

Research Project to Investigate Floating Booms for Containing Alligator Weed Following Treatment.

September 2002



Installing floating Boom at the junction of Williams River and Tumbledown Creek.

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**Research Project to Investigate Floating Booms for containing Alligator Weed
Following Treatment**

Project Title:

A Research Project to Develop Methods of Containment of Fragmented Alligator Weed Following Treatment.

Project Reference: ID # 34639

Proponent: Port Stephens Council

Contact Person: Graham Prichard
phone: (02) 49800392
PO Box 42 Raymond Terrace, NSW 2324

Date: October 2001- September 2002

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

Acknowledgements

The original idea for this project was provided by Ken Bunn, Regional Coordinator Hunter Central Coast Regional Weed Management Committee. Work was conducted by officers from PSC and MCC. Landowners are thanked for allowing access through their properties to the riverbank sites. NSW Waterways Authorities are acknowledged for providing and assisting in the initial installation of the booms. Kathryn Dark and Graham Prichard completed the project. This project was funded by the National Heritage Trust, Port Stephens Council (PSC), Maitland City Council (MCC), Department of Land and Water Conservation NSW (DLWC), Waterways Authority NSW (WA), Department of Agriculture NSW (NSW Ag).

report compiled by Graham Prichard
Senior Weeds/Pest Management Officer, Port Stephens Council

Introduction.....	5
Background	5
Aim	6
Methods.....	6
Materials	6
Sites.....	7
East Seaham 1	7
East Seaham 2	7
Paterson.....	7
Glenoak.....	7
Table 1.....	8
Treatments.....	8
Williams River.....	8
Paterson River.....	9
Observations and recording.....	9
Results	10
Figure 1.....	10
Figure 2.....	11
Figure 3.....	12
Table 2.....	12
Discussion	13
Recommendations.....	14
Evaluation.....	15
Outcomes.....	15
Appropriateness.....	17
Effectiveness.....	17
Transferability	17
Figures	18
Figure 4.....	18
Figure 5.....	18
Figure 6.....	18
Figure 7.....	19
Figure 8.....	19
Appendix.....	20
References	20

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

INTRODUCTION

Floating booms have been proposed to contain fragments of Alligator Weed without adversely impacting on human utilisation of the river or the environment. This report assesses the effectiveness of the booms for that purpose and comments on issues affecting the management of Alligator Weed.

It was conducted by officers from PSC and MCC between November 2001 and September 2002.

The project complements the following existing plans and projects;

- Increasing Alligator Weed Management Options in the Hawkesbury Nepean Catchment (proj. no. 28427)
- Alligator Weed herbicide trials
- Alligator Weed field survey programme conducted by PSC and MCC
- Alligator Weed Regional Management Plan

BACKGROUND

Alligator Weed (*Alternanthera philoxeroides*) is believed to have been accidentally introduced to the Hunter Valley in the mid 1940s. It is a current and potential threat to rivers, creeks, drainage channels, wetlands, dams and adjoining land in many parts of Australia. It is a category W 1 noxious weed in NSW and a prohibited species in all other states. Alligator Weed has been declared a Weed of National Significance. If not controlled it can completely cover the surface of water bodies and wetlands, which will adversely impact on native flora and fauna. Amenity, conservation and agricultural values are reduced significantly in areas infested with Alligator Weed.

It is a summer growing perennial herb, with small white papery flower heads 8-10 mm in diameter borne in summer. Leaves are shiny, spear shaped, opposite, sessile, entire and about 2-7cm long and 1-2 cm wide. Stems are hollow and may grow to 10 m long. It has the ability to grow as an aquatic plant either free floating or rooted to substrate or as a terrestrial plant. Propagation is by vegetative means, as the plant does not produce viable seeds in Australia. (Julien in Biology of Australian Weeds 1995)

Despite ongoing herbicide treatments in the Paterson, Hunter and Williams rivers existing infestations persist and new outbreaks are continually being found. Alligator weed is a brittle plant and is known to fragment when disturbed. The exact causes of fragmentation are not known, but it has been suggested that the application of the herbicide Glyphosate causes fragmentation (pers. com. Ken Bunn.) Alligator Weed may also fragment naturally during winter, a strategy various aquatic plants use to overwinter and disperse (Sainty & Jacobs 1994). Cattle, floods, boats and other disturbance also cause stem fragmentation. In aquatic situations these stem fragments can float

