density follow-up control

WARD	SITE	PHASE	HECTARES	
New Lynn	Bishop Park	Low Density Follow-up	5.98	
	Kaurimu Park	Low Density Follow-up	0.88	
	Kowhai Park	Low Density Follow-up	5.07	
	Little Muddy Creek Esplanade Reserve	Low Density Follow-up	1.93	
	Rahui Kahika Reserve	Low Density Follow-up	12.07	
	Wirihana Park	Low Density Follow-up	1.68	
	Beverly Hills Scenic Reserve	Low Density Follow-up	1.12	
	Daffodil Scenic Reserve	Low Density Follow-up	0.67	
	Little Muddy Creek Esplanade Reserve	Low Density Follow-up	3.30	
	Tainui Reserve	Low Density Follow-up	1.68	
	Henderson	Chapman Strand	Low Density Follow-up	1.55
		Coletta Esplanade	Low Density Follow-up	1.22
Cranwell Esplanade		Low Density Follow-up	0.29	
Cranwell Esplanade		Low Density Follow-up	0.05	
Cranwell Esplanade		Low Density Follow-up	0.01	
Dawnhaven Esplanade		Low Density Follow-up	2.10	
Falls Park		Low Density Follow-up	0.05	
Henderson Park		Low Density Follow-up	2.42	
Kelvin Strand		Low Density Follow-up	2.18	
Opanuku Reserve		Low Density Follow-up	0.81	
Plummer Domain		Low Density Follow-up	0.22	
Plummer Domain		Low Density Follow-up	0.14	
Plummer Domain		Low Density Follow-up	0.02	
Plummer Domain		Low Density Follow-up	0.26	
Spinnaker Strand		Low Density Follow-up	3.87	
Spinnaker Strand		Low Density Follow-up	3.87	
Taipari Strand		Low Density Follow-up	14.30	
Massey	Epping Esplanade	Low Density Follow-up	1.76	
	Manutawhau Reserve/Walk	Low Density Follow-up	0.77	
	Manutawhau Reserve/Walk	Low Density Follow-up	0.49	
	Manutawhau Reserve/Walk	Low Density Follow-up	3.23	
	Moire Park	Low Density Follow-up	20.09	
	Moire Park	Low Density Follow-up	3.21	
	West Harbour Esplanade	Low Density Follow-up	6.61	
Waitakere	Fawcett Esplanade	Low Density Follow-up	0.07	
	Fawcett Scenic Reserve	Low Density Follow-up	0.06	
	Henderson Valley Park	Low Density Follow-up	0.96	
	Henderson Valley Park	Low Density Follow-up	0.21	
	Henderson Valley Park	Low Density Follow-up	0.08	



Henderson Valley Park	Low Density Follow-up	0.11
Henderson Valley Park	Low Density Follow-up	0.22
Henderson Valley Scenic Reserve	Low Density Follow-up	0.48
Henderson Valley Scenic Reserve	Low Density Follow-up	3.01
Kay Road Baie Fill	Low Density Follow-up	50.79
Laingholm Scenic Reserve	Low Density Follow-up	0.21
Laingholm Scenic Reserve	Low Density Follow-up	1.36
Laingholm Scenic Reserve	Low Density Follow-up	0.19
Laingholm Scenic Reserve	Low Density Follow-up	0.18
Laings Esplanade	Low Density Follow-up	0.73
Les Waygood Park	Low Density Follow-up	6.06
North Piha Esplanade	Low Density Follow-up	2.79
North Piha Strand	Low Density Follow-up	4.15
Palamino Reserve	Low Density Follow-up	4.56
Piha Domain	Low Density Follow-up	4.44
Piha Domain	Low Density Follow-up	0.39
Piha Esplanade Reserve	Low Density Follow-up	1.72
Piha South Road Reserve	Low Density Follow-up	0.63
Seibel Scenic Reserve	Low Density Follow-up	1.83
Shona Esplanade Reserve	Low Density Follow-up	6.37
Shona Esplanade Reserve	Low Density Follow-up	0.11
Tane Reserve	Low Density Follow-up	0.10
Tane Walk	Low Density Follow-up	0.23
Tasman View Esplanade	Low Density Follow-up	0.26
Te Henga Park	Low Density Follow-up	10.72
Waitakere Quarry	Low Density Follow-up	25.21
Waitakere Quarry	Low Density Follow-up	57.37
Wekatahi Reserve	Low Density Follow-up	0.71
Cascade Reserve	Low Density Follow-up	1.67
Claude Able Reserve	Low Density Follow-up	2.26
Driving Esplanade	Low Density Follow-up	2.13
Kauri Reserve	Low Density Follow-up	7.23
Laingholm Drive Esplanade Reserve	Low Density Follow-up	2.03
Laingholm Scenic Reserve	Low Density Follow-up	4.94
Raroa Park	Low Density Follow-up	0.37
Ruru Reserve	Low Density Follow-up	0.31
Taumata Scenic Reserve	Low Density Follow-up	1.22
Waiatarua Reserve	Low Density Follow-up	0.32
Waiatarua Reserve	Low Density Follow-up	0.12
Waiatarua Reserve	Low Density Follow-up	0.58
Warner Park	Low Density Follow-up	0.53
Total		313.92

