

Alligator Weed Control 2004/2005



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1 Introduction

Alligator weed (*Alternanthera philoxeroides*) has been described as one of the world's worst aquatic and terrestrial weeds. Originally from Brazil, alligator weed is now a major weed problem in parts of the United States, Australia, China, India, Thailand and Indonesia. It was first discovered in New Zealand in the northern Wairoa River, near Dargaville, in 1906. Alligator weed is an accidental introduction to New Zealand and is believed to have arrived with ship ballast. It is now widespread in Northland where it has become a serious weed of waterways and cropping land. It is common in Auckland waterways and there are one or two sites in the Bay of Plenty, Christchurch and Taurimaranui. There are several infestations in a range of habitats in the Waikato.

Aquatic alligator weed takes root in shallow water and on stream banks, or floats as 'rafts' of vegetation. Stems can grow up to 10 metres out over water, and up to 1 metre in height. Aquatic alligator weed grows very quickly and can rapidly overtake streams and drainage canals, clogging them with vegetation and trapping sediments, thus increasing the risk of flooding. In natural wetland areas alligator weed is a threat to native flora and fauna, and would be extremely difficult to eradicate in such a habitat once established. On rivers and lakes it can form large mats, altering natural vegetation, interfering with recreational activities and poses a threat to hydro power.

As a terrestrial weed, alligator weed is capable of rapid growth, particularly under warm, wet conditions and can out-compete crops and pastures. On land it tends to have a different growth form from that of the aquatic form, being more prostrate and developing a very deep root system. Alligator weed will take up heavy metals from the soil and is believed to be toxic to livestock.



Photo 1: Terrestrial alligator weed

Alligator weed is a subtropical plant, flourishing in warm, damp conditions with growth slowing considerably over winter months. Reasonable frosts will knock back all vegetation, however underground stems and the root system persist and vigorous re-growth occurs in spring.

Alligator weed's 'weediness' can be attributed to its tolerance of a wide range of habitats; very rapid growth rate under favorable conditions; extremely efficient vegetative reproduction, and its ability to quickly bounce back from conventional weed control techniques. It does not set seed in New Zealand but the plant stems break easily and rapidly form root systems. Alligator weed is subsequently spread through the transport of stem fragments naturally via water movement, and through human activities such as boating, fishing, drainage works, agricultural contracting and soil movement – particularly soil movement associated with subdivision development.

Few herbicides are effective against alligator weed and most do not translocate very effectively into the root system so that, even though above ground vegetation dies off, underground parts remain viable and vegetation very quickly reestablishes. This is the situation with both glyphosate (Roundup™) and diquat, the only herbicides registered for use over water in New Zealand. While glyphosate knocks back alligator weed, where it is associated with other vegetation treatment with glyphosate appears to give it a competitive advantage as it recovers much more quickly than the other vegetation.

There have been many observations by Environment Waikato Biosecurity Plant Pest Contractors (BPPCs) and Biosecurity staff of alligator weed, post herbicide treatment, where the plant has been defoliated but the stems remain turgid and appear to be viable. Without follow-up treatment these stems quickly produce re-growth. There have been reports of treatment with glyphosate increasing dispersal of alligator weed due to increasing fragmentation of stems.

2 A brief history of Alligator Weed in the Waikato

Pre 1990: Two small infestations known, one on land at Orongo near Thames and one in a wetland area on the outskirts of Te Aroha. The Orongo infestation is believed to have originated from contaminated crop bins brought onto the farm from Northland. By 1990 the Orongo infestation was believed eradicated.

1990: Alligator weed discovered on the Lower Waikato River. The area was surveyed and Paul Champion, NIWA, was consulted over suitable control treatments. Alligator weed was found in patches over an area of approximately 27 hectares. It was mostly found in association with water celery (*Apium nodiflorum*). The recommended control treatment was an application of diquat in autumn followed by glyphosate or metsulfuron (Escort™) on any re-growth.

1993: Alligator weed had spread from the Lower Waikato upstream to delta islands.

1994: A report by Paul Champion (1994) found the use of Escort for the treatment of alligator weed has no adverse effects on fish and aquatic invertebrates. The report also found one annual treatment of alligator weed with metsulfuron was insufficient to effectively prevent its spread.

1994: Resource consent from Environment Waikato granted for the use of metsulfuron over water for the treatment of alligator weed in the Waikato River delta area. The five year consent restricts herbicide application to once a year.

1999: Above resource consent expires. New five year consent allows two applications of herbicide a year. Application of herbicide is restricted to three months of the year – December, February and March.

Alligator weed has spread further upriver as far as the Aka Aka Stream and the confluence with Mawhitiwhiti Stream.

Alligator weed was found to be cultivated in Hamilton City by Somalian and Sri Lankan communities who had mistaken it for the culinary plant mukunuwenna (*Alternanthera sessilis*).

2000: The new subdivision of Canaandale in Hamilton was found to have alligator weed. Spread appears to be due to soil movement associated with the development and 50 properties were affected. Isolated infestations also found during the next year in Te Rapa, Horsham Downs, Fairfield, adjacent Netherville retirement village, Caversham and Dinsdale (Plant Pest Advisory Services 2002). Treatment of these sites is carried out by the occupiers with ready-mixed herbicide in spray bottles supplied by BPPCs for Hamilton.

2001: Scattered infestations of alligator weed found along the Waikato River near Ohinewai and the outlet stream from Lake Whangape.

2002: Lake Whangape was surveyed and large areas of alligator weed found. A report by Champion (2002) affirms it has most likely been there for at least a year, possibly up to five years. The infestation was treated with glyphosate, however Champion (2002) advises the use of metsulfuron is necessary for eradication. The alligator weed was most likely brought into the Lake inadvertently by fishermen. The Department of Conservation (DoC) is the agency responsible for managing Lake Whangape. In 2003 they requested Environment Waikato Biosecurity organise a resource consent allowing the use of metsulfuron and asked for funding assistance for control.

Alligator weed was found in a cropping paddock on a Pukekawa farm.



Photo 2: Alligator weed on Lake Whangape

2003: Alligator weed was found in a wetland area on two adjacent dairy farms at Te Rore, near Te Awamutu. Part of the infestation area is under a QEII covenant. Diquat and glyphosate were used on aquatic alligator weed. Herbicide trials were set up on terrestrial alligator weed. Eelers were known to have used this site so it appears likely this has been the source of spread into Te Rore.

The historic Orongo infestation reappears after the land is contoured for drainage. Alligator weed is scattered over 7 paddocks in two properties.



Photo 3: Alligator weed at Te Rore

3 Alligator Weed 2004/2005

3.1 New infestations

Several new infestations were found in and around Hamilton City during 2004. These included a new subdivision (Somerset Heights), and industrial/commercial sites - Perry's landfill, Perry's sand mine, and Hamilton Organic Recycling Centre. Alligator weed was also found within Netherville Retirement village along with new infestations along the Resolution Drive road verge. Due to the high risk of spread of alligator weed from these sites, Environment Waikato Biosecurity group used the Restricted Places provision under the Biosecurity Act for the first time and placed notices on all these sites. The Restricted Place provision allows Environment Waikato staff to monitor all movement in and out of the site and ensure no activities are carried out which may result in further spread of alligator weed. Activities associated with subdivision (contaminated soil/vehicle/equipment movement) and disposal of contaminated green waste are the most likely cause of these new infestations, and it is probable these sites are related.

