FINAL REPORT

WEEDS OF NATIONAL SIGNIFICANCE

Strategic Cabomba Control by Community Action

Commonwealth ID: 34505

Aquatic Habitat Restoration after Cabomba Control

Commonwealth ID: 34506

A JOINT INITIATIVE OF THE
LAKE MACDONALD CATCHMENT CARE GROUP
MARY RIVER CATCHMENT COORDINATION ASSOCIATION
ENVIRONMENT AUSTRALIA
NOOSA SHIRE COUNCIL
THE DEPARTMENT OF NATURAL RESOURCES AND MINES
THE ALAN FLETCHER RESEARCH STATION
NOOSA LANDCARE

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Summary

Cabomba is an American underwater plant that is recognised as a weed of national significance because it; degrades potable water quality; is a public safety risk; and threatens nature conservation.

The Lake Macdonald Catchment Care group (LMCCG) has carried out two Weeds of National Significance projects:

- 34505 'Strategic Cabomba Control by Community Action'
- 34506' Aquatic Habitat Restoration after Cabomba Control'

The Commonwealth Department of the Environment and Heritage approved these projects under the National Weeds Program 2001-2002.

Total funding for both projects consisted of:

Commonwealth	$118,200
State agencies	$ 32,500
Local Government	$131,400
LMCCG	$ 50,900

Projects were based on weed control with an emphasis on 'on the ground action' plus realistic results within a short time frame. They are an example of a partnership approach to environmental management, with the local community providing direction and Noosa Council being the major service provider.

Cabomba is managed at Lake Macdonald by mechanical removal, using a Queensland manufactured water weed harvester (HV2600). The projects involved harvesting cabomba at strategic locations within the lake and determining the best harvesting regime to manage cabomba. Native water plants were propagated and planted to provide long-term, competitive cabomba control.

The Queensland Department of Natural Resources and Mines provided scientific evaluation and support. Abyss Diving Co. carried out all underwater activities.

Project results have been aligned with the National Strategy for Cabomba Weed Management.

2.1.5 Minimise potential for further spread.
Lake Macdonald is at the headwaters of the Mary River system. Since harvesting began, no cabomba plants have been found down stream to date.

2.1.6 Maintain the natural characteristics of waterways.

- Cabomba prevents normal recreational activities. In the harvested areas, fishing and boating, uses have been able to be continued.
- Aesthetic /landscape values of the lake have been maintained in high use areas.

2.2.2 *Provision of alternative aquarium plants*
The aquatic plant nursery has developed methods for cultivating and supply of native water plants. While these have been used for revegetation there is now the knowledge and awareness that they can be used in aquaria and water plant projects. Locations of native plant populations used in these projects have been recorded.

2.3.2 Improve the understanding of Ecology / Biology of cabomba
Cabomba growth was reduced by:

- Falling winter temperatures
- Drought and lowered lake water levels
- Dirty water inflows (0.2m Secchi disc)
- Wind and waves over 100mm

Mechanical harvesting resulted in:

- Water temperature increase, up to an 8°C increase after harvesting
- Improved light penetration. The cabomba canopy intercepted 93% of the available light at a depth of 0.5 m.
- Taller waves
- Increased dissolved oxygen (5.5 ppm unharvested; 6.4 ppm harvested)
- Smaller cabomba plants (2.9 m unharvested; 1.2 m harvested)
- More cabomba plants (5.3 plants m^2 unharvested; 6.05 plants m^2 harvested)
- Reduced cabomba biomass (46 tonnes ha^{-1} unharvested; 18 tonnes ha^{-1} harvested)

Results of the revegetation work with native plants are:

- Development of a system for cultivating Hydrilla and Vallisneria
- Developed a simple transport and planting method called ‘the Bomb method’

2.3.4 Quantify the impacts of cabomba.
During the revegetation work, the group:

- Recognized that cabomba is inedible to birds, fish and turtles
- Established the importance of Hydrilla and Vallisneria as food for native birds.

2.3.5 Change community attitudes and actions on control.
Development of a harvesting regime to keep the cabomba infestation below an impact threshold of 30t ha^{-1}.
Engaged local community groups, schools, and government bodies to raise awareness of the impacts of unmanaged cabomba in waterbodies

2.4 Coordination of management.
The projects have engaged the wider community in cabomba issues by:

- Raising community awareness of the impact of cabomba and how the aquatic environment functions

- Conducting educational activities for school children, university and TAFE students
- Holding field days attended by Local Government, Landcare, Catchment Care, Rivercare, Waterwatch groups and local landholders.
- Encouraging innovative, sustainable management of water resources.

Other documents arising from the projects were:
'Standard Operating Procedures for Research Diving. March 2002'
A document that minimises risks to human safety and the environment.

'Environmental Recovery Plan April 2002'. Lake Macdonald Catchment Care Group.

Introduction

Weeds of national significance.

Weeds are a burden on many aspects of the Australian lifestyle. The impact is most noticeable on rural and environment values, but also affects tourism, trade and public health. The sheer number of weedy species can be overwhelming. (Queensland has 1060 naturalised exotic species) and many weeds have the ability to grow in several states so the problems are of national concern.

In the past some weed control programs were often short term, ad hoc and fragmented, probably due to poor coordination/ cooperation between government agencies, ignorance of weed biology and inadequate funding. Outcomes of such programs were unsustainable.

The National Weeds Strategy aims to provide well thought out plans aimed at developing long-term management of a few targeted weed species, which are problems of national concern.

Three ministerial councils (Standing Committee on Agriculture and Resource Management; Standing Committee on Conservation; Standing Committee on Forestry.) endorsed the identification of weeds of national significance (WONS). The nation's worst weeds were assessed on four criteria:

- Invasiveness
- Impacts
- Potential for spread
- Socio-economic and environmental values

The inaugural 20 WONS species are:

Alligator weed, cabomba, hymenachne, mimosa, pond apple, salvinia, and willows. athel pine, blackberry, Chilean needle grass, gorse, lantana, mesquite, Parkinsonia, parthenium weed, prickly acacia, rubber vine, serrated tussock, bitou bush and bridal creeper.

Seven of the WONS species have an impact on water,(the first 7 listed) which highlights water as a precious natural resource, particularly in Australia- the driest inhabited continent on earth. Of these 7 waterweeds cabomba is the only submerged species. Underwater plants present a control challenge because they cannot be sprayed with conventional herbicide treatments and because, most water in Australia is allocated for potable or irrigation use.

The National Strategy for Cabomba Weed Management was developed by industry, community and government. Its vision is "To stop cabomba destroying our waterways". The strategy has four desired outcomes:

1. No new cabomba infestations develop.
2. Stop the trade in cabomba.
3. The impacts of existing cabomba infestations are minimised.
4. Commitment to coordination of the strategy exists at all levels.

In 2001 Environment Australia called for funding proposals that would help implement the strategy. Submissions needed to be community driven, feasible with on the ground action and achievable results produced within 18 months. Seven cabomba

components were developed, one by the Commonwealth, three by the State government and three by the Lake Macdonald Catchment Care Group.
Of these, only two proposals were funded:

- **LMCCG 34505 "Strategic cabomba control by community action."**
- **LMCCG 34506 "Aquatic habitat restoration**."

Project 34505 aims to manage 100ha of a cabomba infestation by mechanical harvesting with a HV2600 machine built by 'Aquatic Weed Harvesters Pty Ltd'. Lake Macdonald is strategically located at the headwaters of the 305km. Mary River system.
Project 34506 aims to revegetate of 100ha of the lake bed using native water plants. These are propagated in the LMCCG aquatic plant nursery specially built at Pomona. These projects are examples of partnership activity between the community, Noosa Council, Environment Australia and Queensland Department of Natural Resources and Mines. Noosa Council is the major financial and service partner.

Methods
Cabomba harvesting concentrated on priority areas of the lake based on:

- containment/preventing cabomba spread
- public access/ safety/ recreational use
- potable water management.

An 'Environmental recovery Plan April 2002' was prepared setting out the harvesting regimes that were allocated to priority locations. As cabomba is a relatively new weed species, very little is know about its biology. As a result the plan seeks to answer several research questions which are the key to developing informed management methods.

A scuba diving team from 'Abyss Diving Co.' made underwater transect assessments. Standard Operating Procedures for research diving March 2002, were developed which documents safety aspects of the work and also minimised environmental damage to the lake.

Twenty permanent 50m transects were evaluated on a monthly basis. Video tape recordings of the cabomba infestation on the lakebed were made at each transect. Transects 1-5, 10-12 are located near the dam wall and have high public visitation rates making them priority areas for harvesting. Transects 13-15 are at the headwaters of the storage. At each transect a monthly $1m^2$ quadrat sample was taken for biomass, species composition, plant length, buoyancy/ specific gravity, plant number and damage. There is a considerable distance between these transects which caused problems with moving the machine. The drought during 2002 lowered water levels in transects 13-15 so that harvesting operations could not be carried out after May 2002.
Records of the lake turbidity, wave height and weather were made.
Samples of cabomba were analysed by the Natural Resource Science Laboratories at Indooroopilly, for chemical composition.
Two temperature loggers and a light logger were set up at the lake.
The Lake Macdonald Catchment Care group reviewed all aspects of the project monthly.

Results

This report documents the results by addressing the relevant sections of The National Strategy for Cabomba Weed Management.

2.1.5 Minimise potential for further spread.

Lake Macdonald is situated at the headwaters of the Mary River system. Water leaving the lake flows another 305km before reaching the sea, at Maryborough. A high priority was containing the cabomba infestation to Lake Macdonald to prevent spread throughout the 305km system. The majority of intense harvesting occurred in areas near the lake spillway. Harvesting reduces the likelihood of weed dispersal by removing cabomba's main propagule, its stem tip. Since harvesting started there have been no new cabomba outbreaks downstream.

Harvesting greatly reduced the underwater cabomba infestation (Table 10). Every 5m section of 50m transects were assigned a score indicating cabomba density. The totals of each transect's score were averaged over the year. Harvested areas averaged 15.4 compared to 33.8 for control areas. An average reduction of 54%.