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

away, driven by wind or water currents and may re-establish. While research has been conducted on biological and herbicide control methods, no research has been carried out on ways of containing fragments or the viability of fragments. This research project seeks to provide data on the feasibility of using floating booms as a containment method and also to provide an indication of the viability of plant fragments. Fragments are often transported into terrestrial areas where infestations establish. Due to the failure of chemical, mechanical, educational and traditional biological control methods to effectively control Alligator Weed, the use of physical methods (floating booms) has been proposed.

AIM

To investigate the use of floating booms for containing floating Alligator Weed fragments to prevent further spreading of infestations.

METHODS

Floating booms were placed in the river to contain infestations of Alligator Weed. Assessments were made of vegetation before and after treatment of Alligator Weed with herbicide. To be effective, floating booms must contain floating fragments, not restrict aquatic recreational pursuits, be easily installed and maintained, cause no interference with normal landuses including grazing and cause no harm to the environment.

Materials

Two types of floating booms were used in this project. Booms designed and used as wave reduction devices at various points within the river but no longer required for that purpose were donated by the Waterways Authority NSW. These booms had previously been installed to reduce the impact of boat wakes on the shoreline. After it became apparent the wave reduction booms were of unsuitable design for this project booms constructed of different materials were used.

The wave reduction booms are constructed of a 50mm PVC pipe core surrounded by rings of foam and covered in perforated rubber sheeting. Sections are 3m long and joined by short chains. The diameter of the booms is 30 cm (figure 4).

During the course of the project the condition of the booms deteriorated (figure 3). The wave reduction booms were not economical to repair and new sections of specifically designed boom were purchased. The new sections are made of 150mm PVC pipe, linked by rubber straps. The joints are sheathed by short sections of rubber (figure 6). These booms are specifically designed to contain aquatic weeds. A total of 44 metres of boom was purchased. The booms have been anchored by attaching each end of them to several heavy concrete blocks. Both types of booms were manufactured locally by Pitbull PTY LTD.

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

Sites

Three sites were initially selected for the trials, although four sites were eventually used. Two sites within the Williams River Weirpool at Seaham were selected for reasons of access and presence of Alligator Weed. This section of the river is not subject to tidal influence due to the impounding effect of the Seaham Weir, and forms part of the potable water catchment for Grahamstown Reservoir. It has higher levels of nutrients as a result of impoundment and catchment landuses, which increases the growth of Alligator Weed. Alligator Weed sites are used for grazing and have been completely cleared. Extensive modifications to the river structure have been made under flood management programs and as a result of the total clearing of native vegetation. All sites occur on private property.

Sites

East Seaham 1

Situated near a sharp bend in the river this site contained large areas of shallow water over deep mud providing ideal habitat for the large infestation of Alligator Weed present.

East Seaham 2

This site has expanses of shallow water and deep mud supporting large mats of Alligator Weed. The boom could not be adequately anchored in position and was washed inshore and beached amongst the Alligator Weed. As the trial progressed this site was discontinued due to the difficulty of maintaining the boom in position and the size of the infestation being too great to be enclosed by the amount of boom available.

Paterson

Situated on a bend, this site is exposed to the effects of diurnal tides. Alligator Weed is tolerant of brackish water and has thrived in the muddy banks, which are much steeper than in the Williams River. The boom remained in position at this site.

Glenoak

This site also has shallow water and deep mud supporting an infestation. The boom is placed just inside the creek junction, protecting it from any current and wind. This is the most northerly infestation known in the Port Stephens area. An important benefit to this site is containing the most upstream infestation of Alligator Weed

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

therefore preventing further upstream infestation (Alligator Weed has been spreading upstream for several years, Pers. com. Ross Duncan).

Table 1.