During March 2005 a new site of alligator weed was found on a maize property on the outskirts of Cambridge when an AgResearch consultant requested BPPC Chris Hale to identify an unknown weed in the paddock. The maize had already been harvested and sent off the property. Chris Hale traced the maize silage and inspected the properties concerned. No alligator weed was found but these properties will continue to be monitored. The Cambridge property is believed to be earmarked for subdivision development (a known exacerbator of alligator weed spread) and has been declared a Restricted Place to minimise the risk of spread.

In April a new site of alligator weed was confirmed at a residential property at Kihikihi. An alligator weed sample specimen seen during routine watering of Biosecurity office pot plants led the lady concerned later to identify alligator weed growing in a garden at the Waterford Birthing Centre in Hamilton (reported in August 2005).



Photo 4: Somerset Heights subdivision sediment pond

3.2 Control of Alligator Weed Under Resource Consent

Alligator weed is difficult to control and extremely difficult to eradicate once established. Mechanical control is out of the question as it breaks the plant into fragments, exacerbating spread. The only known successful eradication of alligator weed known in New Zealand was an infestation in the Bay of Plenty managed by Environment Bay of Plenty. The herbicide Starane™ (fluroxpyr) was used and applied up to monthly over about five years, effectively knocking the alligator weed back as it reappeared and exhausting the root system.

Environment Waikato has had greatest success using metsulfuron on aquatic and terrestrial alligator weed. Picloram plus triclopyr (Tordon™ Brushkiller) has also been used on terrestrial alligator weed, achieving reasonable control. To use metsulfuron over water requires resource consent. Consent for the use of metsulfuron over water in the Waikato River delta area was due to expire at the end of January 2005. (Effective ability to carry out control actually ended in December as this consent did not allow control work to be carried out in January). An alligator weed working group was set up comprising Environment Waikato Biosecurity staff and Plant Pest Contractors, DoC staff and NIWA to better manage alligator weed. In particular, it had become evident that the restriction of herbicide applications to three months over summer was seriously limiting the ability to achieve effective control of alligator weed in the Delta area and a major goal of the working group was to ensure a robust consent application for year-round control was developed. Chris Dawson, consultant from Bloxam, Burnett & Olliver was contracted to prepare a resource consent application to allow the use of metsulfuron over water at all known aquatic alligator weed sites. Environment Waikato Resource Use staff visited a number of alligator weed sites with Biosecurity staff and contractors, and were consulted throughout the development of the application. Proposed consent conditions were refined several times before everyone was satisfied a practical working document had been formulated.

While this consent application was being put together short term resource consents were approved for the use of metsulfuron over water at Somerset Heights, Te Rore and Lake Whangape. This allowed control work using metsulfuron to be carried out in these sites early in 2005.

Resource consent to use metsulfuron at all known sites of alligator weed was granted in March 2005 (Consent number 112000). For the first time, control work could be carried out at virtually any time of the year with restrictions on timing of herbicide applications now only limited to two weeks and weekends of the game hunting season, and the whitebait spawning season in known spawning areas of the delta. This is a huge improvement on past resource consent timing restrictions.

The Te Rore and Lake Whangape consents have now been surrendered as these areas are covered under the new consent. The Somerset Heights consent remains active.xxxx

4 Alligator Weed Control Works 2004/2005

Figure 1 shows all known sites of alligator weed in the Waikato as at the end of October 2005.

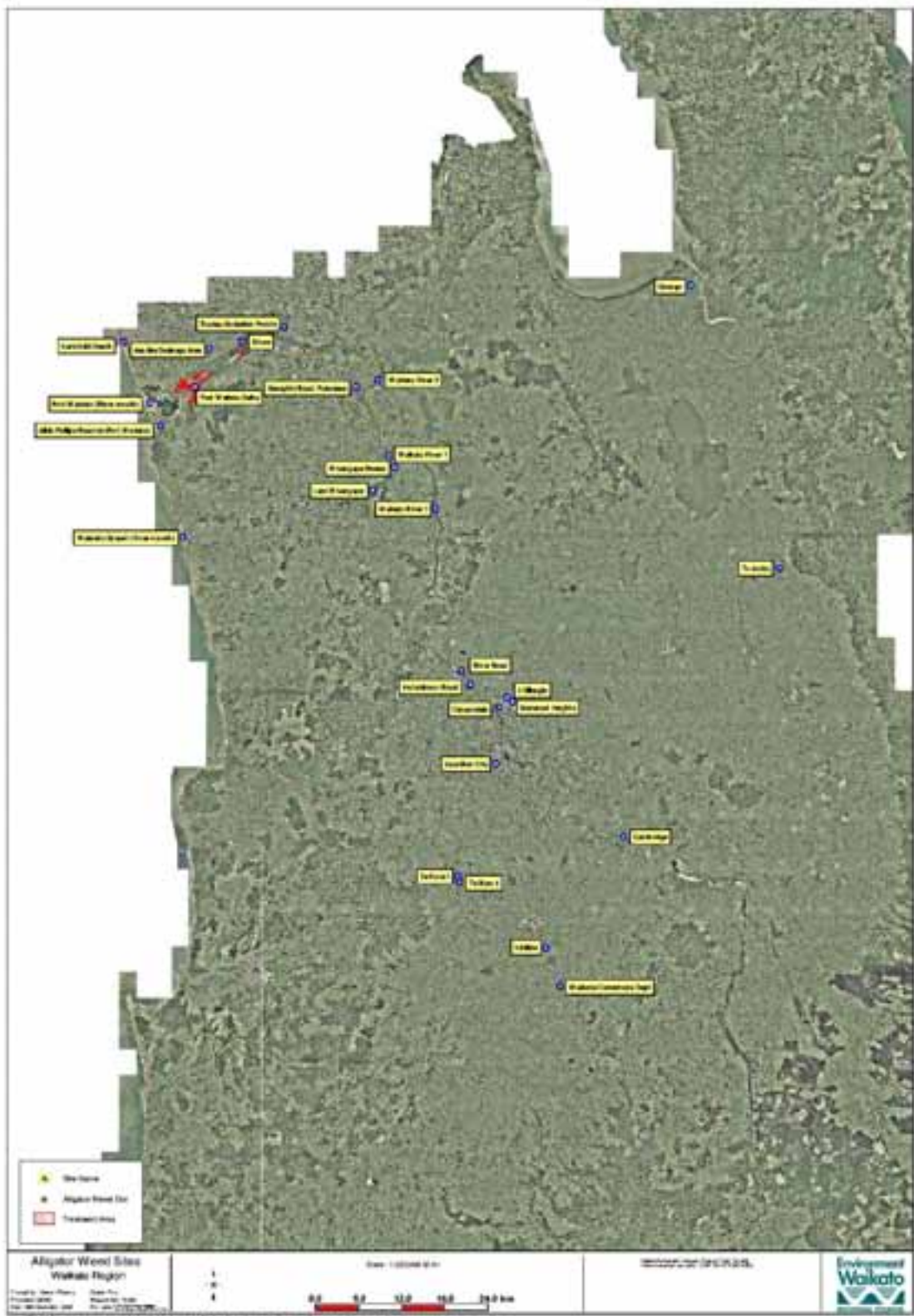


Figure 1: Known sites of alligator weed in the Waikato as at 31 October 2005.