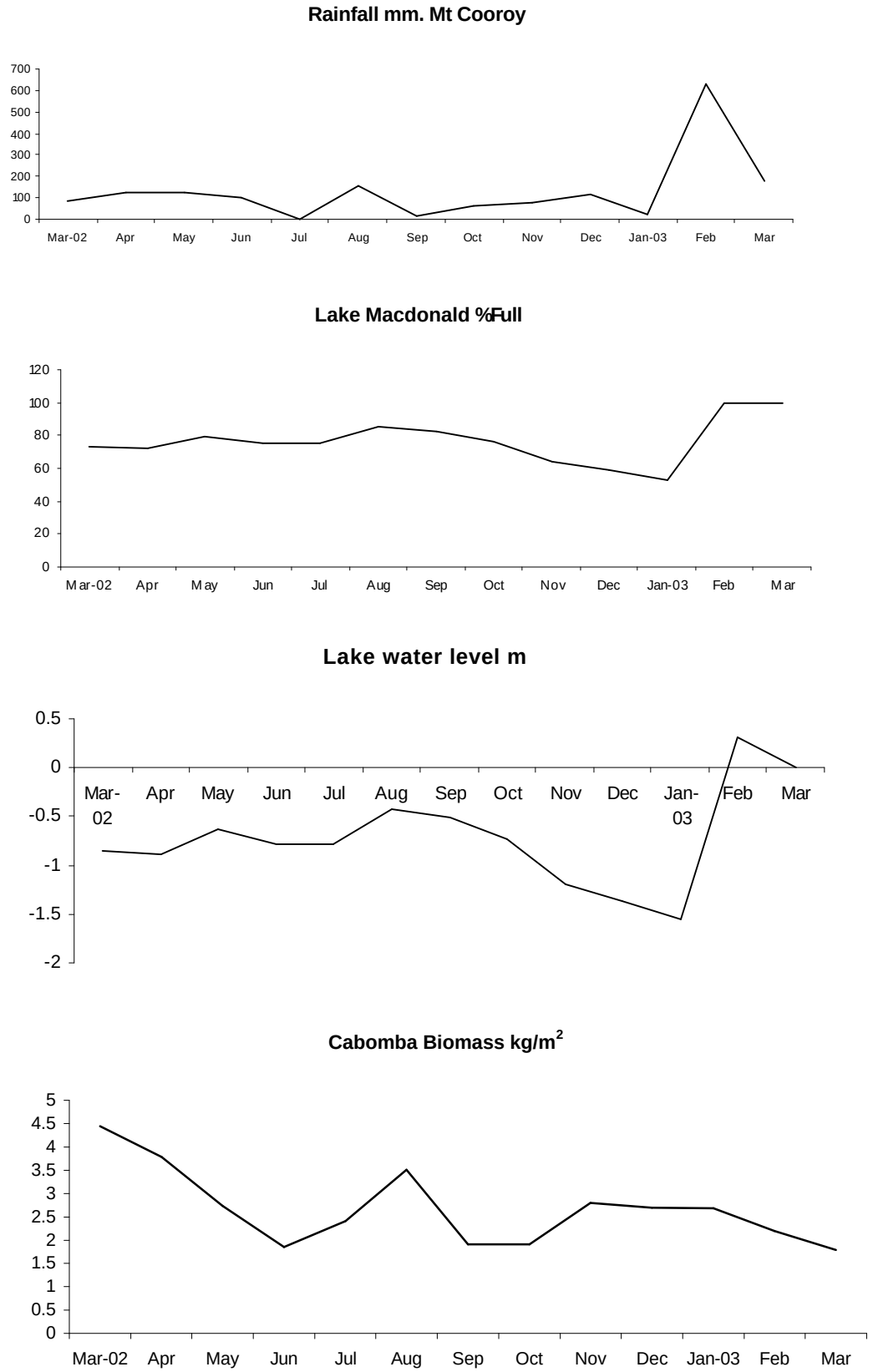
2.1.6 Maintain natural characteristics of waterways

Rainfall events had a significant impact on the growth of cabomba. Figure 1. shows rainfall (measured at Mt. Cooroy by Mr Adrian Warner), lake water capacity as percentage full, lake water levels relevant to the dam wall and cabomba biomass measured in the control areas.

Drought affected most of 2002, the Weather Bureau's forecast average for the district is 1445mm, actual rainfall was 774mm, down by about 50%. Also from October to December the lake experienced high water consumption and evaporation, causing a sharp drop in water levels. In February 631mm of rain brought an infow of dirty water and a very sudden rise in water levels (from minus 1.56m to 0.31m overflow in 24hrs).

The drought and dirty infows are thought to have reduced overall biomass from 55 tonnes ha^{-1} to 27 tonnes ha^{-1} .

Figure 1. Rainfall, lake capacity, water levels at the spillway and cabomba biomass during 2002.



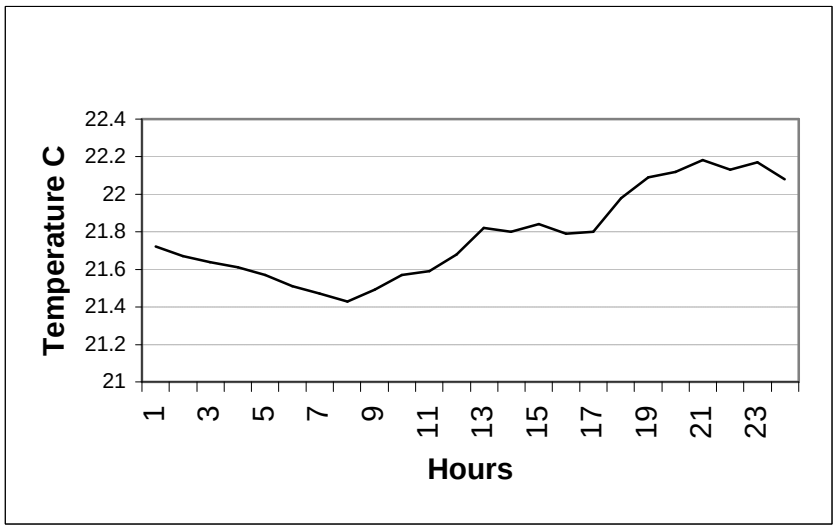
Cabomba tolerates a wide climatic range. Throughout the projects some insight into the habitat at Lake Macdonlad was achieved by monitoring temperature and light levels.

Temperature.

Dataflow Systems Pty Ltd is based at Cooroy and manufacture unique, low cost data recording sensors, ideal for environmental monitoring.

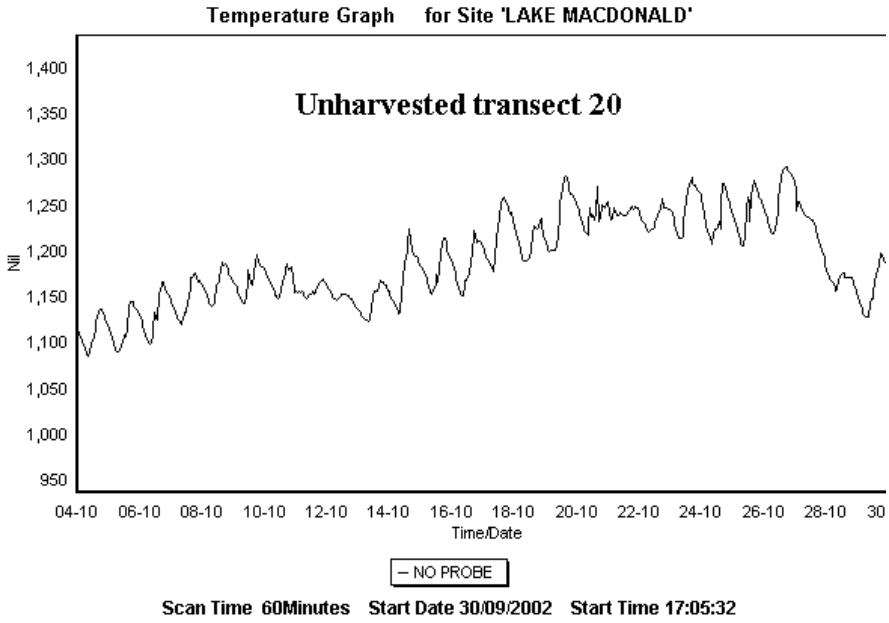
The temperature loggers were stationed 1m deep in 2.2m column of water at transect 20, an unharvested control, and transect 8, a harvested area. These locations were chosen because they both have the same aspect and lakebed profile.

Figure 2. A typical daily temperature range.



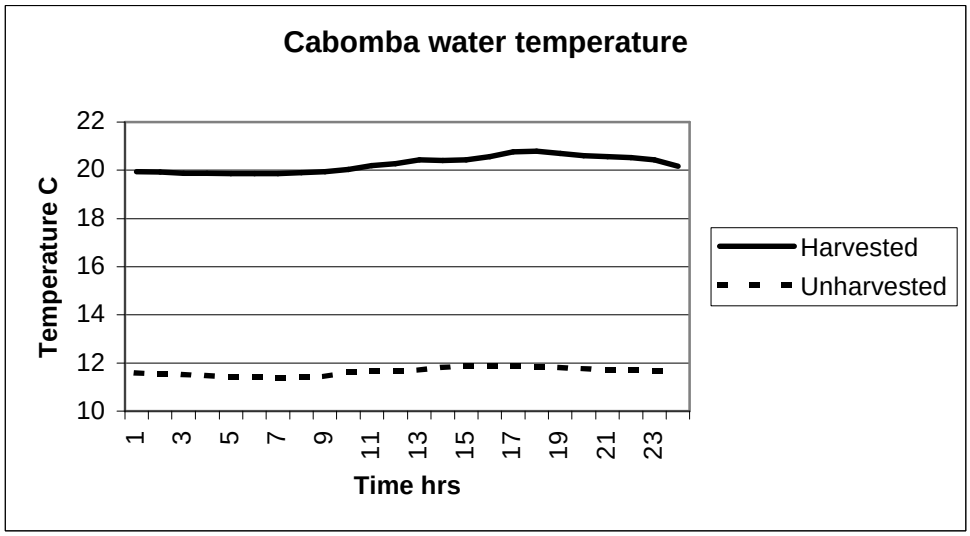
The daily temperature variations at both sites were similar, with the lowest reading occurring at about 9am with the maximum temperature reached at about 9pm.