Boom Locations

Paterson River, Woodville	356487	1382709
Williams River, East Seaham 1	369663	1385384
Williams River, Seaham 2	368169	1385559
Williams River, Glen Oak	369691	1389188

The projection used is AGD66, ISG 56/1

Treatments

Herbicide use in water throughout NSW requires a licence issued by the NSW Environment Protection Authority (EPA). The EPA is the agency responsible for the Protection of Environment Operations Act 1997 under which licencing is required for using herbicides in water. Both PSC and MCC possess such a licence and conduct weed treatment in accordance with the requirements of all legislation, codes and permissions. An off label permit was obtained to use Brushoff™ in the Paterson River.

Three treatments were conducted using motorised equipment to apply the glyphosate herbicide Roundup Biactive™ (Williams River) or Brushoff™ (Paterson River) in accordance with label requirements. Other sections of the rivers were sprayed at the same time as the boom trials. Roundup Biactive™ is used at the label rate of 1:100. Brushoff™ is used at the rate of 10g per 100 litres of water. Weather conditions impose constraints on herbicide treatments. Landowners have not been affected by the treatment methods.

Williams River

Within the upper Williams River the application of herbicides is restricted by the need to protect the potable water catchment. Delays to treatment occur when water is transferred to Grahamstown Reservoir for domestic use. The Hunter Water Corporation conducts water quality and chemical residue testing after herbicide application and before resuming pumping, in order to ensure the suitability of the water for human consumption. The first treatment was conducted 13,14,15 November 2001. The second treatment was conducted on 22, 23, 24 January 2002. The third treatment was scheduled for April May. This was deferred several times for reasons including unsuitable weather and Hunter Water Corporations water pumping requirements. In July approval was given by Hunter Water to conduct the treatment. By this

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

time the Alligator Weed had died back from the effects of winter and minimal herbicide treatment was possible.

Paterson River

The Paterson River site was selected on the Maitland City Council side of the river in an infestation of Alligator Weed subject to the effects of diurnal tidal flows. The tide is capable of transporting Alligator Weed fragments up or downstream. Treatment in the Paterson River was conducted by the Maitland City Council in consultation with PSC. The first treatment was conducted using Roundup Biactive™. During the term of the trials MCC obtained an off label permit (permit number 5575) to use Brushoff™. This was used only in the Paterson River as the permit did not allow the use of Brushoff™ in the potable water supply of the Williams River. The second and third treatments in the Paterson River was conducted using Brushoff™.

Observations and recording

Sites were visited before and after treatment and details recorded of the boom condition, Alligator Weed phenology, amount of fragmentation, the viability of fragments, the estimated percent of vegetation cover by species and the species reaction to herbicide application. (appendix 1).

**Research Project to Investigate Floating Booms for containing Alligator Weed
Following Treatment**

RESULTS

The data was collected by estimating the percentage of the area enclosed by the booms and riverbank covered by Alligator Weed. This data is subject to error caused by data being recorded by different persons. Changes in site conditions during the monitoring also contributed to error.