The Waikato River delta area remains the largest alligator weed site with the weed scattered in patches over approximately 200 hectares. The delta is a unique

environment and has been classified as a 'Key Ecological Site' by Environment Waikato. The delta is tidal and much of the area is estuarine habitat. Access to much of the area is only possible by boat at mid to high tide. All control work and monitoring is strongly influenced by the variable weather conditions and dictated by tides.

The new resource consent allowed Environment Waikato Biosecurity to apply metsulfuron aerially for the first time and a total of 54 hectares has been treated by this method. Other control work has been carried out by airboat spraying by Aqua-Ag. Figure 2 shows the areas of the delta that have been treated.

Spraying at the delta began in December 2004 with three days spraying by airboat. This was carried out under the old resource consent which expired at the end of December. No further spraying was able to be carried out until the new consent was finally approved in March 2005. This put the seasonal control somewhat behind as alligator weed puts on vigorous growth over the summer. Airboat spraying under the new consent began in April and continued in the months of May, June, August, September and October – a total of 26 days were spent spraying at the delta by the airboat. Most treated areas have been covered twice in this time. A schedule of all airboat spraying carried out has been documented by Biosecurity staff and can be found in Appendix A. Copies of the spray diary sheets of Aqua-ag are also kept on file by Biosecurity. Airboat spraying is carried out using hose and gun and a herbicide mix of metsulfuron and glyphosate.

Fifty four hectares in the 'Reed Bed' area received aerial application of metsulfuron in May and a repeat application of 45.75 hectares was carried out late June. Although there was a good result from the aerial treatment, alligator weed is well known for its resistance to effective herbicide translocation throughout the whole plant, and its ability to bounce back within months is well known to Biosecurity staff and BPPCs. On a visit to the delta area in August by BPPC Phil Mabin, and Biosecurity staff Wendy Mead and Ben Parry to check on treatment effectiveness, alligator weed was found to be resprouting as expected. Follow-up of the aerially sprayed areas was carried out by airboat beginning at the end of August.

Monitoring Plots have been set up in the delta area. See monitoring section page 17.

4.1 Waikato River

In April and May Phil Mabin and Ben Parry surveyed the Waikato River from Hamilton to Port Waikato and all alligator weed found was sprayed with metsulfuron and roundup. Fifty sites of alligator weed were found – three between Ohinewai and Whangape Stream, 46 between Whangape and Tuakau, and one between Tuakau and the 'Elbow'.

4.2 Albie Philips Reserve, Port Waikato

The drain in Albie Philips Reserve was inspected in August. The drains were reasonably clear. The dominant weed was water celery (*Apium nodiflorum*) and little alligator weed was found. Alligator weed was sprayed during September by Phil Mabin.

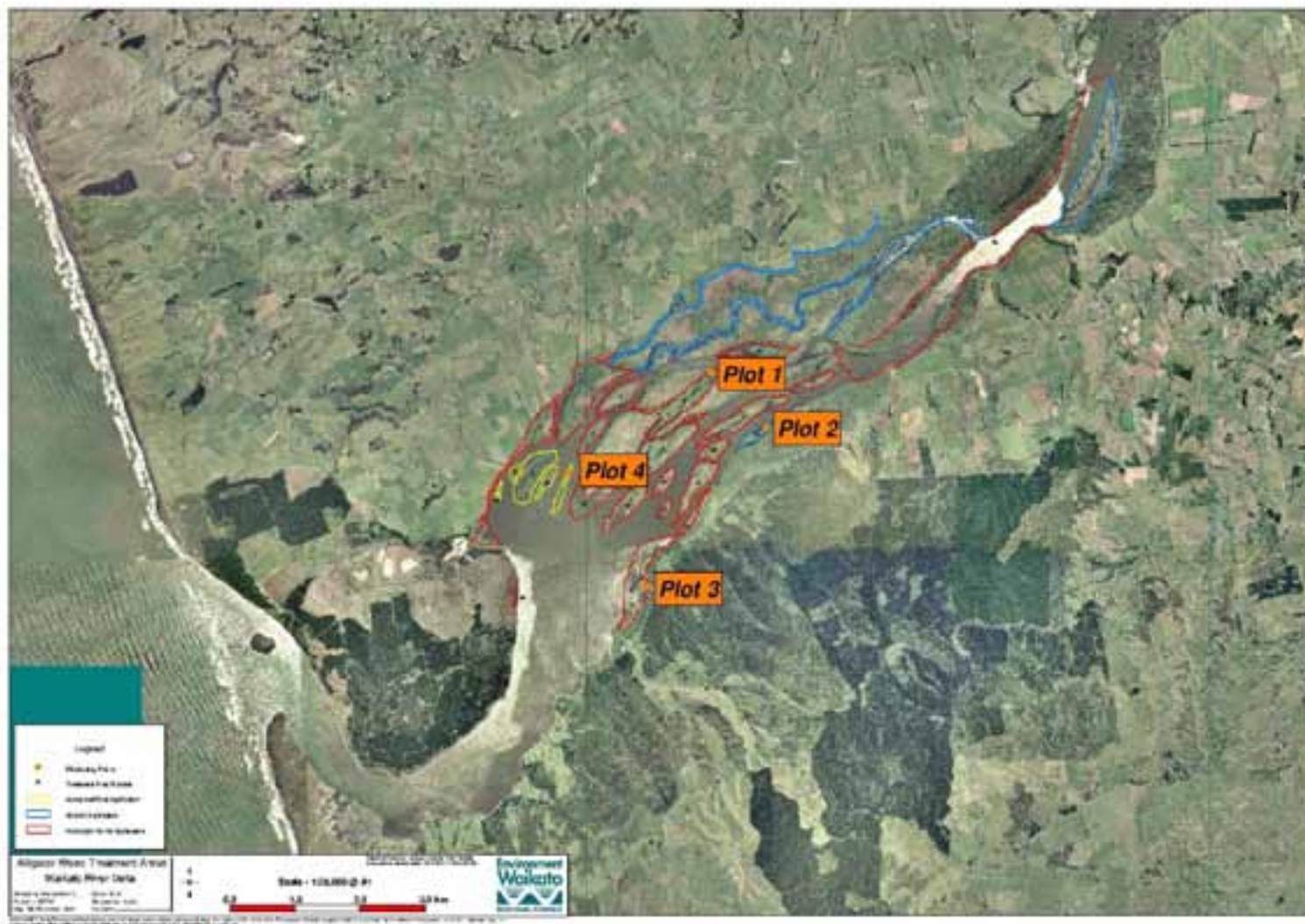


Figure 2: Treatment application areas (yellow = aerial plus airboat follow-up. blue = airboat alone), and monitoring plots, Waikato River delta 2004-05



Photo 5: 'Reed Bed', Waikato River delta area, aerially sprayed twice



Photo 6: Re-growth of alligator weed after two herbicide treatments

4.3 Kariotahi Beach

Kariotahi Beach was surveyed in October 2004. Five new sites of alligator weed were found and treated by Phil Mabin. Small amounts of regrowth of previously treated sites were found and sprayed.