Figure 3. The lake's maximum and minimum temperatures for October.



Mechanical removal of cabomba has a marked effect on water temperature, a difference of 8 C was recorded (Figure 4).

Figure 4. The effect of harvesting cabomba on water temperature, 8th October 2002.

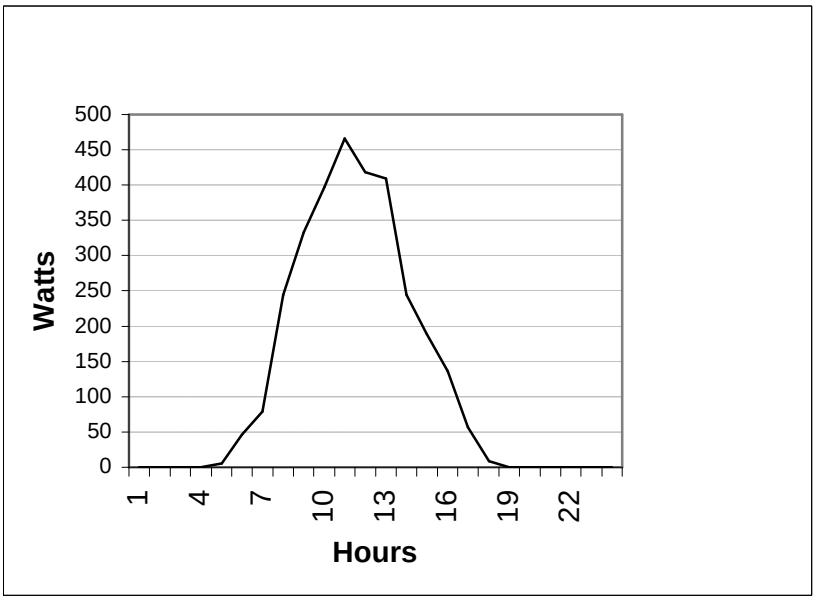


Light.

An Odyssey Dataflow Systems Pty Ltd energy sensor was used to collect solar irradiance data for Lake Macdonald. These sensors are designed for photosynthesis/ecological studies underwater. Silicone photovoltaic diodes that sense light in the 400-700nm waveband, the photosynthetic range for plants. Incoming energy was logged every five minutes and data is stored as Watts per metre^2.

As an example a sensor was positioned in a cabomba free location, 0.5m below the water surface on 28th November. In a 24 hour cycle the first watt of energy was recorded at 4.45am, rising sharply to a peak of 466watts per 5 minute period at 11.05am, with the last watt occurring at 6.40pm. (Figure 5)

Figure 5. Daily sunlight recorded as watts m^{-2}, 0.5m deep at Lake Macdonald, November 2002.



2.2.2 Provision of alternate aquarium plants.
Project 34506 involved setting up an aquatic plant nursery to provide native water plants. So far 33,631 Hydrilla and Vallisneria species have been propagated for revegetation work at Lake Macdonald. The methods developed could be used to supply these native plants to other water habitat projects.

2.3.2 Improve the understanding of cabomba ecology and biology.
Cabomba biomass data is in table 8 (on page 19). The main factor influencing biomass weight was harvesting frequency.

Cabomba biomass was influenced by the drought (August- January) 2002, especially in summer. In February 2003 the lake refilled quickly. Inflows of turbid, dirty water, also reduced cabomba plant weights. Also a mechanical breakdown with the compactor truck stopped operations in December- January.

Cabomba plant length decreases with harvesting intensity (Table 9 page21). This is important to water managers because of the public safety risks from entanglement in cabomba stems. In the studied areas plants over 2m long are dangerous. Mechanical harvesting is an effective means of managing public safety risks. The intensely harvested areas were kept well under control during the project. After repeated harvesting the plant size becomes smaller .eg intense cutting March 0.84m, April 1.92m, May 0.94m., where as the controls were 2.95m, 3.3m and 2.53m respectively.

The number of cabomba plants per square metre is hard to determine during winter when cabomba often lays horizontal on the lakebed. In general the number of plants increases after continuous harvesting and the plant size becomes smaller (Table 10).

Cabomba is a very competitive plant as seen by the low abundance of native plants recorded in (Table 11 page23). During 14 months of scuba diving hardly any native plants were recorded. Only on 6 occasions, and the plant weights were less than 0.1% of the sample. Prior to 1990 the lake had large stands of native plants.(Anderson and Garraty 1994)

Specific gravity or buoyancy values of different plant parts influences the overall impact of harvesting (Table 12). Cabomba is an underwater herb consisting of a single growing point from which up to 90 stems arise. The stems are rope like and flexible, being held erect by the buoyancy of the plant canopy. Like many other aquatic organisms, cabomba relies upon buoyancy to maintain its optimum position in the water column. Buoyancy can be measured as Specific Gravity. Cabomba's canopy has a SG of 0.93 gml^{-1} and is buoyant in water (SG 1) whereas the stem has a SG of 1.30 gml^{-1} and sinks. The relative SG changes from week to week but in general the canopy is very light in summer and heavier in winter.
The harvester performs best at a cutting depth of 0.8m. Only the plant canopy is removed. In winter the remaining stems fall to the bottom, in summer the remaining stems either stay erect or fall depending on their specific gravity.

Cabomba analysis.
This information is important to water and waste engineers as it shows relevant quantities of nutrients removed by harvesting at different depths.

Ninety seven samples of cabomba were analysed for nutrient status by the Natural Resource Sciences Laboratories. The aim was to find out what elements were stored in cabomba and whether the water quality reflected chemical composition of the plant. In table 1 nitrogen and phosphorous results show a gradient from top to bottom of the plant, while manganese and iron concentrations increase with depth.

Table 1. **N**utrient composition of cabomba plant sections.

Plant section	Nitrogen %	Phosphorus %	Manganese ppm	Iron ppm
Top 20cm	2.28	0.22	923	1,046
Mid stem	1.99	0.19	1,246	7,366
Lower stem	1.97	0.18	2,633	8,166
Roots	1.64	0.15	763	19,000

Table 2. Nutrient analysis of different water plants growing in Lake Macdonald

Plant	Nitrogen%	Phosphorous%	Potassium%	Manganese ppm
Cabomba	1.45	0.13	0.91	3300
Hydrilla	2.03	0.16	1.7	7200
Vallisneria	1.63	0.13	2.5	2500
Snow Flake	1.76	0.11	0.9	270

Table 3. Cabomba analysis and nutrients removed by harvesting at Lake Macdonald.

Composition	Cabomba			Quantity harvested (kg ha^{-1})
	Maximum	Minimum	Normal	
Protein %	20.1	9.1	13.3	1,395
Nitrogen%	3.21	1.45	2.13	226
Phosphorus%	0.24	0.13	0.17	18
Potassium%	1.5	0.85	1.77	188
Calcium%	0.63	0.18	0.53	56
Magnesium%	0.3	0.2	0.22	23
Sulphur%	0.45	0.12	0.41	43
Sodium%	2.89	0.8	2.17	231
Chloride%	2.2	0.8	1.27	135
Copper mg/kg	46	15.4	12.0	0.12
Zinc mg/kg	710	44	73.0	0.78
*Manganese mg/kg	7200	880	5,400	57.4
*Iron mg/kg	68000	15000	19,000	202
Boron mg/kg	86	32	63.3	0.67
Loss on ignition %			68.0	

*High levels probably due to a complex of epiphytic microbes.

2.3.4 Quantify the impacts of cabomba.

The effect of cabomba on light penetration through water was measured (Table 4, figure 7). The light sensor was set to scan data every 5minutes. In a 30-minute period 6 scans were recorded. Starting at the water surface for 30 minutes, then lowering the recorder by 0.5m depths every 30 minutes. Only the centre 3 recordings were used at

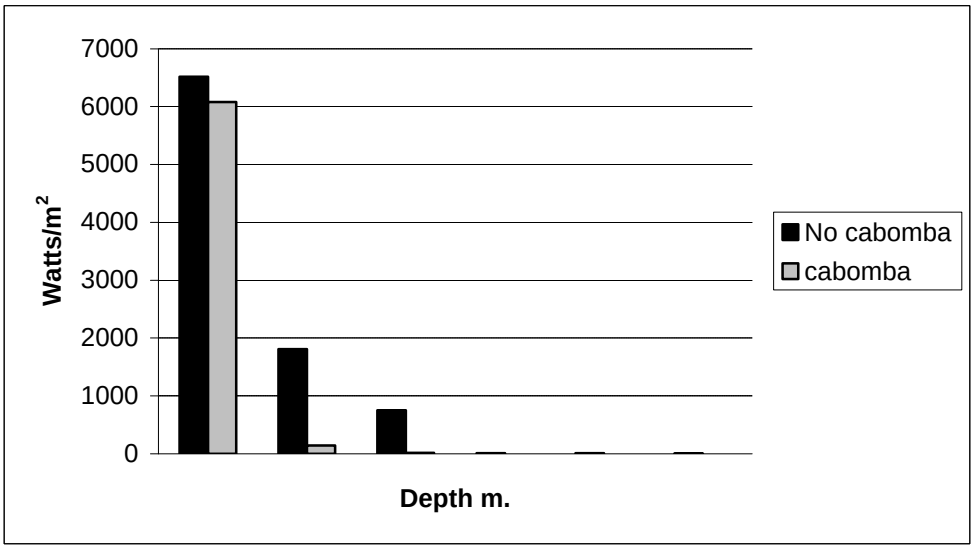
each depth station. The value used to plot the chart was light as Watts.m^{-2} recorded over 15 minutes. Table 4 shows the actual recordings.

Table 4. The effect of cabomba on light penetration through water.

