



tuggerah lakes estuary

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Restoration of Tuggerah Lakes estuarine system through improved water quality management

Caring for our Country Preliminary Progress Report - \$2M savings from Stage 1

September 2011



Wyong
Shire
Council
Caring for our Country



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This project is coordinated by Wyong Shire Council, through funding from the Australian Government's Caring for our Country.

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Table of contents

Project 1: Streambank Rehabilitation and Establishment.....	4
<i>Streambank Establishment Works</i>	4
<i>Streambank Establishment Works</i>	12
Project 2: Saltmarsh Rehabilitation and Establishment.....	13
<i>Saltmarsh Rehabilitation Works</i>	13
<i>Saltmarsh Establishment Works</i>	16
Project 3: Lower Pioneer Dairy Wetland Rehabilitation (Tuggerah Lagoon).....	17
Project 4: DECCW (now OEH) Ecological Response model	19
Project 5: Environmental monitoring.....	21
<i>Saltmarsh Rehabilitation Monitoring</i>	21
<i>Long-term Water Quality Monitoring</i>	24
<i>Streambank Rehabilitation Monitoring</i>	24
Project 6: EMP Education/Communications	25

Table of Figures

Figure 1: Extent of works – Wyong 110.1-110.9	6
Figure 2: Wyong 110.2 before reprofiling (note vertical embankments).....	7
Figure 3: Wyong 110.2 before reprofiling	7
Figure 4: Wyong 110.2 after reprofiling and planting	7
Figure 5: Wyong 110.4 before reprofiling	8
Figure 6: Wyong 110.4 after reprofiling and planting	8
Figure 7: Wyong 110.5 prior to construction of cattle crossing area and reprofiling.....	8
Figure 8: Wyong 110.5 prior to construction of cattle crossing area and reprofiling.....	8
Figure 9: Wyong 110.5 after reprofiling, planting and construction of cattle crossing.....	8
Figure 10: Wyong 110.9 prior to planting	9
Figure 11: : Wyong 110.9 after planting.....	9
Figure 12: Slope prior to reprofiling, note vertical face and undercutting below tree roots.....	10
Figure 13: Slope after reprofiling and during placement of coir matting for soil protection.....	11
Figure 14: Placement of piles and large woody debris for toe protection.....	11
Figure 15: Reach 44 as seen from opposite bank prior to rehabilitation. Photo taken from submarine cable crossing point on south bank.....	12
Figure 16: Reach 44 as seen from opposite bank after reprofiling, toe protection and during coir matting placement. Photo taken from submarine cable crossing point on south bank.....	12
Figure 17: TL 20 prior to rehabilitation works.....	14
Figure 18: TL 20 after reprofiling.....	14
Figure 19: TL 20 after planting and wrack placement.....	15
Figure 20: TL 19 prior to rehabilitation	15
Figure 21: TL 19 after reprofiling.....	16
Figure 22: Tuggerah Lagoon – Water Hyacinth prior to works commencing.....	17
Figure 23: Tuggerah Lagoon – Australian Environmental Services removing water hyacinth.....	18
Figure 24: Australian Environmental Services machinery on Tuggerah Lagoon.....	18

Project 1: Streambank Rehabilitation and Establishment

Streambank Establishment Works

Rehabilitation Target: 0.7km

Rehabilitation Achieved: 1.55km

The proposed works for this project included the rehabilitation of streambanks at the following sites:

- Wyong River - 110.2, 110.3 & 110.4;
- Ourimbah Creek - 0.1 and 0.2

The proposed Ourimbah Creek sites required access along Ourimbah Creek Road which contained timber bridges with reduced load limits. Wyong Shire Council's Roads and Stormwater Unit had programmed to replace two of these bridges during 2010 and 2011. As the second of the bridges was not scheduled for replacement until mid-May 2011 and the proposed works required the use of machinery too heavy to cross the original bridge, it was decided to concentrate efforts on other sites to ensure time frames for completion and targets for streambank rehabilitation could be met.

Wyong River Reach 110 (110.1 – 110.9)

The GHD Due Diligence report recommended that savings could be made by consolidating works on the Wyong River Reach 110 sites (a total of 9 proposed sites) to reduce costs of site preparation, environmental protection, erosion control and plant floating costs. The postponement of the Ourimbah Creek sites allowed resources and funds to be reallocated to permit completion of all sites within reach 110, rather than taking a 'compartmentalised' approach.