4.4 Lake Whangape

The Department of Conservation manages Lake Whangape and is supported by Environment Waikato to control alligator weed there. A short term resource consent allowed an aerial application of metsulfuron to be carried out over Lake Whangape for

the first time on the 24th January 2005. A follow-up aerial application was carried out early April. Planned winter follow-up applications were unable to go ahead because of wet weather and high lake water levels.

Good control has been achieved, but as with control at Waikato River delta, regular follow-up treatment is necessary to maintain gains in control.



Photo 7: Lake Whangape 2002



Photo 8: Lake Whangape 2005

4.5 Whangape Stream

Whangape Stream was surveyed early May 2005. Small patches of alligator weed were found scattered along the Stream and treated with metsulfuron by Phil Mabin. With a resource consent now enabling better control of alligator weed in the Lake to be carried out, fewer weed fragments should float downstream and there should be a reduction in alligator weed establishment here.

In June 2006 one property owner adjacent Whangape Stream was found to be using a digger to remove willows from the stream edge. Phil Mabin advised the owner the digger must be cleaned and inspected it prior to moving. Alligator weed was known to be present on the property however it appears the digger works have dispersed it further and the infestation area has now been fenced off to prevent further spread and will be controlled by BPPC.

4.6 Pukekawa

The onion paddock was surveyed in February 2005. All alligator weed was spot-sprayed with metsulfuron. An inspection in September 2005 confirmed good control has been achieved and very little alligator weed was found.



Photo 9: Alligator weed in Pukekawa onion paddock

4.7 Perry's Sand Quarry

Alligator weed at Perry's sand quarry was treated aurally and by ground in September and October 2004. The high risk of alligator weed dispersal from this site because of normal quarry activities resulted in Environment Waikato declaring part of the property a Restricted Place in September 2004. The alligator weed area was fenced and Perry's staff advised no work was to be carried out within fenced area without approval of BPPC. One further aerial application of herbicide was carried out in March. Further follow-up by handspray treatments with metsulfuron were carried out in January, March and June. Very good control has been achieved, however small patches of alligator weed remain and continual treatment will be necessary. Initial monitoring of the Restricted Place conditions was carried out by Phil Mabin but it appeared management at the site did not fully appreciate their responsibilities with some potentially serious breaches noted. Management responsibilities were clearly laid out and Perry's staff have been cooperative since. Alligator weed management of this site, along with the other Perry property was taken over by BPPC Gail Cole in March 2005.



Photo 10: Perry's Sand Quarry after treatment



Photo 11: Perry's Sand Quarry September 05 showing regrowth of alligator weed

4.8 Hamilton City Council's Horotiu Landfill, River Road

When first discovered there were large infestations of alligator weed in pond areas. The area was surveyed in May 2005 and then aurally sprayed with metsulfuron. Infested areas were fenced off and declared a Restricted Place. In November Chris Hale visited the site with Paul Champion (NIWA) and the herbicide Arsenal™ (Imidazolinone) was trialed on terrestrial weed. Applications of metsulfuron were carried out February, March and June. EW Biosecurity has an agreement with Perry's to dispose of alligator weed greenwaste or contaminated soil at the landfill. Good control of alligator weed had been achieved and only small amounts were found during an inspection in October 2005.

Perry's lease the landfill site from Hamilton City Council (HCC) and have been in discussion with HCC and EW regarding rehabilitation of the site and the use of 'cleanfill' as part of this. Perry's sought permission to dispose of alligator weed as cleanfill, however HCC and EW Biosecurity turned this request down.



Photo 12: Alligator weed regrowth at Horotiu September 05



Photo 13: Dead stems in pond September 05

4.9 Hamilton Organic Recycling Centre

Because of the high risk of spread of alligator weed from this site it has been declared a Restricted Place. Metsulfuron was applied to alligator weed in January, March, April and May 2005 with very good results. The area continues to be monitored and inspected regularly by BPPC Gail Cole.

4.10 Netherville Retirement Village, Hamilton

Spot spraying of all alligator weed within the village was carried out by Ben Parry in March, April and May with very good results. Gail Cole is carrying out a hand weeding trial on a small patch of alligator weed in a resident's rose garden. Two hundred and fifty dollars of garden vouchers were given to two residents with roses and citrus that appeared to be affected by spray. Gail Cole found a seedling she suspected was alligator weed (not known to set viable seed in New Zealand) and sent to Paul Champion for identification. The seedling was grown on to enable identification but was found not to be alligator weed.

4.11 Resolution and Wairere Drive

A Restricted Place notice was placed on the Resolution Drive road verge to minimize the risk of spread of alligator weed by HCC mowing contractors and earthworks being carried out for a new water pipeline. The herbicide Arsenal™ was applied in April 2005 with good initial results but typical re-growth was noted by September 2005.

4.12 Somerset Heights, Hamilton

Alligator weed control in the sediment pond at Somerset Heights subdivision is carried out under resource consent 111587. The site is a Restricted Place. Management of the pond is currently carried out by the developers Somerset Heights Joint Venture Ltd who plan to convert it to a planted wetland. BPPC Gail Cole is managing the alligator weed control and Restricted Place conditions. Regular applications of metsulfuron over the summer period were carried out with very good results. The pond was dredged in September 2005 with the dredgings going to the HCC Landfill under instruction from Gail Cole.

4.13 Canaandale, Hamilton

Alligator weed in this residential area is present in lawns on private properties and road verges. Occupiers are supplied with pre-mixed metsulfuron and carry out control work. BPPC inspections are carried out about four times a year and there has been a significant reduction in alligator weed infestations. A high turn over of occupants continues to make BPPC management of the area difficult.

4.14 Te Rore

Control of alligator weed at the Te Rore site was delayed in the 2004/2005 season while waiting for resource consent to use metsulfuron over water. Previous herbicide treatments in the wetland area with glyphosate or diquat proved ineffective and the habitat (wetland with large willows) is very difficult to work in with spray equipment. To alleviate access problems drainage works were carried out late 2004 and early 2005 and screens to capture alligator weed fragments were regularly cleaned. Drainage tailings were sprayed with Answer™ (metsulfuron) in February. With resource consent approval aerial application of metsulfuron was carried out in March 2005. Follow-up spraying was carried out on the ground in April and May.

BPPC Chris Hale manages the Te Rore site and, along with BPPC Heidi Pene, he makes full use of Environment Waikato's Biosecurity Information System (BIS) which now holds excellent records of all activities in all the alligator weed properties under their management. An example can be seen in Appendix B.



Photo 14: Dead willows and alligator weed after spraying at Te Rore

4.15 Orongo, Thames

Alligator weed has been treated with different herbicides and results have been monitored to try to assess which herbicide is most effective for control of alligator weed in a pasture situation while minimizing effects on pasture if possible. See monitoring section page 17.

Alligator weed control was carried out in January and March. Paddocks were sprayed with glyphosate in April in preparation for regrassing later in the month. All activity relating to alligator weed management is recorded in BIS as above.