	Light recorded as Watts/m^2	
Water depth m	Harvested	Unharvested
Surface	6418	6080
0.5	1807	141
1.0	749	15
1.5	113	2
2.0	13	0
2.5	6	0

Where the water body was free of cabomba some light reached a depth of 2.5m. At a depth of 0.5m light levels were 1807 Watts.m^{-2} in clear water and 141 Watts.m^{-2} in cabomba. The cabomba canopy had intercepted 93% of the light that would normally be available at 0.5m. Hardly any light (2 Watts.m^{-2}) reached 1.5m depth.

Figure 7. The effect of cabomba canopy on light penetration through water.



Tom: No depth on x-axis

2.3.5 Change community attitudes on control.

There is a linear relationship between harvesting frequency and the resultant cabomba biomass (Figure 6). Repeated harvesting has a profound effect on cabomba biomass, basically the more frequently the infestation is harvested, the smaller the biomass. During the project, whenever an area looked good, from a control point of view, the cabomba biomass was under 30 t ha$^{-1.}$ A harvesting regime capable of keeping a cabomba infestation below 30 t ha$^{-1.}$ addresses most of the problems associated with cabomba. According to Figure 6 this would mean harvesting at 6-8 week intervals.

Overall harvesting efficiency is affected by cabomba biomass and the distance travelled to unload the machine (Table 5). Other factors affecting the operation are:

- Weather, wind over 20kph is unsafe.
- Rain

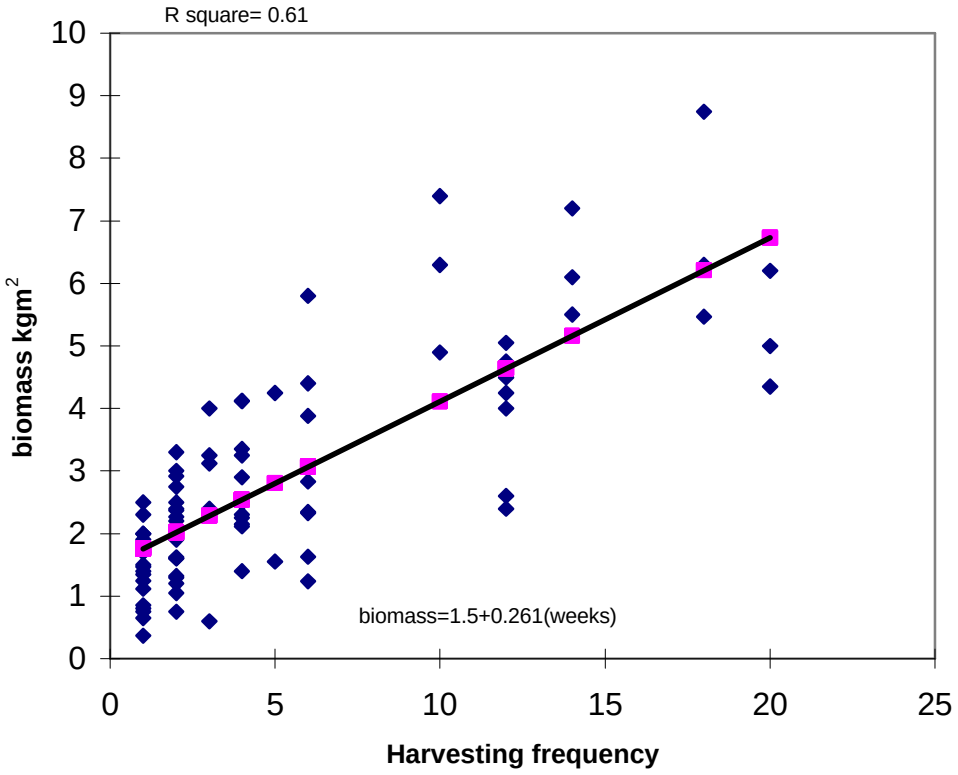
- Water levels below 0.5m. (Harvester draws 0.5m empty and 0.8m loaded)
- Turn around distance between harvester and truck ramp
- Submerged obstacles
- Cutting depth, 0.8m optimal. 1.4m maximum

Table 5. Effect of turn around distance and weed biomass on harvester operational efficiency.

Turn around distance	Weed biomass	Harvester load weight tonnes	Harvester Loads/day	Daily tonnage	Turn around time minutes	Compacto liquid L
0.5km	100t ha^{-1}	1.2	6-7	5-6	30	2000
	50	1.2	3-4	2-4	45	1000
2.0	100	1.2	3-4	2-4	60	1000
	50	1.2	2-3	1.5-3	90	500

This information is important to water managers contemplating cabomba control using mechanical harvesting. The construction of unloading ramps and general access factors such as water depth are vital to an efficient operation.

Figure 6. Relationship between cabomba biomass and harvesting frequency.



Aquatic nursery Project 34506

The Lake Macdonald Aquatic Nursery is situated on the Yurol Forest Drive in Pomona, adjacent to the Noosa and District Landcare Nursery. To date 33,631 native water plants have been supplied by this facility.

Nursery Construction

The construction of the Aquatic nursery was completed at the end of March 2002. The Aquatic nursery covers an area of 64m^2 with compacted earth and gravel overlay. Eight Aquatic ponds were built to grow *Hydrilla verticillata* and *Vallisneria nana*. The ponds measure 2.4m×2.4m×0.6m and are made from treated hardwood. The ponds are lined with a double layer of heavy duty black plastic, held in place with top rail capping. The floors of the ponds consist of a 30mm layer of fine river-washed sand. All ponds are open to the elements.

The nursery site has no mains power. No electric pumps could be used to oxygenate the pond water. A Horiba™ multiprobe (U-10) was used to assess dissolved oxygen, pH, turbidity and temperature levels in the ponds in September 2002 (Table 6).

Table 6: Data recorded in aquatic nursery ponds (25th September 2002)

	Temperature (^{0}C)	**pH**	**Turbidity**	**Dissolved O_2 mg/L**
Pond 1	22.6	8.4	5	8.2
Pond 2	22.3	8.3	4	10.02
Pond 3	22.5	8.4	6	7.9
Pond 4	22.7	8.3	6	7.6
Pond 5	23.2	8.4	5	8.3
Pond 6	22.6	8.3	7	9.03
Pond 7	23.7	8.3	4	7.4
Pond 8	22	8.3	4	8.5

Aquatic Plant Sourcing, Collection and Transport

Collection of plant material occurred in the Mary River Catchment. The sites of good source materials were identified through Mary River Catchment Care Group and Noosa and District Landcare networks.

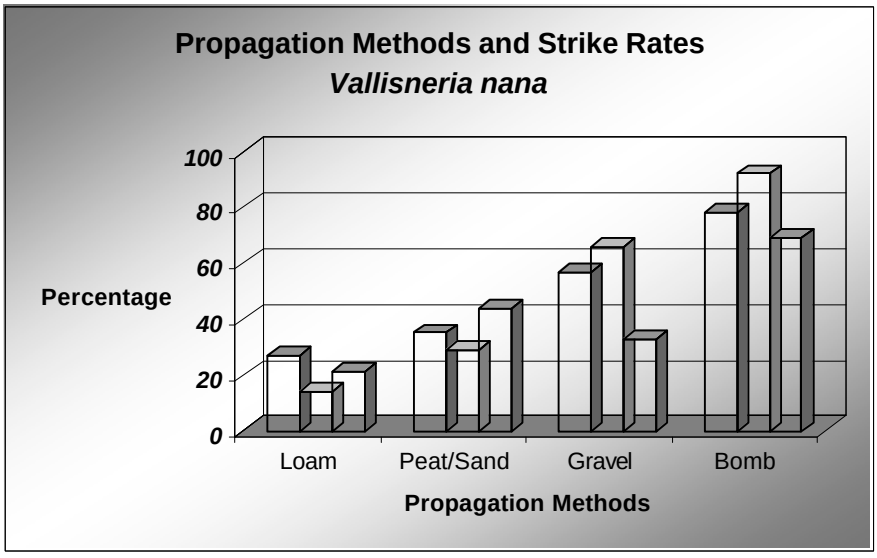
Hydrilla verticillata was collected from Skyring Creek and *Vallisneria nana* was collected from Middle Creek. *Hydrilla* was collected using an extendable pruning saw to extricate the *Hydrilla* mass from the slow-moving water body. The *Hydrilla* mass was placed in large bags and transported to the nursery ponds for grading and assessment. *Vallisneria* was taken off the sandy benthos by hand and the plant mass, including roots, was placed into 20 litre plastic drums for transport to the nursery.

Plant Propagation

The collected plant materials are placed in holding ponds for one or two days to be sorted through and as a quasi-quarantine measure. All plants were rinsed under running water to dislodge any unwanted materials such as silt, mucilage and aquatic herbivores. The treated plants were placed into a second holding pond ready to be prepared for planting.
Initially plant propagation occurred through exploiting the vegetative reproduction systems of *Vallisneria* and *Hydrilla* and by testing a variety of potting mixes.

In trials conducted at the nursery the stock *Vallisneria nana* were divided into single plantlets at the root base. *Hydrilla verticillata* stems were propagated from the lower nodes on the new growth tips (~5 cm). Clay loam, peat/sand (1:1) and fine gravel (= 5mm) potting mixes were used in Jiffy™ #515 Pot Strips (4 × 5cm). The propagation plant material was placed into the pots and back-filled with the potting mix. Growth of new roots and general plant health, using these methods, was poor. Root development occurred spasmodically across the range of potting mixes and within the two selected species (Figure 8&9). Experience derived through these processes indicated that these species of aquatic plants do not take readily to vegetative reproduction using these potting mixes. Further trials and research are needed to determine the optimal vegetative reproductive conditions for these species, which take into account temperature ranges and other environmental variables.