Works on the property at Reach 110 were commenced in early March 2011 and bank protection works were completed in early June 2011. The works comprised of:

- battering back of vertical embankments at scour locations to achieve a stable profile;
- protection of slopes using jute/coir matting;
- placement of temporary toe protection using coir logs;
- removal of WONS and other environmental weeds; and,
- extensive riparian planting using tube stock of local provenance species.

The works were protected by the installation of 1,400 lineal metres of stock fencing, together with a stabilised controlled cattle crossing.

Additional planting will be carried out during September and October 2011 in areas between the identified erosion points to provide for a continuous riparian corridor along the full extent of the reach.



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The following Caring for Our Country Targets were addressed by the works:

- Improvement of Water Quality management in the Tuggerah Lakes estuary by streambank rehabilitation:
 - 1.4km of streambank rehabilitation including 0.48km of active erosion sites.
- Increasing the area of native habitat:
 - Planting of 0.9Ha of riparian area with 18,500 tubestock plants. A further 2,500 plants will be added in September/October to increase density in planted areas and fill in areas between erosion points to increase total area of planting to 1.26Ha.
- Improved management practices:
 - 1.26Ha of streambank and riparian vegetation protected by stock proof fencing and controlled stock crossing point together with agreement for provision of off-stream watering points.
- Reduce the impact of Weeds of National significance:
 - Weeds were managed within the full 1.26Ha riparian area with 150m² of core infestation of lantana and 30m² of outliers treated together with 1675m² of core infestation and 300m² outliers of blackberry. Grazon extra herbicide was used to treat blackberry together with manual and mechanical removal. Lantana was removed mechanically.
- Increase the recruitment and retention of volunteers involved in natural resource management, especially youth.
 - Volunteers from "Green Corps" partnered with Wyong Shire Council catchment management crews putting in an estimated 505 'person hours' to the project.

The area included in the completed works is shown in Figure 1:



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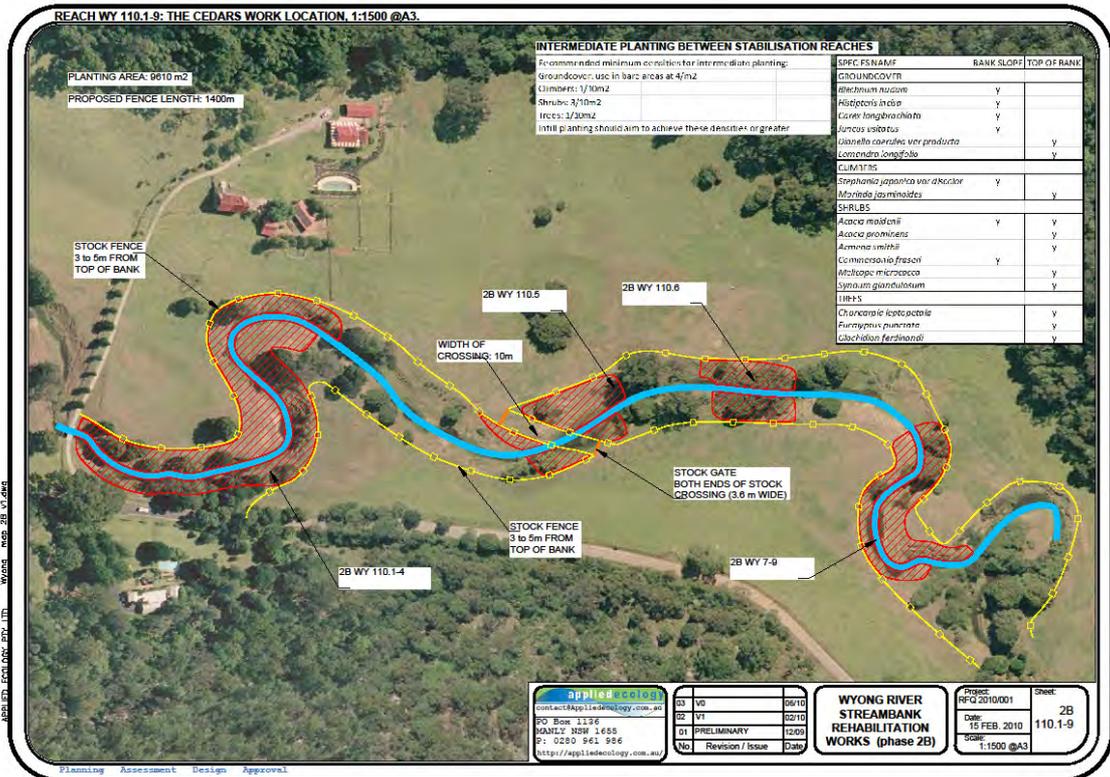