4.16 Cambridge

With alligator weed confirmed on this property at 3910 Cambridge Road, a survey was conducted by BPPC's and Biosecurity staff to ascertain the extent of infestation. The property was declared a Restricted Place and cropping has ceased here for the short term at least. Chris Hale set up trial plots to monitor control effectiveness in April 2005 and the alligator weed was sprayed with metsulfuron in May with good results although weed stems from densest areas retain a viable appearance. Alligator weed at this site appears to be dormant over winter but is showing signs of re-growth by October.



Photo 15: Cambridge maize paddock with alligator weed



Photo 16: Monitoring Plot at Cambridge after treatment

4.17 Te Aroha

A very small infestation of alligator weed persists on a residential property on the outskirts of Te Aroha. Environment Waikato works staff from Te Aroha are carrying out control here.

5 Alligator Weed Surveillance

The Biosecurity Group employed a Waikato University student, Ben Parry for nine months during 2004/2005. A major component of his work was to assist with alligator weed control and carry out surveillance. Areas surveyed included the Waipa River from Te Rore to Ngaruawahia and along the Mangakawere Stream from the Te Rore infestation, to the Waipa River. No alligator weed was found.

The Waikato River was surveyed from Hamilton to Port Waikato by Phil Mabin and Ben Parry. This survey is carried out in conjunction with direct control of all alligator weed found along the River.

In Hamilton, survey areas included Kirikiriroa Stream, Resolution Drive, Wairere Drive, parts of Hukanui, Netherville and surrounds, and the Somerset subdivision.

Lake Waikare and Whangamarino Wetland were surveyed by helicopter and no alligator weed was found.

6 Alligator Weed Monitoring

6.1 Waikato River Delta

BPPC Phil Mabin measured vegetation in the nine monitoring plots established in 2003. Full results can be found in Environment Waikato document number 1017878 'West Waikato Weeds Ltd Annual Report for Direct Control Projects' by Phil Mabin and Megan Hickman. Figure 3 shows the changes between December 2003 and November 2004 in the average % cover by alligator weed in those 9 plots.

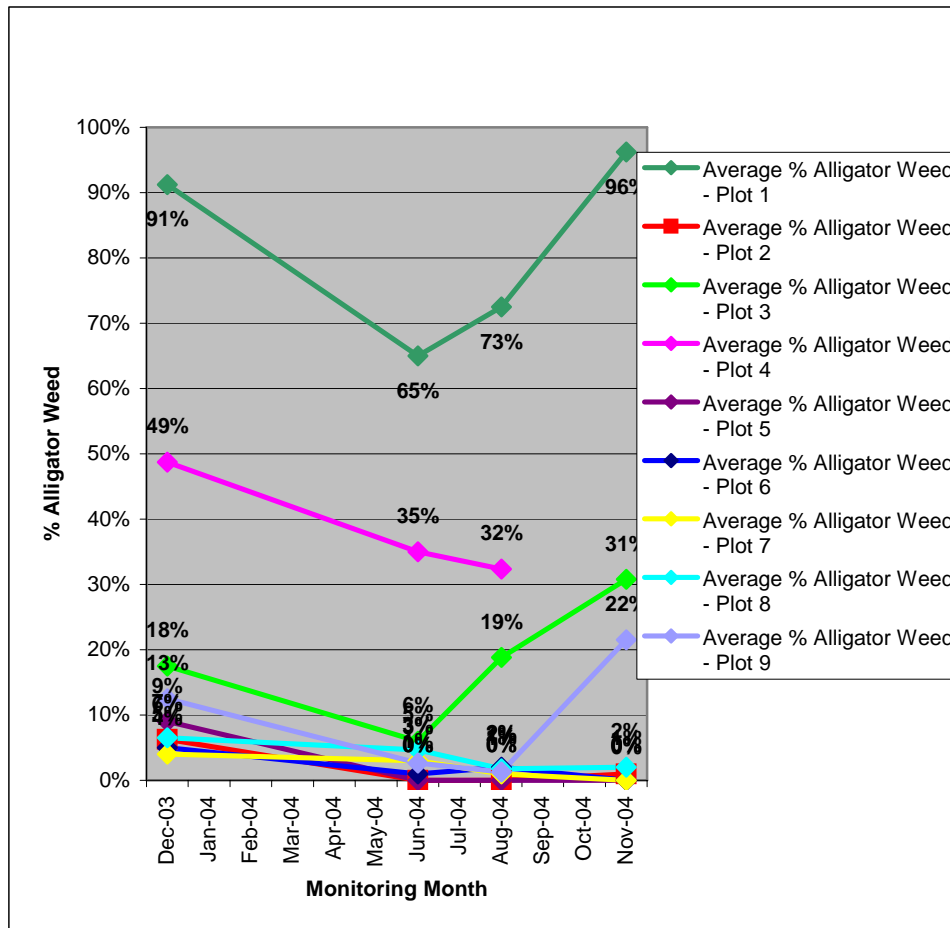


Figure 3: Changes, between December 2003 and November 2004, in the average % cover of alligator weed in 9 plots established in 2003 (Mabin & Hickman 2005)

Plots 1,2,3,4 and 6 received a single spray treatment. Markers for Plot 4 were lost so this data is an estimate only. Plots 5 and 7 received two spray treatments. Plots 8 and 9 received no treatment. It would appear from the data that where the percentage of alligator weed is greater than 10 percent it recovers after winter to a level greater than the previous summer regardless of whether it has been treated. Plots receiving two applications of herbicide appeared to show reduced alligator weed. However percentage alligator weed was low to begin with.

Four new monitoring plots (10m square, - see positions in Fig. 2) were set up in the delta in May 2005 to better assess the effects of control work on alligator weed and other vegetation. Working between tides it is possible for two or three people to carry out monitoring measurements in one day. Vegetation is recorded according to species in five abundance classes determined by % cover:

- Class 1 - Rare <5%
- Class 2 - Occasional 5-25%
- Class 3 - Common 25-50%
- Class 4 - Abundant 50-75%
- Class 5 - Very abundant >75%

Monitoring is to be carried out four times a year, and has been carried out twice since May. Table 1 shows a summary of the results. Environment Waikato document number 1007779 contains full details to date. Photo records of monitoring are also kept.