Observation of the collected mass of *Hydrilla verticillata* left in the ponds for a couple of weeks showed the formation of adventitious roots occurring along the nodes. This observation led to the development of the current planting technique – the "bombs". This technique uses concrete weights tied to a bunch of selected *Hydrilla/Vallisneria* (~10/5 plants per bomb, respectively) for the purpose of delivery to the lake benthos. Once securely at the benthos it was anticipated the plants would throw adventitious roots and establish on the benthos. The bombs are made from concrete formed in Hyco™ propagation trays. Two sizes of bombs are used, depending on the species planted. Size 1 (85mm × 40mm, 150g.) are used for the larger *Vallisneria nana* and Size 2 (50mm × 10mm, 38g.) are used for smaller *Vallisneria nana* and *Hydrilla verticillata*.
Figure 8: *Vallisneria nana* propagation success rates according to propagation method.



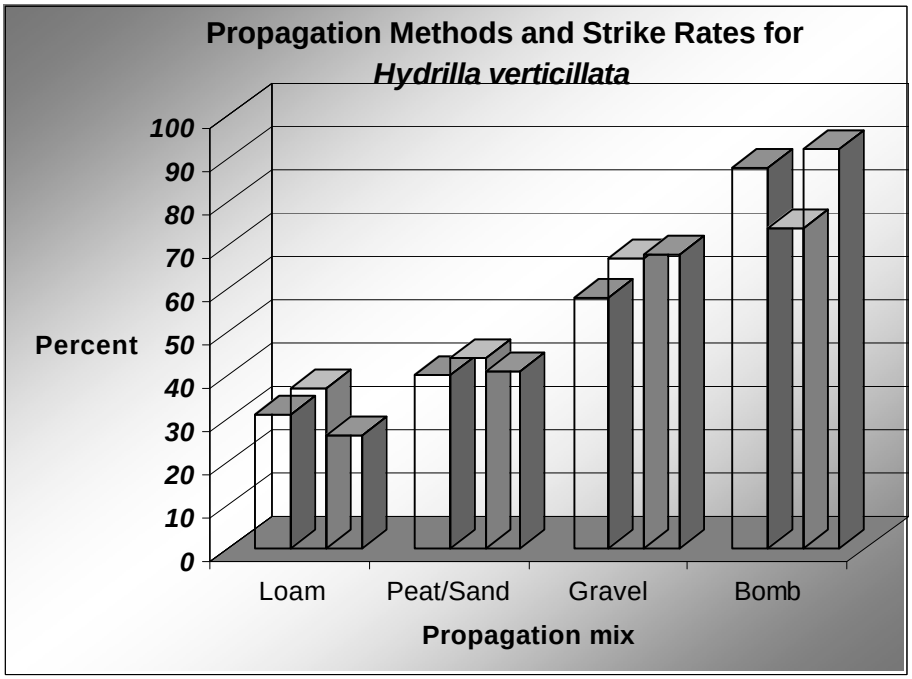


Figure 9:*Hydrilla verticillata* propagation success rate according to propagation technique.

Lake Planting Technique
The prepared plants are transported to the planting site in 20 litre buckets. These buckets are placed on the motorised pontoon and, at the correct transect location, the plants are dropped into the water – "grow and throw".

Video Transect Analysis
Video taping of transects was undertaken by Abyss Diving Pty. Ltd. The twenty lake transects were recorded once a month, over a period of 3 days. Each video transect footage contained vision starting at the shoreline and continuing for 50 meters into the water body or until no *Cabomba caroliniana* was found. Hand signals, recorded on video, were used to indicate 5 meter intervals along the transect line.

The videos were analysed using a ranking system. The 3 parameters assessed were the density of *Cabomba caroliniana*, the posture of the plant and its mucilage load in each 5-meter interval. A grading score (1 to 5) for each parameter was used to quantify the density and mucilage loads of Cabomba at each intervals within the transects. The plant's posture was assessed according to the stance of the plant – upright, leaning over or prostrate. These subjective assessments were used as spatial measures, because depth of field was indiscernible from the video footage. The videos were assessed by the same person throughout the project to ensure consistent subjective assessments. Incidental information, such as fish species present etc., was recorded as well. Data is shown in table 9&10.

Table 10 Cabomba video total scores of 50m transects, comparing harvested areas with control areas.

Treatment	Transect	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Feb	Yearly average
Harvested	1		9	12	11			17	8	10		11			
	2		17	19	20		14	18	22		13	17			
	3		23	23	28			24	29		24	22			
	12		11	14	9	21	9	12	11		3	7			
	Average		**15**	**17**	**17**	**21**	**11.5**	**17.8**	**17.5**	**10**	**13.3**	**14.3**			**15.4**
Control	16	36	35	25	30		35		40		33			37	
	17	37	46	29			32	37	20		33			33	
	19				31		35	40	39		46			40	
	21				35		25	25	29		20			38	
	Average	**36.5**	**40.5**	**27**	**32**		**31.8**	**34.0**	**32.0**		**33.0**			**37.0**	**33.8**

The yearly average of video assessment scores indicates that harvesting has lowered the occurrence of cabomba underwater by at least 54% (15.4 compared to 33.8 average score).

2.4 Coordination of management.

The lake Macdonald Catchment Care group is a community driven water resource management group.

Education and awareness

Dissemination of information on cabomba is considered a vital part of this project. We have covered a wide cross section of the community, including educational institutions, Government agencies, Councils, environment groups and the general public.

Vehicles for the delivery of this information have included public static displays, articles in a number of community group newsletters, talks given by project officers, local newspapers, television and radio interviews, and school activity days (listed on page 28).

Lake Macdonald Catchment Care Group has forged strong relationships with local Catchment and Landcare groups. These networks are extremely important for imparting information about the Cabomba infestation in Lake Macdonald. Trainees, under Noosa and District Landcare's supervision, are using the Aquatic Nursery to broaden their knowledge.

The school excursions have been particularly rewarding with parents, teachers and students showing a high level of interest. We have also produced brochures, posters and hand outs to display at the Rural Futures Centre, Pomona and field days.

Public awareness has been raised immensely over the duration of these projects. Education and awareness are essential elements in the fight against exotic aquatic weed invasion. By raising public awareness, the Lake Macdonald Catchment Care Group has received widespread support for investigating the field of biological control. Therefore, it is imperative to keep Cabomba in the public's mind in order to gain support for the introduction of a biological control agent

Volunteers

Volunteers played a large part in completing the objectives of these projects.

Twenty two people volunteered their time, skills and good humour in the monthly preparation of native aquatic plants for revegetating Lake Macdonald. An average of 27 hours per week was spent by volunteers working in the aquatic nursery. The volunteers learnt about aquatic plant propagation, aquatic weed control and aquatic ecosystems. They also learnt aspects of biological control and conducted lively debates over morning tea on these issues.

The development of the two projects has sparked the interest of many target groups. Open days, local publications and public presentations covered a wide audience. Local gardening groups, Lions Clubs, school groups and parents, University students, Horticultural trainees, local government employees, Landcare and catchment groups, fishing groups and newspaper audiences.

These projects have created a new awareness of importance of water plants in aquatic ecosystems. Previously the adage "out of sight out of mind" was the dominant paradigm. This view is slowly been turned around to emphasis the integral role that aquatic plants play in the health of ecosystems. A commonly recognised local example is Camphor laurel, which has taken approximately 100 years to establish in pest proportions, compared to 10 years for Cabomba. This graphic example illustrated the impact and tenacity of the cryptic Cabomba to the general public.

Where to from here.

Education.

Increased public awareness is a key driver in programmes such as these. The public needs and desires information about the goings-on in their local environments. A clear and concise educational programme addressing the impact of aquatic weeds on the Australian biota would be a cost effective and timely tool to combat aquatic weed invasion. These educational programmes can be easily tailored to suit the respective audience.

Research.

Further research is needed to develop propagation and planting techniques pioneered in these projects. Water resource management, through "soft engineering" methods, will play an important, sustainable, cost effective and vital role in the management of aquatic ecosystems.

Biological control.

While these projects concentrated on mechanical harvesting and competitive native plants it became obvious that the cabomba problem really needs a natural, long term solution. The Lake Macdonald Catchment care group has been effective in organising a financial stakeholder group prepared to support overseas exploration for natural enemies of cabomba. Environment Australia has committed funds for one year, which will enable CSIRO to start this exploration. If natural control agents are identified overseas then every effort should be made to establish biological control of cabomba in Australia.

Tom Anderson	**Conor Neville**	**Phil Moran**
Project Manager	**Project Officer**	**Plant Propagator**

Table 8. The effect of harvesting on cabomba bio mass.

		Cabomba biomass, kg/m, 2002 Lake Macdonald																	2003				
Treatment	Transect	wac	Jan	wac	Feb	wac	March	wac	April	wac	May	wac	June	July	wac	Aug	Oct	wac	Nov	Jan	wac	Feb#	wac	Mar
Intense	T1			2	3	1	2.3	3	0.6	2	3.3						1.87	4	4.12	1.37	6	1.24	1	1.35
	T2	6	4.4	2	2.4	1	1.25	4	2.25	2	2.1			3.6	12	5.05	3.25			1.77	6	1.63	1	1.47
	T3	12	4.25	2	2.75	1	1.4	4	2.9	2	2.2						3.6	4	2.49	4.34	6		1	0.8
	T4	12	2.6	2	2.27	1	2.5	4	2.3	2	1.9			2	12	4.5	2.5			6.29	6	2.83	1	0.85
	T5	12	4	3	3.12	1	0.75	4	1.4	2	1.05						2.37	4	2.12	4.51		2.12	1	0.65
Average			**3.81**		**2.71**		**1.64**		**1.89**		**2.11**			**2.80**		**4.78**	**2.72**		**2.91**	**3.66**		**1.96**		**1.02**
	T10	1	2	3	2.4	2	2.5	4	3.35			2	1.2	0.75		1.5	1.8	2	1.32		6	2.33	14	3.45
	T11	1	2	3	4	2	1.62	4	3.25			2	0.75				1.62	2	2.92		6	3.88		
	T12	6	5.8		3.78	2	1.6	4	2.15				3.9	3.6	12	4.75	2.25				6			
Average			**3.27**		**3.39**		**1.91**		**2.92**				**1.95**	**2.18**		**3.13**	**1.89**		**2.12**			**3.11**		**3.45**
Low	T6	1	1.7	5	4.25	1	0.37	5	1.55	2	1.6		1.65	1.12		2.5	1.95	1	1.5	2.86		2.49	14	2.4
	T7	1	1.9	3	3.25	2	2.37	6	2.35	2	1.3		3.1				2.75	1	1.12	3.07		3.12		
	T8	12	2.4	20	5		0.4		2.65	3	2		3.05	1.9		4.5	1.12			3.49		3.03		1.35
	T9	20	4.35	20	6.2		4		6.3	3	1.95						2.15			3.37		1.13	1	0.8
Average			**2.59**		**4.68**		**1.79**		**3.21**		**1.71**		**2.60**	**1.51**		**3.50**	**1.99**		**1.31**	**3.20**		**2.44**		**1.52**
Control	T16		5.85		3		3.9		5.37				3.72	1.9		5.17	2.62		5.14	4.24				
	T17		4.85		5.04		5		3.15		3.4		1.25	4.62		5.25	2.45		2.32	2.87		1.93		1.8
	T19								3.12		2.3		1.12	2.25		2	1.25		1.52	2.24		2.43		2.35
	T20								3.5		2.5		1.3	0.87		1.6	1.3		2.22	1.42		2.25		1.22
Average			**5.35**		**4.02**		**4.45**		**3.79**		**2.73**		**1.85**	**2.41**		**3.51**	**1.91**		**2.80**	**2.69**		**2.20**		**1.79**
Intense	T13	10	7.4	14	6.1	18	6.3				3.4													
	T14	10	6.3	14	7.2	18	8.75				3.3													
	T15	10	4.9	14	5.5	18	5.47	4	1.75				3.02											