Figure 1: Extent of works – Wyong 110.1-110.9

Photo point monitoring of significant erosion points within the Wyong River Reach 110 is shown below:



Figure 2: Wyong 110.2 before reprofiling (note vertical embankments)



Figure 3: Wyong 110.2 before reprofiling



Figure 4: Wyong 110.2 after reprofiling and planting



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Figure 5: Wyong 110.4 before reprofiling



Figure 6: Wyong 110.4 after reprofiling and planting



Figure 7: Wyong 110.5 prior to construction of cattle crossing area and reprofiling



Figure 8: Wyong 110.5 prior to construction of cattle crossing area and reprofiling



Figure 9: Wyong 110.5 after reprofiling, planting and construction of cattle crossing



Figure 10: Wyong 110.9 prior to planting



Figure 11: : Wyong 110.9 after planting

Ourimbah Creek Reach 44

Reach 44 is located on the northern side of Ourimbah creek just upstream of Lees Bridge. Scour in this location had left an exposed vertical embankment of approximately 150 metres in length with unstable trees located on the edge of the embankment. The tree roots had lost much of their supporting soil and significantly overhang the embankment. In lower velocity areas some vegetation had re-established in the slumped material deposited around the toe of the embankment. In the higher velocity areas around the outside of the bend, the scour plane was continuing to encroach further into the reserve as sediment continued to be removed from the slope.

The works in this location involved removing 6 mature trees from the embankment overhang, together with one immature tree located in the batter area. The slope was reprofiled to between 1-in-2 and 1-in-3 batter to minimise impact on the trees to be retained in the riparian zone. The removed trees with root balls intact were placed at the toe of the embankment to provide for toe protection at the base of the slope. These trees were secured using hardwood piles extending approximately 700mm higher than the top of the woody debris to prevent remobilisation of the debris during flood events.

The batter slope was of low fertility and water holding ability, therefore soil amelioration was carried out prior to stabilisation with coir logs and coir matting. Soil amelioration used organic soil mix to a depth of approximately 100mm together with organic mulch. Both were placed under the coir matting.

The coir matting provides temporary soil stabilisation against erosive forces from wind and raindrop impact on the exposed soil surface as well as minor flood flows. Approximately 1,500m² of riparian area was revegetated using provenance tube stock in early August.

A WoNS removal program will take place in the reserve area adjoining this streambank project as part of Stage 2 works.

The following Caring for Our Country Targets were addressed by the works:

- Improvement of Water Quality management in the Tuggerah Lakes estuary by streambank rehabilitation:
 - 150m of streambank rehabilitation.
- Increasing the area of native habitat:
 - Planting of 1,500m² of riparian vegetation.

Photo point monitoring of Ourimbah Creek Reach 44 is shown below:



Figure 12: Slope prior to reprofiling, note vertical face and undercutting below tree roots



Figure 13: Slope after reprofiling and during placement of coir matting for soil protection



Figure 14: Placement of piles and large woody debris for toe protection



Figure 15: Reach 44 as seen from opposite bank prior to rehabilitation. Photo taken from submarine cable crossing point on south bank.



Figure 16: Reach 44 as seen from opposite bank after reprofiling, toe protection and during coir matting placement. Photo taken from submarine cable crossing point on south bank.

Streambank Establishment Works

Establishment Target: 1km

Establishment Achieved: 3,200km

Streambank establishment works were undertaken on the streambank sites rehabilitated under Contract 1. Maintenance activities included weed removal, watering, mulching, replacement of failed plantings and/or supplementary planting and maintenance of livestock exclusion fencing where required.

Other specific establishment works included:

- Wyong River Reach 81: required repeated treatment of bamboo.
- Ourimbah Creek Reach 45: rectification of concentrated flow paths and scour on site was undertaken together with mulching to improve soil condition and natural recruitment processes.
- Saltwater Creek Reach 2: further bush regeneration works and sediment removal from the channel to permit drainage of the channel for planting within the waterway area

Site	Person hours for maintenance	Length of streambank
Wyong River Reach 36	11	120m
Wyong River Reach 61	41	100m
Wyong River Reach 81	108	150m
Wyong River Reach 104	10	150m
Ourimbah Creek Reach 41	42	150m
Ourimbah Creek Reach 45	68	350m
Saltwater Creek Reach 2		2,180m

Project 2: Saltmarsh Rehabilitation and Establishment

Saltmarsh Rehabilitation Works

**Tuggerah Lakes Active Saltmarsh
Rehabilitation Target: 0.2ha**

**Tuggerah Lakes Active Saltmarsh
Rehabilitation Achieved: 1.4042km**

Active rehabilitation sites LM7 (0.39ha) & LM8 (0.816ha)

The rehabilitation works at these sites, located at Sunrise Avenue Halekulani, were commenced in May 2010. Planting of the sites was delayed due to high water levels in the lake for an extended period of time. In June 2010 reprofiling was completed and the sites were 80% planted, planting was completed in September 2010.