Table 1: Alligator weed monitoring summary November 2005

Plot 1	Dominant Species in subplots			No. species		Alligator weed	
	Species	Subplots	Abundance	Exotic	Native	No. Subplots	Abundance
May	Apium	All	75-100%	4	1	1/25	<5%
August	Apium	All	75-100%	2	1	1/25	<5%

Plot 2	Dominant Species			No. species		Alligator weed	
	Species	Subplots	Abundance	Exotic	Native	No. Subplots	Abundance
May	Willow weed	22/25	25-75%	9	2	20/25	5-25%
	Glyceria	14/25	50-100%				
August	None			7	1	1/25	<5%

Plot 3	Dominant Species			No. species		Alligator weed	
	Species	Subplots	Abundance	Exotic	Native	No. Subplots	Abundance
May	Willow weed	All	25-50%	4	1	15/25	5-25%
	Rush*	23/25	25-50%				
August	Willow weed	24/25	25-50%	3	1	14/25	5-50%
	Rush*	20/25	5-25%				

Plot 4	Dominant Species			No. species		Alligator weed	
	Species	Subplots	Abundance	Exotic	Native	No. Subplots	Abundance
May	Alligator weed	All	25-50%	5	3	All	25-50%
	Willow weed	All	5-25%				
	Apium	22/25	5-25%				
August	Alligator weed	20/25	25-50%	4	2	20/25	25-50%
	Willow weed	17/25	5-25%				
	Apium	17*/25	*v sm seedlings only				

Plots 1 and 3 were not treated in the 2004/2005 season. Plot 2 was treated by air boat in December 2004. Plot 4 was treated twice aerially and follow-up by airboat was carried out in August 2005. With only two measurement sets carried out so far it is too soon to draw conclusions about the control. Plot 4 which has been treated three times, has lost considerable foliage (see photos below). However, stems remain turgid and

there appears to be some early re-growth. Past observation of the behaviour of alligator weed would suggest this alligator weed will quickly reestablish unless it receives further herbicide treatments before the end of the year.



Photo 17:Plot 4 August 05



Photo 18: Plot 4 regrowth August 05

6.2 Orongo

Monitoring has been carried by BPPCs at the Orongo site since 2003. Transects have been set up and percentage cover of alligator weed recorded. Although monitoring in February showed an increase in percentage cover since November 2004, there has been a decrease in percentage since 2003 (Figure 4).

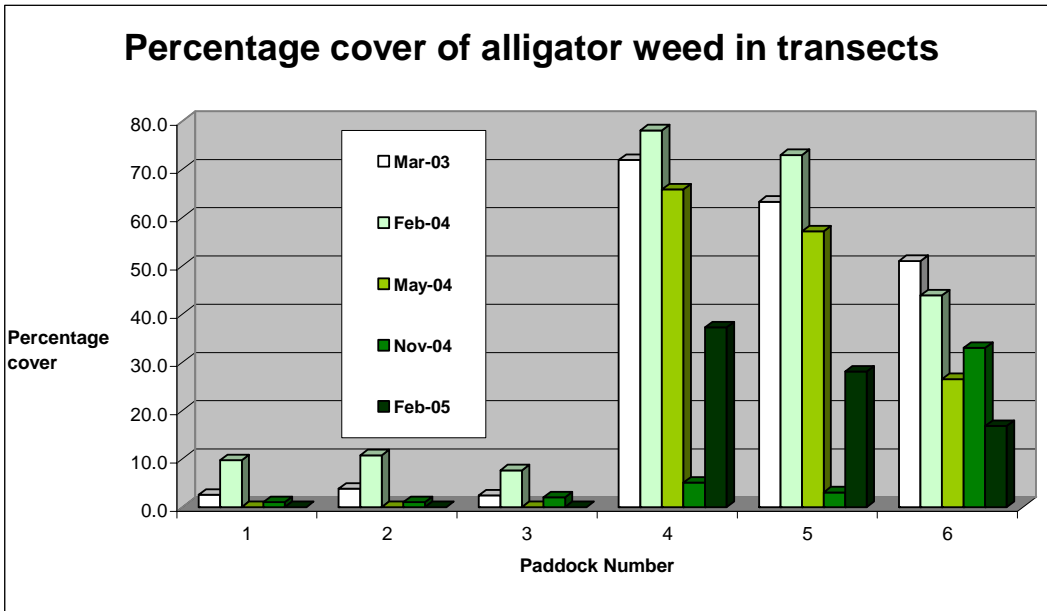


Figure 4: Percentage cover alligator weed. From Waipa-Waikato West Annual Report 04/05

Alligator weed density measurements recorded show a significant reduction (Figure 5)

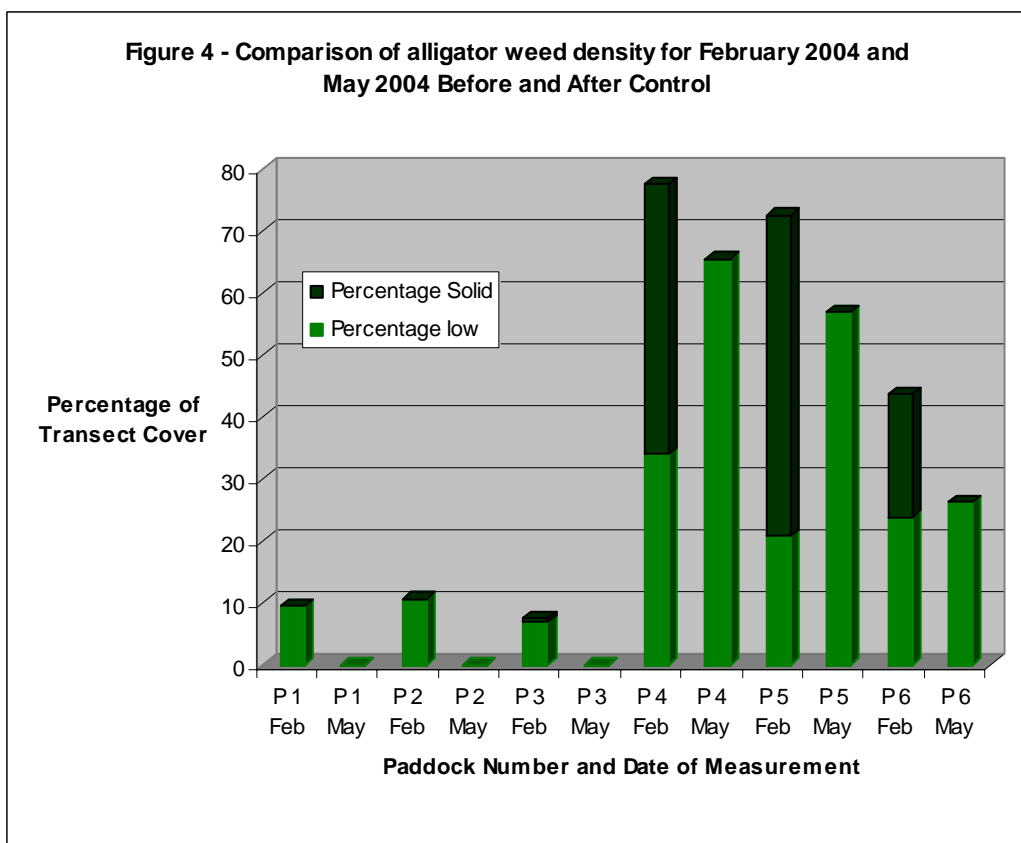


Figure 5: Alligator weed density. From Waipa-Waikato West Annual Report 04/05

7 General

7.1 NIWA Consulting

Environment Waikato has a contract with Paul Champion of NIWA to act as a consultant for alligator control methods. Paul supplied Environment Waikato with Arsenal™ to trial. Although it is a registered herbicide in New Zealand, Arsenal™ is not currently being distributed and is unavailable for purchase. Paul will be carrying out control trials at NIWA.

7.2 Alligator Weed Awareness

There has been an alarming increase in the number of alligator weed infestations in the Waikato region. All would appear to have resulted from human induced spread and alligator weed has become very strongly associated with subdivision and roading development in Hamilton City.