Wac = weeks after harvesting. # Lake refilled in February after drought. Missing values are the result of adverse weather, diver workloads.

Table 9. The effect of harvesting on cabomba plant length.

Cabomba Plant length, m, 2002 Lake Macdonald																						2003					
Treatment	Transect	wac	Jan	wac	Feb	wac	March	wac	April	wac	May	wac	June	July	wac	Aug	Oct	wac	Nov	Jan	wac	Feb#	wac	Mar
Intense	T1			2	2.2	1	0.6		1		1.5						1.4	4	2.2	1.6	6	3.5	1	2.1
	T2	6	4.3	2		1	0.9		2.2		1				12		2			1.8	6	1.5	1	2.1
	T3	12	3	2	3.2	1	1		3.5		0.7						1.1	4	1.5	1.3	6		1	2.7
	T4	12	3.1	2	2.5	1	1.2		2		1				12		1.2			1.5	6	2.42	1	1.8
	T5	12	3	3	2.1	1	0.5		0.9		0.5							4	2.4	1.1		2.1	1	1.5
Average			**3.35**		**2.50**		**0.84**		**1.92**		**0.94**						**1.43**		**2.03**	**1.46**		**2.38**		**2.04**
	T10	1	2.5	3	3.4	2	1.7		2.6			2					1	2	2.3		6	3	14	4.2
	T11	1		3	1.9	2	1.1		3.1			2					1.2	2	2.6		6			
	T12	6	2.4		3.5	2	0.5		2.5						12		0.9				6			
Average			**2.45**		**2.93**		**1.10**		**2.73**								**1.03**		**2.45**			**3.00**		**4.20**
Low	T6	1	2.6	5		1	1		0.9		1											1.58	14	3.7
	T7	1	4.2	3		2	1.1		1.6		1.1							1	1.4	2.3	10	2.8	14	
	T8	12	4.4	20	4		1.2		1.6		2						2.5	1		2.8		3.4	14	4
	T9	20	3.1	20	4		2.3		4.5		0.9						1.1		2.9	3.7			1	1.1
Average			**3.58**		**4.00**		**1.40**		**2.15**		**1.25**						**1.80**		**2.15**	**2.93**		**2.59**		**2.93**
Control	T16		2.6		3.1		3.1		3.4								2.7		2.6	2.3				
	T17		2.7		3.1		2.8		3.2		2.1						1	2	3.4	1.6		3.6		3.7
	T19										2.5						0.9		1.8	1.4		1.7		3.8
	T20										3						1.2		2.8	1.5		2.5		3.7
Average			**2.65**		**3.10**		**2.95**		**3.30**		**2.53**						**1.45**		**2.65**	**1.70**		**2.60**		**3.73**
Intense	T13	10	2.8	14	2	18	3				2.3													
	T14	10	3.2	14	2.9	18	3.7				3													
	T15	10		14	2.5	18	3.7		1.9															

Table 10. The effect of harvesting cabomba on plant number per m^2

Cabomba plant number 2002 Lake Macdonald																		2003							
Treatment	Transect	wac	Jan	wac	Feb	wac	March	wac	April	wac	May	wac	June	July	wac	Aug	Oct	wac	Nov	Jan	wac	Feb#	wac	Mar
Intense	T1			2	4	1	4	3	5	2	8						5	4	8	4	6	2	1	5
	T2	6	5	2	8	1	5	4	5	2	12				12		3			3	6	2	1	3
	T3	12	5	2	5	1	7	4	4	2	5						5	4	6	5	6	4	1	2
	T4	12	7	2	4	1	8	4	8	2	8			4	12		3			4	6	5	1	6
	T5	12	8	3	4	1	4	4	6	2	6						6	4	4	7		5	1	8
Average			**6.25**		**5.00**		**5.60**		**5.60**		**7.80**			**4.00**			**4.40**		**6.00**	**4.60**		**3.60**		**4.80**
	T10	1	5	3	6	2	7	4	3			2		3		3	8	2	3		6	2		2
	T11	1		3	7	2	5	4	5			2					5	2	3		6	4		
	T12	6	5		4	2	3	4	7				4		12	5	10				6	6		
Average			**5.00**		**5.67**		**5.00**		**5.00**				**4.00**	**3.00**		**4.00**	**7.67**		**3.00**			**4.00**		**2.00**
Low	T6	1	6	5	3	1	3	5	8	2	7							1		7		9		3
	T7	1	5	3	5	2	7	6	9	2	5							1	3	4		2		
	T8	12	6	20	4		3		10	3				3					3	5		3		1
	T9	20	4	20	3		5			3	5						5		4	2		4	1	8
Average			**5.25**		**3.75**		**4.50**		**9.00**		**5.67**			**3.00**			**5.00**		**3.33**	**4.50**		**4.50**		**4.00**
Control	T16		3		6		5		6				7	9			4		4	9		0		
	T17		7		4		9				9		4	9		5	6	2	3	8		4		2
	T19										8			4			4		8	7		7		8
	T20								3		5			4			4		4	6		5		3
Average			**5.00**		**5.00**		**7.00**		**4.50**		**7.33**		**5.50**	**6.50**		**5.00**	**4.50**		**4.75**	**7.50**		**4.00**		**4.33**
Intense	T13	10	11	14	9	18	4				11													
	T14	10	7	14	7	18	3				8													
	T15	10	5	14	5	18	4	4	6															

Table 11. Native plants recorded during cabomba diving operations at Lake Macdonald.

Cabomba Native plants 2002 Lake Macdonald

																				2003			
Treatment	Transect	wac	January	wac	February	wac	March	wac	April	wac	May	wac	June	July	wac	August	October	wac	November	January	wac	Feb#	wac
ntense	T1			2	nil	1	nil	3	nil	2	nil						nil	4	nil		6	nil	1
	T2	6	nil	2	nil	1	nil	4	nil	2	Nym 10g			nil	12	nil	nil			nil	6	nil	1
	T3	12	nil	2	nil	1	nil	4	nil	2	nil						nil	4	nil	nil	6	nil	1
	T4	12	nil	2	nil	1	nil	4	nil	2	nil			nil	12	nil	nil			nil	6	nil	1
	T5	12	nil	3	nil	1	nil	4	nil	2	nil						nil	4	nil	nil		nil	1
	T10	1	Hyd 10g	3	nil	2	nil	4	nil			2	nil	nil		nil	nil	2	nil		6	nil	
	T11	1	nil	3	nil	2	nil	4	nil			2	nil				nil	2	nil		6	nil	
	T12	6	Nym 40g		nil	2	nil	4	nil				nil	nil	12	nil	nil				6		
Average																							
Low	T6	1	nil	5	nil	1	nil	5	nil	2	nil		nil	nil		nil	nil	1	nil	nil		nil	
	T7	1	nil	3	nil	2	nil	6	nil	2	nil		nil	nil		nil	nil	1	nil	nil		nil	
	T8	12	nil	20	nil		nil		nil	3	nil		nil	nil		nil	nil			nil		nil	
	T9	20	nil	20	nil		nil		nil	3	nil		nil	nil		nil	nil			nil		nil	1
Average																							
Control	T16		nil		nil		nil		nil	nil	nil		nil	nil					nil	nil			
	T17		nil		nil		nil		nil	nil	nil		nil	nil		Nym 20g	Nym 10g	2	nil	nil		nil	
	T19								nil	nil	nil		nil	nil					nil	nil		nil	
	T20								nil	nil			nil	nil					nil	nil		nil	
ntense	T13	10	nil	14	nil	18	nil				Bly 5g												
	T14	10	nil	14	nil	18	nil				nil												
	T15	10	nil	14	nil	18	nil	4	nil				nil										

Hyd = Hydrilla, Nym= Nymphoides indica, Bly= Blyxa sp.

Table 12. Cabomba specific gravity records.

