CONFERENCE PAPER

Vegetation Maintenance Treatment of Kahibah Creek to control flood levels

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About this edition

This is a re-typeset edition of a paper presented to the 50th Annual Floodplain Management Authorities Conference (Gosford, February 2010) by C. Coombs and V. Tysoe of Gosford City Council. It is kept here as a reference for the Ettymalong Creek Landcare group; copyright remains with the authors and the conference.

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The small grey numbers in the margin (for example p.3) give the page of the original PDF where that passage begins.

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Abstract

Introduction

Kahibah Creek at Umina Beach is a complex creek system with many meandering tributaries and shallow lagoons. It also has a very flat longitudinal gradient. The creek has expanses of both native and weed vegetation and this vegetation, if not controlled, can elevate flood levels to the adjoining urban development to dangerous levels. Much of the system has been altered in the past by drainage works; however an ecological management plan for the creek requires that it be maintained in an ecologically sustainable manner.

Methods

Mechanical control of *Typha orientalis* Bullrushes is being undertaken by a technique known as "Cutting and Drowning".

An Integrated Pest Management approach has been implemented to control *Salvinia molesta*. The process uses a combination of various techniques.

Bush Regeneration is another method being undertaken along the creek system. The purpose of the works is to ensure that these localised vegetation communities are rehabilitated and protected.

'Long Stem' tree planting has been implemented to replace those noxious species that have been removed. The advantages of 'Long Stem' plants are increased growth rates and root establishment at depth to enable them to withstand flooding and drought periods.

Results

Typha infestations have been reduced by 95% by using the cutting and drowning technique. *Salvinia* occurrence has also been significantly reduced by using an integrated pest management technique. The riparian areas of bushland that are undergoing restoration are also showing signs of good health.

Conclusions p.2

The above methods used for controlling flood flows are proving effective and are providing a significant increase of native riparian habitat.

Body & Discussion

Background

Kahibah Creek at Umina Beach is a complex creek system with many meandering tributaries and shallow lagoons eventually entering the ocean at Broken Bay. Geologically speaking the site topography consists of a very flat longitudinal gradient with a natural elevation less than five metres above sea level, with a permanently high water table, localised flooding with periodic waterlogging in depressions and very low soil fertility. [1] (Chapman & Murphy 1989).

The creek has expanses of weed and remanent native vegetation, however this vegetation consists of three Endangered Ecological Communities listed under the Threatened Species Conservation Act, 1995. Those communities are as follows 'Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin & South East Corner Bioregion', 'Umina Coastal Sandplain Woodland' and 'Sydney Freshwater Wetlands in the Sydney Basin Bioregion'. [2] (Payne 2004).

However this vegetation, if not controlled, can elevate flood levels to the adjoining urban development to dangerous levels. Much of the system has been altered in the past by drainage works and urbanisation of the Woy Woy area.

An ecological management plan for the creek was prepared in 2004 for Gosford City Council ie The Kahibah Creek Riparian Management Plan (KCRMP). (Payne 2004). Objectives of the KCRMP are as follows:

[1] Identify opportunities to protect and enhance the natural areas of Kahibah Creek by identifying opportunities to retain, protect and rehabilitate areas of native river bank and aquatic vegetation.

[2] Identify and implement flood mitigation measures to minimise flood damage.

[3] Maintain design flood flows and levels for a 1%AEP flood event

[4] Restore and regenerate degraded riparian areas in accordance with specific plans of management and a replanting program.

[5] Consult with the community to ensure understanding and cooperation with achieving aims and objectives of the management plan.

Approvals to undertake maintenance works were granted by the following Federal and State authorities who visited at the time of the preparation of the plan in 2004.

- The Department of the Environment, Water, Heritage and the Arts – EPBC Act 1999
- The Department of Infrastructure, Planning and Natural Resources – Section 130 (1B)
- The Department of Environment and Climate Change – Section 132c

Methods

Mechanical control of *Typha orientalis*



p.3 Bullrush (*Typha orientalis*) are a robust species of semi aquatic perennial plants with a dense root system that grow in fresh water. Bullrushes can attain a height of 2 metres and commonly grow in creeks and rivers where water flow is slow and dissolved nutrient levels and exposure to sunlight is high.

"From a hydraulic perspective bullrushes can increase the co-efficient of friction ('n' value) and potentially can increase the flood levels to adjacent properties". [3] (Payne 1998 page 4).

In 1998 short term field eradication trials were undertaken in Kahibah Creek by Gosford City Council. These trials consisted of four techniques; (It should be noted that spraying was eliminated from the trials as there were public concerns regarding the application of herbicide into waterways by spraying), even though this technique is approved by the EPA.