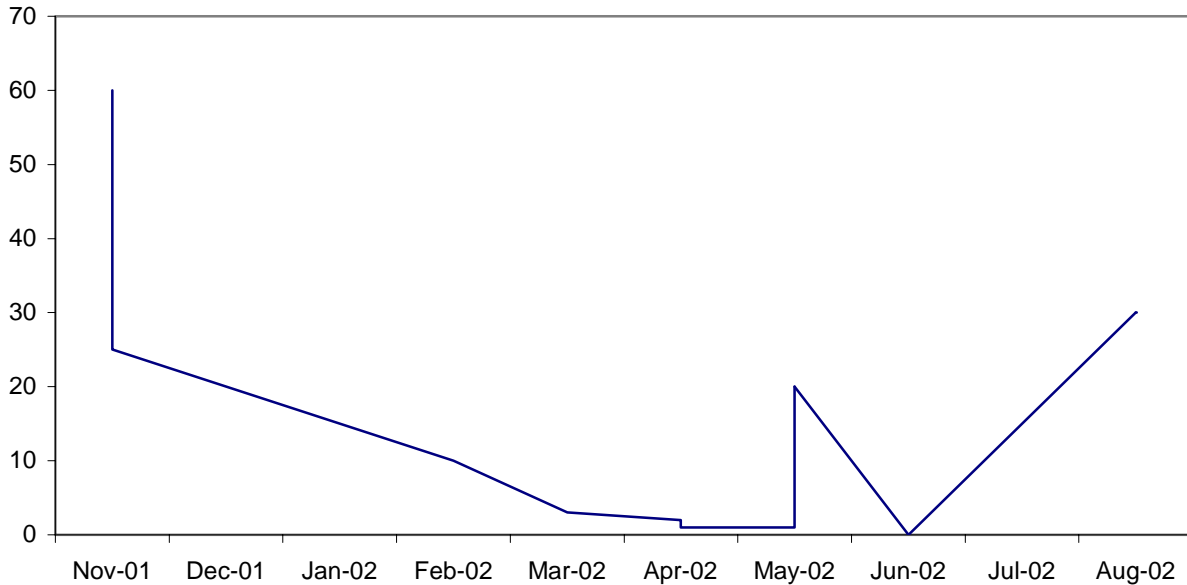


Figure 1.
Alligator Weed % Cover East Seaham I

This graph indicates that glyphosate application results in a substantial reduction in biomass. However, regrowth occurs and fragments remain viable. The upwards trend during the later stages of monitoring is a result of regrowth and viable fragments.

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

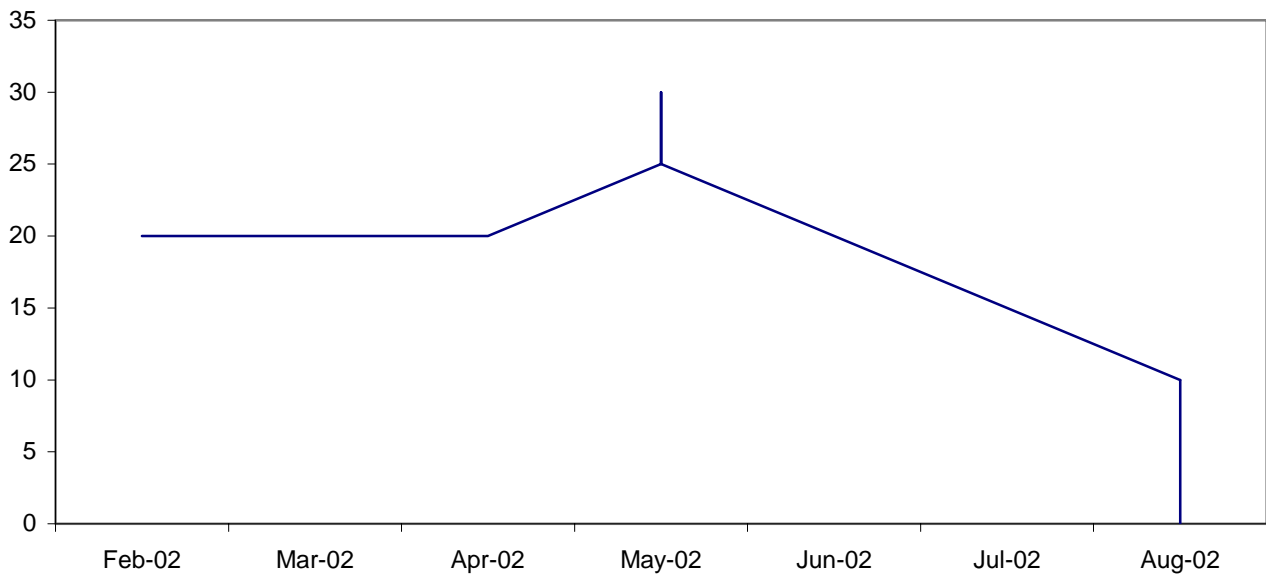


Figure 2.

Alligator Weed % Cover Paterson River

This graph shows the effect of Metsulfuron Methyl is slower following treatment and possibly that the first treatment was made less effective by an unknown factor. The end figure of 0 % cover is explained by the death of all above ground portions of Alligator Weed and that the fragments remaining are non viable, indicating Metsulfuron Methyl is more effective for Alligator Weed control than Glyphosate in aquatic situations.