Cabomba Plant specific gravity g/ml 2002 Lake Macdonald

Treatment	Transect	wac	Jan	wac	Feb	wac	March	wac	April	wac	May	wac	June	July	wac	Aug	Oct	wac	Nov	Jan
Intense	T1		1.1	2	0.94	1				2								4		0.99
	T2	6		2	1.01	1				2				0.98	12					1.13
	T3	12	0.96	2	1	1				2								4		1
	T4	12	0.88	2		1				2				1	12	1.12				
	T5	12		3	0.98	1			1.07	2								4		0.88
Average			**0.98**		**0.98**				**1.07**					**0.99**		**1.12**				**1.00**
	T10	1		3		2						2		1.02		1.03	1.02	2		
	T11	1		3	1.05	2			0.99			2					0.99	2		
	T12	6			1.01	2									12	1.06	0.99			
Average					**1.03**				**0.99**					**1.02**		**1.05**	**1.00**			
Low	T6	1	0.93	5		1			1.1	2				0.98		1.17				1.01
	T7	1	1	3		2			1.05	2								1		1.07
	T8	12	0.93	20					1.05	3				1		1.04	1.01	1		
	T9	20	1	20						3										0.96
Average			**0.97**						**1.07**					**0.99**		**1.11**	**1.01**			**1.01**
Control	T16		0.85						0.93					0.94			0.98			
	T17		0.93		1.06									0.98			0.95	2		
	T19													0.98		1.02				
	T20						0.97							1.08		1.13				
Average			**0.89**		**1.06**		**0.97**		**0.93**					**1.00**		**1.08**	**0.97**			
Intense	T13	10		14	1	18	0.97													
	T14	10		14	0.96	18	1													
	T15	10		14	0.96	18	0.96		0.9											

Table 13. The effect of harvesting cabomba on water clarity, as Secchi disc readings.

Cabomba Secchi disc readings m. 2002 Lake Macdonald

Treatment	Transect	wac	Jan	wac	Feb	wac	March	wac	April	wac	May	wac	June	July	wac	Aug	Oct	wac	Nov	Jan	wac	Feb#	wac	Mar
Intense	T1			2	1.5	1	1.5		1.2	2				1.8			1.3	4	1.1	1.01	6		1	0.8
	T2	6		2	0.9	1	1.3		1.3	2					12	1.7	1.4				6		1	
	T3	12	1.2	2	1.2	1	1.3		1.2	2							1.2	4			6		1	1
	T4	12		2		1			1	2				1.8	12						6	1.2	1	0.8
	T5	12		3	1.1	1	1.2		1.3	2								4		1		0.95	1	0.8
Average			**1.20**		**1.18**		**1.33**		**1.20**					**1.80**		**1.70**	**1.30**		**1.10**	**1.01**		**1.08**		**0.85**
	T10	1		3		2						2					1.3	2			6	0.85	14	0.9
	T11	1		3		2			1			2					1.2	2	1.3		6			
	T12	6				2			1.1						12		1.3				6			
Average									**1.05**								**1.27**		**1.30**			**0.85**		**0.90**
Low	T6	1		5		1	1.2			2				1.7		1.8				1		1.05	14	0.8
	T7	1	1.25	3		2			1.3	2				1.9			1.4	1		1	10	0.9	14	
	T8	12	1.3	20					1	3			1.45	1.6		1.7	1.1	1		0.9			14	0.82
	T9	20	1.3	20	1.3		1.3		1.4	3									1.4	1.1		0.8	1	
Average			**1.28**		**1.30**		**1.25**		**1.23**				**1.45**	**1.73**		**1.75**	**1.25**		**1.40**	**1.00**		**0.92**		**0.81**
Control	T16		1.9		1.4								1.95						1.7					0.85
	T17		1.7													2	1.7	2				1		1.1
	T19												2.2				1.5			1		1.3		0.95
	T20												2.35									1.2		
Average			**1.80**		**1.40**								**2.17**			**2.00**	**1.60**		**1.70**	**1.00**		**1.17**		**0.97**
Intense	T13	10		14		18	1.7															0.2		
	T14	10	1.7	14		18																0.2		
	T15	10		14	1.3	18			1.5													0.2		

Red figures are weeks after harvesting. # Lake refilled in February after drought

Table 14 Revegetation, plantings and dates for Lake Macdonald

Revegetation schedule for Lake Macdonald														
Date	Transect	Hydrilla	Vallisneria	Date	Transect	Hydrilla	Vallisneria	Date	Transect	Hydrilla	Vallisneria	Date	Transect	Hydrilla
2July02	1	321	369	17July02	1	198	531	22Oct02	1	97	105	21Mar03	1	40
	2	311	488		2	126	261		2	56	105		2	40
	3	265	417		3	198	531		3	65	105		3	40
	4		516		4	126	263		4	34	105		8	15
	5		256		5	126	261						9	40
	6		313		6		540		6		506		10	40
	7	196	98		7	126	675		7		164			
	8	213	70		8	300	261		8		378			
	9		33		9		265							
	10		30		10		605		10		269			
	14		327		11		535							
					12		261							
					16		1620							
	Totals	**1306**	**2917**		**Total**	**1200**	**6609**		**Totals**	**252**	**1737**		**Totals**	**215**
27Nov02	10	200	330	5Dec02	1	560	405	14Feb03	3		2000			
	11				2	560	415		4		2000			
	12				3	560	470		5		2500			
	13				4	350	480		6		2375			
	14				5	350	370							
	15				6	345	420							
	16				7	548	300							
	17				8	455	330							
	18				9	560	310							
	19				10	470	300							
	20				11	457	200							
					12	475	300							
	Totals	**200**	**330**		**Totals**	**5690**	**4300**		**Totals**		**8875**			

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Education and Awareness Acivities

Static Displays

Commonwealth Bank, Cooroy
Noosa Regional Art Gallery, Pomona
Rural Futures Centre, Pomona
Noosa and District Museum, Pomona
Noosa Parks Association- Environment Centre
Noosa Library, Noosaville

Public Presentations

Noosa Lions Club, Noosa Junction
Noosa District Show, Pomona
Cooroy State School, Weed buster week, Cooroy
Sunshine Coast Branch – Australian Labour Party
Noosa Green Corps
Noosa District High School
Pomona State School, Pomona
Cooran State School, Cooran
Noosa Parks Association, Noosa
University of the Sunshine Coast
Imbil State School, Imbil
Cooroy State School, Special Education Unit, Cooroy Noosa Community Boards- Mayor and Councillors, Noosa
Cooroy Scouts Group, Cooroy
Mooloola Waterwatch, Mooloola
Noosa Waterwatch, Pomona
Gerry Cook Fish Hatchery
Camphor Laurel Initiative Group (covering Noosa, Cooloola, Caloundra and Maroochy Shires)

Articles

Monthly progress reports to Lake Macdonald Catchment Care Group (12)
Progress reports for Mary River Catchment Care Group (6)
Codline articles (2)
Noosa and District Landcare articles (7)
Noosa News article (1)
Channel Seven News (1)

Publications:

McLean,V. Cook,G and Anderson,T.. (2002). Cabomba ecology and management. Proceedings of the 7th. Queensland Weed Symposium. Emerald. Qld. 24-27th June 2002

Anderson,T. (2001). Cabomba management options. Proceedings of the 11th Biennial Noxious Weeds Conference. Moama. NSW 3rd-6th September 2001

Public Presentations.

Anderson,T. 2001. Cabomba management options. 11th Biennial Noxious Weeds Conference. Moama. NSW 6th September 2001

Anderson,T. 2002. Cabomba ecology and management. 7th. Queensland Weed Symposium. Emerald. Qld. 27th June 2002

Anderson,T. 2002. Cabomba management options. Oxley Creek Environmental Group. Inala. 6th August.

Anderson,T. 2002. Cabomba Control Options. Mary River Pest management Advisory Group. Tiaro. 7th August.

Anderson,T. 2002. Cabomba ecology and management. RANA(Restore Australian native amphibia). 5th October.

Seminars.

Garraty,K. 2002. Biological control of cabomba. Special seminar of the Lake Macdonald Catchment Care Group. Cooroy. 12th March.

Anderson,T. 2002. Cabomba impacts on water quality. Australian Institute of Environmental Health Engineers Seminar. Gold Coast. 18th September.
Workshops.

Forums.
Anderson,T. 2001. Cabomba role of the Lake Macdonald Catchment Care Group. NSW North Coast Weed Advisory Forum. Yamba. 29th November.

Anderson,T. 2002. What is a weed? -cabomba. The Hut Environmental & Community Association Inc. Regeneration Forum. Brisbane Botanical Gardens. 21st September.

Anderson,T. 2002. Cabomba, the role of the Lake Macdonald Catchment Care Group. South east Queensland Pest Advisory Forum. Biggenden. 20th November.

TV
7 Coast News. Cabomba project by the Lake Macdonald Catchment Care Group. Noosa. 27th November 2002.

Radio

Coast FM. . Cabomba, A project by the Lake Macdonald Catchment Care Group. Noosa. 27th November 2002.

Newspaper

Frank Wilkie. 2002. Expert team fighting dam weed. Sunshine Coast Daily (Saturday feature). Maroochydore. 7th December.

Appendix 1

PROJECT REPORT

(Please see the attachment to this report for guidelines)

PLEASE REPORT ONLY ON FUNDED ACTIVITIES.