1 Excavation.

2 Cut and Paint.

3 Cut and Drowning.

4 Direct application of herbicide by spraying.

Results from the trials to control the bullrushes varied. For both the Cut and Paint, and excavation methods, regrowth occurred within 90 days. The most successful method trialled was Cut and Drown technique as no regrowth had occurred by the end of the field study (140 days).

By 2005 Gosford City Council implemented works in the Kahibah Creek System. The chosen method for Bullrush control was based on the results of the field trials in 1998 (the Cut and Drowning technique). This technique effectively drowns the Bullrush plants by starving the root mass (rhizomes) of oxygen, and is best undertaken in late summer or early autumn [4] (Apfelbaum 1983). The stems of the plant are cut 200mm to 300mm below the water line stopping the oxygen which is captured by the leaves from reaching the root mass.

Integrated Pest Management



Salvinia (*Salvinia molesta*) is an aquatic free floating fern which can obtain a length of 200mm and is a native of Brazil. It was introduced into Australia by the Aquarium Trade as an ornamental species for indoor tanks and ponds. Salvinia (*Salvinia molesta*) is regarded as one of the worst weeds in Australia because of its invasiveness, and capacity under the right environmental conditions to dominate an open area of water. A Salvinia infestation has been estimated to weigh 400 tonnes wet weight per hectare [5] (CRC Weed Management Guide – Salvinia 2003). Under ideal growing conditions, ie temper-

ature > 25C, Salvinia can double its biomass in as little as two days [6] (Parsons & Cuthbertson, 1992).

The weed once dominant, blocks creek lines and infrastructure causing localised flooding. Another serious issue of these dense floating mats of vegetation is that they look like solid ground and also provide breeding sites for mosquitoes which are known vectors of the – Ross River Fever and Encephalitis diseases.

p.4 Given that the infestation of Salvinia within the Kahibah creek system extended basically from its source to the outlet it was decided by Council Officers to use a number of tactics to control the weed. This approach is known as an Integrated Pest Management program and consists of the following control methods:

Biocontrol: Salvinia Weevil (*Crytobagus salvinae*) has been released onto the weed mass, this weevil is known to suppress salvinia growth, however the climate in Sydney does not allow the beetle to survive over the winter period and it has to be reintroduced the following summer.

Herbicide: Foliar application of an approved herbicide can kill Salvinia effectively, however when using chemical control treat small infestations to minimise herbicide quantity used. Small regular treatments are preferred to large area treatments as rotting Salvinia will putrefy the water.

Cultural Control: methods used included the removal of the weed by hand using booms and barriers to prevent the weed from colonising new areas of the creek. Scoop nets were used when individual plants were spotted. In the longer term modifying the habitat of salvinia by encouraging the growth of native species of macrophytes which cover the surface of the creek thus restricting the available area for Salvinia to grow.

Bush Regeneration

Bush regeneration works have been implemented to create compensatory habitat for the loss of the native and weed tree species that were identified to be removed in the plan. Site selection was limited because of constraints such as flooding risks, limited width of the reserve areas and the viability of vegetation communities.

Given these limiting factors six sites were identified as being suitable for restoration and are listed below in table1 showing there location and area in square metres.

The Australian Association of Bush Regenerators (AABR) provides the following definition. ‘Regeneration refers to allowing natural processes to establish native vegetation, with or without assistance, and without introducing plant propagules.’

Table 1 Comparison of areas which are being regenerated

Description	Location	Areas sub total
KC2	Calypta rd	1,371m2
KC3	Kahibah Lagoon	20,113m2
KC5	Ettamylong Billabong	19,515m2
KC6	Mt Ettalong floodway	11,200m2
KC7	McLaurin Road to oulet	15,900m2
KC8	Iluka Creek and Lagoon	1,650m2
Total Area		**69,749m2**

p.5 For each of the above sites referred to in table 1 a program of bush regeneration was undertaken according to longstanding bush regeneration principals. This involved working from the areas of bushland with the most resilience or with the least requirement for maintenance to those with less resilience and greater maintenance requirements.

A variation of the weed mapping technique developed by the National Trust of Australia (NSW) is used in the accompanying Weed Density Map to illustrate the density and location of weed species on site. This simple mapping technique only considers the relative density of weed species to native species and does not consider strata or nature of the weed (i.e. groundcover, vine, shrub or tree). Colour Key interpretation is outlined in the following table:

Table 2: Colour Key weed density

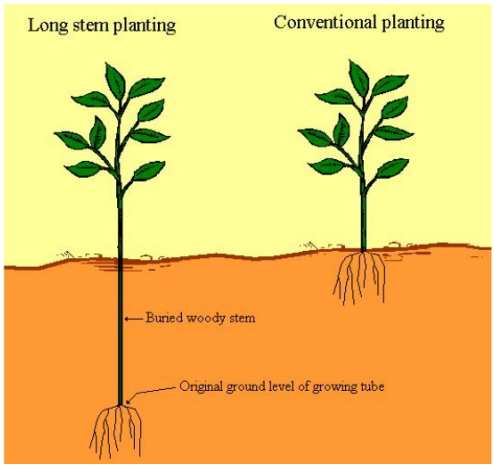
WEED DENSITY KEY		
Chronic Red	Very Poor 70-100%	Areas where bushland has been completely replaced by exotic plant species or bushland where only mature specimens of the dominant highest stratum of the pre-urban plant community remain and seedlings and/or saplings of those dominants are absent due to the infestation of the understorey by exotics or by invading native plant species.
Severe Orange	Poor 30-70%	Areas where bushland is severely infested by exotics and/or invading native plant species and where regeneration of the dominant species of the plant community is being significantly suppressed.
Moderate Blue	Fair 10-30%	Areas of bushland where minor infestations of exotics and/or invading native species.
Good Green	Good 1-10%	Areas of bushland virtually free of exotic plants where the native plant communities display the structure and species composition and diversity typical of those communities in non-urban situations

**(Adapted from the National Trust of Australia (NSW) Weed Density Mapping)*

All layers of vegetation are treated comprehensively within the areas worked. This includes the groundlayer, shrub layer and the canopy. Significant quantities of vines have been removed, especially Morning Glory. On the groundlayer, large quantities of Wandering Jew and Ehrharta have been carefully hand weeded and follow-up treatment has been performed time and time again. Large quantities of Lantana and Bamboo have been removed throughout the sites.

Long Stem Tree Planting

p.6 Long stem trees are native tube stock which have been grown for a least a year in containers or tubes measuring 5cm x 13cm. They have been fertilised using a specific regime until the produced plant has an overall length 1.5m, and a thick woody stem with closely spaced growth nodes. The tube is then planted on the top of the stream bank at a depth of 0.5 – 1.5m with only the top most leaves exposed. This is counter to conventional horticultural recommendations and practices.



[7] Source (www.australianplants.org/Images%20Fact%20shee...)

The longstem technique was originally trialed in the Hunter region of NSW by the Department of Land and Water Conservation, the Hunter Management Trust, Natural Heritage Trust and Bill Hicks who is accredited with developing this technique of propagation. The advantages of using longstem tubes are as follows:

[1] Increased growth rate as planting at depth enables the root zone to access moisture that would not be present if planted conventionally.

[2] Root establishment is at depth enabling the trees to withstand flooding and achieve rapid erosion control.

[3] Minimal follow up care and watering and weeding is largely eliminated.

[4] Ability to withstand drought conditions.

(source: “Rehabilitating Australian Streambanks with Longstem Native Tubestock”)

The long term objective of planting the creekline with trees is to maintain or return the natural light and temperature levels within the creek. By reducing the light intensity and thus temperature of water, a significant reduction of in stream nuisance plants such as Bulrushes and Salvinia occurs.

Take Home Messages

Considering the size of the task at hand, vegetation maintenance and regeneration works for flood control using the above techniques should proceed with the intention of maximum result for any given action. The temptation to create “high visual impact” for onlookers by removing the greatest quantity of weed material in the most high profile, visible location, should be avoided. Regeneration and revegetation activities should concentrate upon the most invasive weeds within the highest resilience sections of the creekline and bushland areas. In this way, results are long lasting and require minimal follow up.

p.7 Vegetation maintenance and regeneration programs must include ongoing follow-up or maintenance over a period of years. In the case of these areas, native vegetation degradation, weed invasion and wilful abuse have been ongoing for decades and will take considerable time to repair. Initial or primary weeding usually triggers a significant germination of both native and introduced species; the removal of a single introduced plant can result in the germination of thousands of weed seedlings. If not treated in a timely fashion with appropriate techniques, these sites can regress.

References

[1] Chapman G.A., Murphy C.L. (1989), *Soil Landscapes of the Sydney 1:100 000 sheet*. Soil Conservation Service of NSW, Sydney.

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[3] Payne R. (1998), Trials to eradicate Cattail (*Typha orientalis*) from waterways and drains on the central coast of NSW. Report prepared for Gosford City Council, Robert Payne ES&M, April 1998.

[4] Affelbaum S,I. (1984), Cattail (*Typha* spp.) Management. Applied Ecological Services. Broadhead, Winsconsin.

[5] Weed Management Guide, Salvinia (*Salvinia molesta*) 2003. CRC Weed management.

[6] Parsons, W.T. and Cuthbertson, E.G (1992) Noxious Weeds of Australia. Inkata Press, Melbourne & Sydney.

[7] Long stem Planting Fact Sheet 28. www.australianplants.org/fsztwentyeight.htm