The alligator weed working group, with Environment Waikato communications staff planned an awareness campaign in 2004. Several resources were developed with the 'See ya later alligator' slogan (Figure 6). Several field visits and/or presentations were carried out to inform Environment Waikato, District and City Council field staff, Federated Farmers, Pukekohe Vegetable Growers and Waikato Conservation Board of the alligator weed problem. Advertisements were placed in local papers, articles were published in Fish & Game and the Contractors Federation Newsletter, and Environment Waikato circulated a media release. Information packs have been sent to contractors throughout the Waikato and all landowners adjacent the Waikato River from Ohinewai to the Port and adjacent Lake Whangape have been sent alligator weed information. Alligator weed awareness continues to be promoted wherever possible.



Figure 6: Alligator weed poster

7.3 Resource Consent Notifications

Twice a year all landowners/occupiers adjacent the Waikato River from Ohinewai to the Port and adjacent Lake Whangape and Whangape Stream are sent information about the alligator weed control programme and are asked if they want individual notification of herbicide spraying. A register of those requesting individual notification is kept and notification is carried out by telephone by Biosecurity staff.

Public notices are placed in local newspapers prior to herbicide spraying advising of intention to spray, and notices are maintained at boat ramps.

There have been no complaints received about the alligator weed spray operations during the 2004/2005 season.

This report will be sent to:

- Group Manager, Resource Use Group, Waikato Regional Council
- Huakina Development Trust
- Waikato Raupatu Lands Trust
- Horahora Marae
- Department of Conservation
- Auckland/Waikato Fish and Game Council
- Onewhero/Tuakau Community Board
- Waikato Conservation Board
- Aka Aka/Otaua Land Drainage Subcommittee

8 Alligator Weed Control Programme 2005/2006

The control programme will continue during 2005/2006. Under Resource Consent number 112000 application of metsulfuron-methyl (Escort or equivalent) for the control of alligator weed in the Waikato River catchment and other North Waikato locations will be undertaken in the following areas:

Site 1	Waikato River Delta	
Site 2	Waikato River between NZMS 260	R12:741-342 and S14:060-850
Site 3	Albie Philips Reserve, Port Waikato	
Site 4	Karioitahi Beach, West Coast	
Site 5	Waikaretu Stream, West Coast	
Site 6	Tuakau Oxidation ponds	
Site 7	Ake ake Drainage Area	
Site 8	Lake Whangape	
Site 9	Whangape Stream	
Site 10	Perry Waste	
Site 11	Perry Sand Quarry	
Site 12	Te Rore	
Site 13	Waikeria	

The concentration of herbicide will not exceed 15 grams of metsulfuron-methyl and 100 millilitres of Pulse to 100 litres of water. The herbicide will not be discharged at a rate that exceeds the practical limits necessary to enable total coverage of alligator weed at each location.

The spraying shall be undertaken by way of hand spray application system, or other such system, except at the Delta area of the Waikato River (Site 1), Lake Whangape (Site 9) and Te Rore (Site 12) where aerial spraying may be undertaken by helicopter provided low drift nozzles are used. All discharges associated with this consent shall cease once

wind conditions exceed 10 kilometres per hour for terrestrial or land based activities, and 5 kilometres per hour for aerial activities.

The discharge shall be undertaken in such a way that no significant adverse effect of off target drift shall occur beyond the boundaries of the target area being sprayed.

It is planned to carry out aerial spraying at the delta over areas aerially sprayed in the 2004/2005 season plus another approximately 20 hectares. Two applications are planned. This will be followed up by spot spaying as necessary by airboat.

It is planned to carry out aerial spraying of the Te Rore site followed by land based spray application as necessary.

All other control work carried out in the 2004/2005 will be followed up as necessary in the 2005/2006 season.

9 Alligator Weed Management

Alligator weed is a serious threat to Waikato rivers, lakes, streams, drainage systems, and wetlands, as well as to agriculture if it becomes established in productive land. Alligator weed is an 'eradication plant pest' under Environment Waikato's Regional Plant Pest Strategy (RPMS). The RPMS objective is to achieve zero density of alligator weed in the region by June 2017. It is Environment Waikato's priority plant pest with more time and resources spent on it than any other plant pest.

The RPMS objective was set prior to 2002 when alligator weed was of much lower incidence in the Waikato. The leap in alligator infestations has resulted in a corresponding leap in the demands on BPPC and Biosecurity staff. The reality of this is that some work that should be done is pushed aside, while not all alligator weed work planned for or needed each year has been completed. The peak growing season, and therefore peak control times for alligator weed, are from October to May which corresponds with peak demands for other plant pest management.

Good control of alligator weed can be achieved when several applications of metsulfuron can be applied in a year. However, it essential regular follow-up treatment is carried out every year for gains in control to be maintained and improved on. It appears that even with persistent, regular treatments, eradication is likely to take at least five years and the potential for reestablishment remains for even longer.

Alligator weed at Lake Whangape is a potential source of infestations further downstream on the Waikato River, as the weed spreads naturally by water movement, so is a priority site for control. The Waikato River delta area is a priority because of potential spread via water and tide movement, spread to new sites via human means due to the high level of recreational activity (e.g. fishing, boating and hunting) in the area, and because the area is classified as a Key Ecological Site. Alligator weed from this area also spreads up the River tributaries and drainage canals.

Te Rore is a priority site as the alligator weed is in a wetland area which flows into a tributary of the Waipa River a short distance away. The area has flooded in the past. The alligator weed is also present on adjacent productive paddocks, and although the landowners are very cooperative there is a risk of further spread via animals or farming equipment/machinery. Although now confined to the wetland area, when first discovered at Te Rore the alligator weed had spread along farm tracks and a tanker track.

The spread of alligator weed to new urban sites is very strongly associated with subdivision and roading development where soil movement, soil disturbance and associated machinery use afford alligator weed ideal conditions for spread. The use of Restricted Place notices were utilised as a strategy to minimize spread of alligator

weed in areas of high risk for the first time 18 months ago. Environment Waikato now has nine Restricted Place notices in effect. The areas under restriction, particularly those where business operations are affected (e.g. Cambridge, Perry sites, organic Recycling Centre) should be priority areas for control.

With the RPMS due to expire mid 2007 and currently under review, how Environment Waikato manages the control of alligator weed, and its objective can be looked at. The relationship between the spread of alligator weed and subdivision development is also being examined. Environment Waikato's Biosecurity Group has commissioned a report from Lisa Koshy, Waikato University to look at the Biosecurity risks associated with subdivision development.

Managing alligator weed in urban areas and residential properties is particularly demanding on time and resources and often complicated further by frequent changes in ownership. In Hamilton City residential areas landowners who agree are supplied with premixed herbicide and carry out control themselves. This saves some time in organising contractors to carry out control and notifying landowners, however regular (three to four/year) inspections are still required. The last two years have seen an improvement in the amount of follow-up spraying and surveillance and monitoring, largely due to employing extra staff (Ben Parry – student) over summer. To give alligator weed the attention it needs at present requires at least this extra staffing as well as the ability to defer some work by BPPC's and Biosecurity support staff.