PROJECT TITLE: Strategic Cabomba Control by Community Action			
PROJECT REF: 34505			
PROPONENT: Lake Macdonald Catchment Care Group, sub Mary River Catchment Coordinating Committee			
PROJECT OFFICER/CONTACT PERSON: Tom Anderson			
DATE THIS REPORT DUE: 31st March 03			
PROJECT SCOPES			
SCOPE NO.	**SCOPE DESCRIPTION**	**PROGRESS (COMPLETED / % COMPLETED / NOT COMPLETED)**	**OUTCOMES AND OUTPUTS** (please see attachment for examples of the types of outcome/output information we are seeking to be included in this column)
2002.01	Provide appropriate technical advice that the proposed methodology will be successful (i.e. Copy of Cabomba Pilot Study Harvesting Report March 2000); to be returned with **Grant Contract**.	**COMPLETED**	Pilot Study report was supplied March 02. Methodology described has been evaluated and improved on during this project.
2002.02	Develop a prioritised combined work plan with Project 34506 'Aquatic Habitat Restoration after Cabomba Control' and return with **Grant Contract**.	**COMPLETED**	A combined work plan was set out in the "Environmental Recovery Plan April 2002" pp16-17

2002.03	Liaise with the Mary River Cod Recovery Project to ensure the proposed treatment does not adversely affect the species, and also seek advice that the proposed treatment will not adversely affect other endangered species including the Mary River Turtle and Purple Spotted Gudgeon Fish; to be returned with **Grant Contract**.	**COMPLETED**	Liaison carried out with officers of MRCCC, Noosa Council cod hatchery, Sunfish representatives at monthly meetings of the catchment care group.
2002.04	Complete and submit a project progress report identifying progress against all scopes by **31 March 2002**.	**COMPLETED**	Report supplied together with an Environmental recovery plan April 2002
2002.05	Collect information on *Cabomba caroliniana* occurrences in Lake Macdonald, including density, biomass, and samples by **31 March 2002**.	**COMPLETED**	Monthly research data has been gathered using Abyss diving Co. 3 day trips usually in the first week of each month starting Jan02-Jan 03 have been completed. Data includes biomass, plant numbers, plant length ,specific gravity, See pp5-6 Scientific studies of Environmental recovery plan.
2002.06	Liaise with stakeholders in the development of a management plan (including extent of areas in hectares to be treated and follow up treatment) to eradicate *Cabomba caroliniana* from Lake Macdonald and revegetate with native aquatic species and provide to Environment Australia **31 March 2002**.	**COMPLETED**	The catchment care group developed an overall management plan with input from the Alan Fletcher Research station, Natural Resource Sciences, QNRM. This document is the Environmental Recovery Plan April 2002 See map 1&2 of ERP
2002.07	Develop appropriate monitoring programs for *Cabomba caroliniana* treated areas and detailed plan for follow-up treatment by **31 March 2002**.	**COMPLETED**	See pp5-6 Scientific studies of Environmental recovery plan. Revegetation using native plants outlined in pp7-8 of ERP.

2002.08	Employ a Project Officer Component 1 Control (8hrs/week @ $16/hr, 22% FTE) and provide supporting documentation (including details of tasks undertaken) by **30 September 2002**.	**COMPLETED**	Job interviews 19/2/02 Conor Neville employed 20/3/02
2002.09	Undertake *Cabomba caroliniana* harvesting services using an HV 2600 floating harvester at $59,800 (including operating costs) and provide supporting documentation by **30 September 2002**.	**Completed**	Harvester purchased by Noosa Council has carried out the project requirements satisfactorily Jan02-Jan03. Feb-Mar03 left.
2002.10	Contract Abyss Diving Pty Ltd (2 person team for 1 day/week) to undertake all underwater operations including sampling and videoing at $9,600 and provide employment details and worksheets by **30 September 2002**.	**Completed**	Abyss Diving Co. engaged (5-7Mar, 9-11Apr, 1-3May, 4-6Jun, 23-25Jul, 27-29Aug, 1-3Oct, 8-9Oct, 26-28Nov 02, 14-16Jan03 at $1548 per session. $9600 NHT. Plus $7,000 QNRM
2002.11	Organise water quality assay analysis (3 assays per month) by Qld Health laboratory at $4,100 and provide supporting documentation by **30 September 2002**.	**Completed**	This activity duplicated by Noosa Water. So allocation was used to fund cost overrun on Aquatic Nursery and maintenance of the LMCCG water quality tester *Horiba U10*
2002.12	Organise macrophyte assay analysis (3 assays per month) by DPI Agricultural Chemical laboratory at $3,600 and provide supporting documentation by **30 September 2002**.	**Completed**	97 assays @ $36each $3492 have been analysed by Natural Resource Sciences Laboratories, Indooroopilly Q.

2002.13	Maintain appropriate site and propagation data (including number of hectares treated and spatial data and supporting information in accordance with Contract Appendix 3 "Guidelines for the Provision of Data") and video records and provide copy to Environment Australia (as part of final report) by **30 September 2002**.	**COMPLETED**	Harvesting has been completed in accordance with ERP pp 4-5. Video taping and research data has been carried out as per ERP pp6-6.
2002.14	Improve general community awareness through the development of **10** products at (including field days, conference presentations, community meetings, posters, Totally Wild program, newspaper articles and radio interviews) by **30 September 2002**.	**Completed**	Project has generated media as per TV, radio, print. 4 conference papers and presentations for NSW and Qld weeds conferences. Field days at local and state level. Industry displays and presentations at SEQ pest Advisory Forums.
2002.15	Complete and submit project annual report identifying progress against all scopes by **30 September 2002**.	**Completed**	
Broader Biodiversity Benefits			*Where relevant, please include a brief description of benefits to non-target species or ecological communities etc*

*If relevant please also attach any required or supporting documentation (recovery plans, research papers, strategies, additional information or comments)

Appendix 1

PROJECT REPORT
(please see the attachment to this report for guidelines)

PLEASE REPORT ONLY ON FUNDED ACTIVITIES.

PROJECT TITLE: Aquatic Habitat Restoration after Cabomba Control

PROJECT REF: 34506

OPONENT: Mary River Catchment Coordinating Committee Inc. on behalf of the Lake Macdonald Catchment Care Group

PROJECT OFFICER/CONTACT PERSON: Mr Tom Anderson

DATE THIS REPORT DUE:

PROJECT SCOPES

SCOPE NO.	**SCOPE DESCRIPTION**	**PROGRESS (COMPLETED / % COMPLETED / NOT COMPLETED)**	**OUTCOMES AND OUTPUTS** (please see attachment for examples of the types of outcome/output information we are seeking to be included in this column)
2002.01	Provide a more detailed budget linked to the workplan (prioritised workplan to be combined with Project 34505 'Strategic Cabomba Control by Community Action'), confirm sites to be treated have high conservation value and very high weed infestation; to be returned with **Grant Contract**.	**COMPLETED**	A combined work plan was set out in the "Environmental Recovery Plan April 2002" pp16-17
2002.02	Liaise with stakeholders in the development of a management plan (including extent of areas in hectares to be treated) to eradicate *Cabomba caroliniana* from Lake Macdonald and revegetate with native aquatic species and provide to Environment Australia by **30 September 2002**.	**COMPLETED**	The catchment care group developed an overall management plan with input from the Alan Fletcher Research station, Natural Resource Sciences, QNRM. This document is the Environmental Recovery Plan April 2002 See map 1&2 of ERP

2002.03	Develop appropriate monitoring programs for revegetated areas by **30 September 2002**.	**COMPLETED**	See pp5-6 Scientific studies of Environmental recovery plan. Revegetation using native plants outlined in pp7-8 of ERP. Scuba diving, underwater-videotaped 50m transects plus quadrat samples at 20 sites in the lake.
2002.04	Employ a Project Officer Component 2 Revegetation (8hrs/week @ $16/hr, 22% FTE) and provide supporting documentation (including details of tasks undertaken) by **30 September 2002**.	**COMPLETED**	Job interviews carried out on 19/2/02, Phil Moran appointed on 20/3/02.
2002.05	Undertake native water plant propagation (*Hydrilla verticillata*, *Vallisneria nana* and *Najas tenuifolia*) including collection and replanting at $16,600 (20hrs/wk @ $16/hr, 53% FTE) and provide employment details and work undertaken by **30 September 2002**.	**COMPLETED**	Over 33,000 hydrilla and vallisneria plants heave been propagated and planted into Lake Macdonlad.in 12months.
2002.06	Ensure the success of the aquaculture component of the project through the provision of appropriate materials such pools, pumps, nutrients and materials, and provide supporting documentation by **30 September 2002**.	**COMPLETED**	Aquatic nursery was completed and operational by April 02.

2002.07	Maintain appropriate site and propagation data (including number of hectares treated and spatial data and supporting information in accordance with Contract Appendix 3 "Guidelines for the Provision of Data") and video records and provide copy to Environment Australia (as part of final report) by **30 September 2002**.	**Completed**	Documentation is Page 16-27 of this report.
2002.08	Improve general community awareness through the development of **5** products (including field days, conference presentations, media releases, Totally Wild program, newspaper articles and radio interviews) by **30 September 2002**.	**COMPLETED**	Pages 19-20, 28-29 of this report.
2002.09	Complete and submit project annual report identifying progress against all scopes by **30 September 2002**.	**COMPLETED**	
Broader Biodiversity Benefits			*Where relevant, please include a brief description of benefits to non-target species or ecological communities etc*

*If relevant please also attach any required or supporting documentation (recovery plans, research papers, strategies, additional information or comments)

Project Reports: Outcome and Output Information we are seeking

1. Monitoring and Inventory Scopes for projects 34505 and 34506	
No. sites monitored	20 transects, 50m in length
How often per year monitored	Monthly
Surveys undertaken	
Habitat modelling/mapping	
Data supplied to TSCS	
Trend Information (best estimate)	
(a) wild populations:	
Increase in number of known individuals in the wild:	Cabomba infestations in harvested areas have been reduced by 54%
Increase in number of known populations in the wild	6 records of native plants, 4 nymphoides indica, 1 Blyxa sp, 1 hydrilla verticillata
Individuals Reintroduced/translocated	33,631 native plants planted
Wild population trend	Cabomba is dominant vegetation Of 168 transect surveyed only 6 had native plants.

2. Habitat and Threat Management Scopes	
Protective fencing	(km)
Weed and or Pest Control	Cabomba control
Other management activities: (please specify) ---Management regime to keep cabomba infestation below 30Tha	Actively applied to 100ha
Additional area protected	Also protects downstream, 305 km of Mary river
3. Community Education, Awareness and Involvement Scopes	
Relevant publications	2
TV,radio, newspaper articles	4
Internet sites	1
Slides/photos	168
Public workshops, talks, seminars	18 talks, 3 forums, 2 seminars
Increase in public inquiries	80%
No. of volunteers involved or volunteer hours	3300 hrs at aquatic nursery 800 hrs at LMCC meetings

4. Planning Scopes	
Recovery Plan status:	Environmental Recovery Plan April 2002 has been adopted
Recovery Plan Objective(s):	Progress Toward Meeting This Objective On Target, ongoing process
Recovery Plan Performance Criteria:	Progress Toward Meeting These Targets On Target
Recovery Team meetings:	6
Other relevant meetings:	LMCCG meetings monthly

Stakeholders and organisations involved in recovery plan implementation:	Mary River catchment Coordinating Committee, Noosa Shire, Maroochy Shire, Queensland Dept Natural Resources and Mines, CSIRO