**Research Project to Investigate Floating Booms for containing Alligator Weed
Following Treatment**

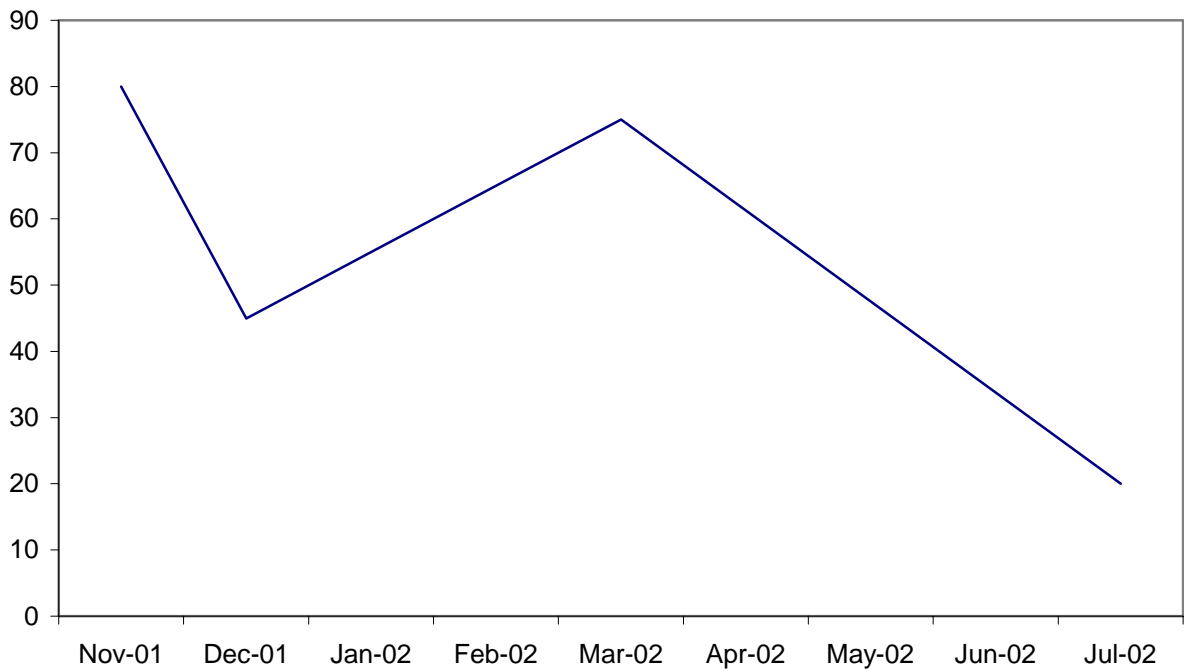


Figure 3.

Alligator Weed % Cover East Seaham II

This data shows the initial reduction in Alligator Weed resulting from the application of glyphosate is followed by a period of regrowth. The decline in cover towards the end of the monitoring is partly a result of winter conditions reducing regrowth.

Table 2.

Presence and Viability of Fragments

Date/Time	East Seaham I	Viable?	East Seaham II	Viable ?	Paterson	Viable ?
12-Nov-01	Y	Y	N	N	Y	Y
11-Dec-01	N	N	N	N	Y	Y
7-Jan-02	N	N	N	N	Y	Y
21-Jan-02	Y	Y	N	N	Y	Y
18-Feb-02	N	N	Y	N	Y	Y
12-Mar-02	N	N	N	N	Y	Y
19-Mar-02	Y	Y	N	N	Y	Y
30-ap-02	Y	Y	N	N	Y	N
30-Jul-02	Y	Y	-	-	Y	N

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

Viability was measured by the presence or absence of shoots and roots on fragments. Note that the fragments in the Paterson site were not ultimately viable, whilst many of those in the Williams River remained viable. Fragments were contained by the booms even when the booms had deteriorated. The fragments present in the Paterson site especially may have been transported to the site by water flow. The fragments recorded at East Seaham II may have been deposited by floodwaters.