References

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Mabin, P and Hickman, M. 2005: *West Waikato Weeds Ltd. Direct Control Projects 2004-1005*. Biosecurity Contractors Report to Environment Waikato

Plant Pest Advisory Services Ltd. 2002: *Alligator Weed Control Programme Hamilton City 1999-2002*. Report to Environment Waikato

Appendix A

Alligator weed Direct Control Herbicide Escort/roundup

DoC 1007660

Area #	Location	Easting	Northing	Date	Litres	Comments	weather	Check/survey?
24	Behind Pana Lodge	2667075	6430035	7/12/2004	450	some retreatment	5km s/w	
24	Windies	2668110	6430246	7/12/2004	450	first main infestation upstream windies	10km s/w	
22	Fowl Run	2668454	6428586	8/12/2004	500	sm clumps amongst glyceria	0 to 5km westerly	
22	Fowl Run	2668454	6428586	9/12/2004	500	low growing alliweed only		
22	Fowl Run	2668454	6428586	28/12/2004	800	amongst willows	0 to 5km northerly calm 5km northerly	
25	elbow	2673855	6432694	28/12/2004	1000			
25	Elbow			2/04/2005	300	few scattered patches, reapplication	5km	
25	Elbow			2/04/2005	300	few scattered patches, reapplication	5km	
25	Elbow			2/04/2005	300	amongst glyceria	5km	
25	elbow			2/04/2005	300	grow back amongst willows	5km	
25	elbow	2674048	6432987	3/04/2005	300	on edges glyceria, patches amongst gly	0 to 5km southerly	
25	elbow	2674048	6432987	3/04/2005	300	50x60 approx 20m in from canal edge	0 to 5km southerly	
25	elbow	2674048	6432987	3/04/2005	800	patches on canal/glyceria	0 to 5km southerly	
25	Elbow			4/04/2005	900		0 to 8km	
25	Elbow front	2673472	6432271	15/04/2005	900	amongst glyceria & edges	zero	spreading up lefthand tributaries
25	Elbow front	2673472	6432271	15/04/2005	300	scattered large infestations 15x15m	zero	
25	Elbow front	2673841	6432666	15/04/2005	300	canal	zero	
25	Elbow eastern			17/04/2005	300	amongst glyceria & dead willows	zero	
24	Start Windies	2671866	6431786	17/04/2004	200		zero	
24	Start Windies	2668332	6433052	17/04/2005	650		zero	
24	Windies	2671846	6431588	18/04/2005	500	Winstone end. Some reapplication. Lg infest under elms, glyc, willow.		
24	Windies	2668219	6430315	18/04/2005	500	Reapplication few patches		
24	Windies			19/04/2005	400	scattered patches. 3 large 20x20m	zero	
24	Windies			19/04/2005	750	Pana Lodge	zero	
24	Windies	2672020	6431894	20/04/2005	750	Pana Lodge. Scattered patches maimai	5km westerly	
25	Elbow front			15/05/2005	1050	canal, and islands	0 to 5km westerly	
4	Holmes Canal			14/06/2005	1000	Scattered clumps	0 to 3 knots SE	
4	Holmes Canal start pt	2670468	6431817	17/06/2005	900		5 to 10km NE	Stopped sprayed - wind inc to 15km
4	Holmes Canal stop	2666330	6429550					
4	Holmes Canal as above			28/06/2005	350	some retreatment		Stopped spray - wind inc to 13km
7	Narrow Is - reed bed			29/08/2005	800	followup after aerial spray scattered single strands & sm clumps.	zero	
4	Holmes Canal			30/08/2005	1000	3mx3m clumps in canal		

	6	Reed Bed main Is	2665138	6427814	1/09/2005	1550	scattered clumps around maimai, followup aerial	zero
	6	Reed bed pampas end	2665329	6427861	13/09/2005	500		zero
	6	Reed bed pampas end	2665251	6427946	14/09/2005	400	scattered short regrowth amongst reeds	0 to 5km
	6	Reed Bed main is			24/10/2005	800	scattered patches.	0 to 5km westerly
	6	Reed bed main is			25/10/2005	800	patches	
4a		Sm island reed bed	2664610	6427627	25/10/2005	500	followup after aerial spray	0 to 5km
	5	Sm island reed bed	2664887	6427784	25/10/2005	500	followup after aerial spray	0 to 5km
	6	Reed Bed main is			26/10/2005	600	2nd followup after aerial	5km westerly
	6	Reed Bed main Is			27/10/2005	330	2nd followup after aerial	
	6	Reed Bed main Is			28/10/2005	700	1st followup after aerial	
6a		Reed Bed			28/10/2005	600	1st followup after aerial, scattered clumps & around maimai	
					26 days	25130		

Appendix B

From Biosecurity Information System (BIS)

Alligator Weed : In 1 large back paddock

Officer	Inspection Date:	Re-insp. Date:	Infest Area:	Max Density:	Comment:
Heidi Pene	17/03/2003	9/05/2003	0.93	Dense	Jeff's first inspection of alligator weed. Survey was done by Jeff and Colleen to assess the density and ground cover in a report to EW. The alligator weed was then sprayed 1/4/03.
	9/05/2003	1/09/2003	0.93	Sparse	Jeff Checked on spray results - approximately 90% knockdown - will check in Spring to confirm results.
	1/09/2003	21/10/2003	0.93	Sparse	Jeff showed Chris and Heidi the site of alligator weed and explained what they had done to monitor it. Density was between medium and sparse but will need rechecking In late October to see if there is a lot of re-growth. Owner has been give 1L of grazon from Jeff to touch up patches.
	11/02/2004		0.93	Medium	Ian not home. Checked allig weed from Welsh prop. Didn't appear to be as bad as Welsh's.
	27/02/2004	5/03/2004			Measured transect. Is worse that last years measurements.
	5/03/2004		0.74	Medium	Checked to decide whether or not to spray right out with granstar and roundup or with tordon gold. Decided tordon gold would be the best option as there is still quite a lot of grass in the paddock.
	9/03/2004		0.74	Medium	Broadcast sprayed by Len Cubitt with tordon gold.
Chris Hale	18/03/2004		0.74	Medium	With Phillip Mabin to spot spray alligator weed in shelter belt and around edges of the paddock.
Heidi Pene	18/01/2005		0.74	Medium	Measured transect. Noted that paddock is to be cut for hay. Spoke to Leasee (Steve Ross) and explained it is banned from intentional spread and it is risky to transfer in hay. He has done this for years and seen no spread but decided to get the paddock boom sprayed with tordon gold to reduce possibility of transfer onto his

Officer	Inspection Date:	Re-insp. Date:	Infest Area:	Max Density:	Comment:
					property. May no longer cut for hay.
Chris Hale	22/01/2005	8/02/2005	0.74	Medium	Sprayed paddock of alligator weed with tordongold, by Urban Plus weed sprayers.
	10/02/2005	22/02/2005	0.74	Medium	Checked paddock sprayed for alligator weed, newly mowed hard to tell.
	22/02/2005	4/03/2005	0.74	Medium	Couldn't measure transect as had been mown and nothing showing.
	4/03/2005	9/03/2005	0.74	Medium	Checked alligator weed noted growing well and suitable to spray.