Forest Protection

WARD	SITE	PHASE	HECTARES
Waitakere	Bendalls Esplanade	Forest Protection	0.42
	Cascade Reserve	Forest Protection	4.20
	Douglas Scenic Reserve	Forest Protection	4.65
	Henderson Valley Scenic Reserve	Forest Protection	13.82
	Kauri Reserve	Forest Protection	17.73
	Ruru Reserve	Forest Protection	3.43
	Seibel Scenic Reserve	Forest Protection	9.66
	Waiaatarua Reserve	Forest Protection	2.40
New Lynn	Rimu Esplanade	Forest Protection	6.06
Total			62.37



YEAR THREE: 2008/2009

Continue with all weed control from year one and two. If processes have been followed areas of initial control should progress to the Follow-up restoration phase. Follow-up should now become Low density follow up. It is anticipated that Long term initial control, Low density follow up and Forest protection phases will remain constant. Areas classed as Low density follow up will not progress to the Forest protection phase until the entire environmental weed seedbank within the soil has germinated and subsequently been controlled. The timeframe for this process depends on the species present however it is likely to take at least three years.

Areas regarded as a high priority for weed control should now be included in initial control operations within year three.

Initial control

WARD	SITE	PHASE	HECTARES	
Waitakere	Awhiorangi Reserve	Initial Control	1.42	
	Foster Strand	Initial Control	1.02	
	Marine Parade	Initial Control	0.46	
	Plantation Reserve			
	Seibel Park	Initial Control	0.77	
	Swanson Stream Reserve	Initial Control	0.22	
	Swanson Stream Marginal Strip	Initial Control	1.12	
	Swanson Stream Esplanade Reserve	Initial Control	3.74	
	Taumatarea Esplanade	Initial Control	2.85	
	Waitoru Reserve	Initial Control	13.25	
	Waitoru Reserve	Initial Control	2.28	
	New Lynn	Gill Esplanade	Initial Control	0.51
		Gill Esplanade	Initial Control	1.39
Gill Esplanade		Initial Control	1.58	
Gill Esplanade		Initial Control	0.54	
Konini Pt Reserve - 1		Initial Control	0.14	
Konini Pt Reserve - 2		Initial Control	0.13	
Okewa Reserve		Initial Control	0.22	
Massey	Kowhai Beach Reserve	Initial Control	0.36	
	Realm Esplanade	Initial Control	2.06	
	Wickstead Strand	Initial Control	0.84	
Henderson	Opanuku Stream Reserve	Initial Control	0.92	
Total			35.82	

Long term Initial Control

WARD	SITE	PHASE	HECTARES
Henderson	Akatea Park	Long Term Initial Control	1.10
Waitakere	Armour Bay Reserve	Long Term Initial Control	0.95
New Lynn	Inaka Esplanade	Long Term Initial Control	1.40
Total			3.45