DISCUSSION

The sites are very different in hydrology, ecology and landform. The treatments were not consistent as Brushoff™ was used in two treatments of the Paterson River site while Roundup Biactive™ was used in the Williams River. Booms of different construction and design were used at different sites. One site was discontinued during the project when it was found to be unsuitable for the amount of boom available. This prevents complete comparison of results between sites. It was expected the areas treated with Metsulfuron Methyl would not have shown fragmentation, but this was not so with a high level of fragmentation recorded. The non viability of the East Seaham II fragments may be due to treatment being conducted when the Alligator Weed was not covered in water and herbicide treatment was more effective. The fragments at this site were also exposed to more sun, effectively drying them and reducing viability.

An interesting result was that fragmentation increased immediately after the mid winter frosts. This complicates the widely accepted understanding that the fragmentation is mainly caused as result of treatment with Roundup Biactive™. The variation in summer fragmentation may be explained by the level of inundation at the time of spraying. East Seaham II, with almost no fragmentation was treated when the Alligator Weed was not covered in water. It has been observed elsewhere that fragmentation does not occur after Glyphosate application when Alligator Weed is not submerged. Further investigation is needed to fully explain the phenomena of fragmentation.

While the booms have been successful in containing the fragments, weather conditions were very benign. There were no substantial floods of storms during the monitoring period. Floods may have damaged and moved the booms. If large booms are utilised the potential for flood damage increases as it becomes increasingly difficult to anchor the booms effectively. Due to the inevitability of floods floating booms may not be suitable for continual use in such aquatic systems.

It is not possible to surround all Alligator Weed infestations with floating booms because of the cost of booms required, number and extent of infestations present in the rivers, and the need for access into the water at various sites within infestations. An effective use of

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

floating booms is to contain isolated infestations and new outbreaks. Priority for boom installation should go to infestations most likely to significantly contribute to fragment spread.

Delays to treatments will always occur due to weather conditions and river flows.

The effect of tidal flows on Alligator Weed in the Paterson River is not fully understood. The booms remained in place against the water flow and withstood the impact of floating debris, but may not have contained all fragments during tidal inundation.

There is no doubt cattle cause fragmentation by trampling Alligator Weed. It would be desirable to exclude cattle from Alligator Weed infestations.

RECOMMENDATIONS

The following recommendations will assist with improving the management of Alligator Weed in the Hunter, Paterson and Williams Rivers.

- Conduct three herbicide treatments per year during the growing season. Prior notice of dates should be given to stakeholders
- Investigate alternative herbicides
- Small isolated infestations in the upper reaches of streams should be contained with booms
- Containment with booms during disturbance or removal
- Prevent cattle from accessing infestations
- Encourage competition by careful herbicide use to minimise non target damage
- Oversow infestations with competitive native species after treatment
- Continue to investigate alternative herbicides
- Monitor the phenology of Alligator Weed very closely to determine patterns of fragmentation and optimum times for herbicide control
- Monitor the phenology of Alligator Weed very closely to determine the cycle for biological control agents and optimum spray times

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

EVALUATION

Outcomes

CRITERIA ITEM	DESCRIPTION	COMPLETED NOT COMPLETED	OUTCOMES AND OUTPUTS
2002.01	Liaise with National Weeds continuing Project 28427 <i>Increasing Alligator Weed Management Options in the Hawkesbury Nepean Catchment</i> by the Hawkesbury Nepean Catchment Management Trust.	completed	Contact made with project leaders. Meetings attended (Sydney basin AW taskforce) 18/9/01 & 30/10/01 Information presented on our infestations, boom project, survey project. Further exchanges of information occurred, and will continue.
2002.02	Collect and map information on <i>Alternanthera philoxeroides</i> occurrences in the Williams, Hunter and Paterson Rivers by 30 September 2002 .	completed	Field survey and treatment mapping completed.
2002.03	Liaise with stakeholders in the development of a management plan (including areas in hectares to be treated and extent of community involvement and locations for booms) to eradicate <i>Alternanthera philoxeroides</i> from the Williams, Hunter and Paterson Rivers by 30 September 2002 .	completed	Meeting 22/4/02, 10/05/02 with DLWC re drain treatments and to revise Local plan to coordinate treatments. Also correspondence with Woodville drainage union re integrated/improved treatment. AW taskforce meetings held each 6 weeks include community reps. Ongoing correspondence with Hunter Water to improve management.
2002.04	Develop appropriate monitoring and evaluation programs for <i>Alternanthera philoxeroides</i> research areas and detailed plan for follow-up treatment at \$4,000 by 30 September 2002 .	completed	Monitoring and evaluation implemented during project. Updated local management plan. Subsequent monitoring to continue.
2002.05	Employ 1 on-ground staff at \$4,900 and provide supporting documentation (including details of tasks undertaken and worksheets) by 30 September 2002 .	Completed	Kathryn Dark and Graham Prichard completed the project. Select sites, instal booms, develop monitoring procedures, record data, produce education materials, repair booms, conduct treatments
2002.06	Maintain floating booms at \$6,300 and provide supporting documentation by 30 September 2002 .	completed	Booms maintained where possible, numerous minor repairs undertaken. Some installation expenses incurred. Replacement booms purchased 13/04/02 and 28/6/02.
2002.07	Ensure substantial progress in follow-up treatment (2 treatments) for the control of <i>Alternanthera philoxeroides</i> by 30 September 2002 .	1. complete 2. complete 3. complete	1. 13/11/2001 2. 22/01/2002 3. 23/07/2002
2002.08	Maintain appropriate site and treatment data records (including spatial data and supporting information in accordance with Contract Appendix 3 "Guidelines for the Provision of Data", and number of hectares treated) and provide copy to Environment	completed	pesticide application records completed.

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

	Australia (as part of final report) by 30 September 2002.		
2002.09	Improve general community awareness through the development of 5 products (including signage, media releases, newspaper articles and radio interviews) by 30 September 2002.	<ul style="list-style-type: none"> 1. complete 2. complete 3. Complete 4. complete 5. Complete 	<ul style="list-style-type: none"> 1. Signs- erected at boom sites 2. Website factsheet 3. PSC Environment and Health Newsletter Dec. 2001 circulated widely throughout PSC 4. Media release- broadcast and printed 5. Tocal Field Days- included a fact sheet, plant display, and staff present to respond to inquiries as part of a broader weed display.
2002.10	Complete and submit project annual report identifying progress against all scopes by 30 September 2002.		

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

Appropriateness

2.1 The appropriateness of the approaches used in the development and implementation of the project.

The consultative nature of this project was developed to address issues created by land tenure, the nature of the Alligator Weed problem, current legislative framework and the varied utilisation of the rivers and adjacent lands. Consultation and cooperation are necessary for the effective control of aquatic weeds where a variety of agencies conduct work in adjacent areas to control weeds. Obtaining resources and expertise from existing agencies is essential to a cooperative and effective project.

Effectiveness

3.1 The degree to which the project has effectively met the stated objectives.

This project has demonstrated that floating booms are effective at containing Alligator Weed fragments while posing no risk to the environment, public or lawful landuse. The wave reduction booms were shown to be deficient in this regard, but the aquatic weed booms were very effective.

Transferability

4.1 The degree to which the approach used to establish, implement and administer the operations of the project could be applied to other projects administered under the National Weeds Program

Other programs should implement consultative processes as a core feature. The implementation and administration of the project has been in accordance with Local Government procedures. With experimental projects such as this a degree of flexibility is required to allow for changes to the project when such changes are likely to improve the outcomes.

Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

FIGURES

Figure 4

Wave reduction boom



Figure 5

Deteriorating boom condition



The Paterson river site, August 2002.

Figure 6

Joints on aquatic weed booms.



Research Project to Investigate Floating Booms for containing Alligator Weed Following Treatment

Figure 7

Damage to *Juncus* Sp.



Figure 8

Regenerating *Juncus* sp.



**Research Project to Investigate Floating Booms for containing Alligator Weed
Following Treatment**

APPENDIX

1. Monitoring data (see file "boom records.xls")

REFERENCES

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