Active rehabilitation sites TL19 (0.087ha) & TL20 (0.1112ha)

The rehabilitation at these active saltmarsh sites located along Lakedge Ave, Berkeley Vale, commenced in February 2011.

These sites required reprofiling to achieve a 1% grade from RL0.2 AHD to RL0.4 AHD. This grade established a slope suitable for periodic inundation (for saltmarsh plant growth) and seagrass wrack assimilation. The soil removed from these sites was determined to be acid sulphate soil which required treatment on site using lime, prior to disposal to landfill.

In addition, the remaining soil was found to be an unworkable saturated material which was not suitable for achieving the required profile or for planting out with saltmarsh. This soil was previously dredged material used to establish a reclaimed shoreline during the Tuggerah Lakes Restoration Program in the 1990's. As a result of this, sandy loam topsoil was imported to provide a suitable media for planting into and grading to the desired profile.

Higher than average rainfall values during April and May resulted in elevated lake levels for an extended period, RL 0.5 to 0.8 AHD which delayed planting. TL19 & TL20 were completed and planted out in September 2011.



Figure 17: TL 20 prior to rehabilitation works



Figure 18: TL 20 after reprofiling



Figure 19: TL 20 after planting and wrack placement



Figure 20: TL 19 prior to rehabilitation



Figure 21: TL 19 after reprofiling

Saltmarsh Establishment Works

**Tuggerah Lakes Active Saltmarsh
Establishment Target: 1.9ha**

**Tuggerah Lakes Active Saltmarsh
Establishment Achieved: 1.737km**

Saltmarsh establishment activities have continued on active saltmarsh rehabilitation sites constructed during the first contract period.

Establishment activities included:

- assessment of plant condition including plant deaths and new growth, soil moisture (visual only) and % cover of weeds;
- management of weeds within saltmarsh areas;
- removal of excess wrack;
- maintenance of wrack fencing;
- mulching as required;
- plant replacement as required;
- litter removal; and,
- maintenance of the root barrier used between the saltmarsh and grassed areas.

Site	Person hours for maintenance	Area established
Long Jetty	120 hours	0.32ha
Berkeley Vale	194 hours	0.217ha
Lake Munmorah LM7 & LM 8	Wyong shire council staff, 385 hours Green jobs team, 579 hours	1.2ha

Project 3: Lower Pioneer Dairy Wetland Rehabilitation (Tuggerah Lagoon)

Lower Pioneer Dairy Wetland Target:
5.5ha

Lower Pioneer Dairy Wetland
Rehabilitation Achieved: 5.5ha

The aim of this project was to improve the integrity and function of a key SEPP14 wetland that had become choked with Water Hyacinth (*Eichhornia crassipes*). The removal of this weed from the wetland has resulted in a system that has a higher ecological and habitat value and is more stable in nature.

This project was undertaken by NSW National Parks and Wildlife Services, who engaged a contractor to undertake the initial weed removal. A truxor was used to remove the Water Hyacinth infestation from the 5.5ha wetland with supplementary spraying of Long-leaf Willow Primrose (*Ludwigia longifolia*) undertaken in the early stages of the project. Maintenance of the wetland will be continued by both the contractor and NPWS.

Key learnings from these works will be used to improve future wetland rehabilitation works undertaken in Stage 2 of the Caring for our Country funding.



Figure 22: Tuggerah Lagoon – Water hyacinth infestation prior to works commencing



Figure 23: Tuggerah Lagoon –removal of water hyacinth with the truxor



Figure 24: Weed removal machinery on Tuggerah Lagoon

Project 4: DECCW (now OEH) Ecological Response model

Below is a summary of DECCW's (OEH's) Ecological Response study and recommendations to be used in Council's future strategic planning and decision making processes. The full report has been sent on CD as supplementary material.

DECCW Stage 1 Tuggerah Lakes Estuary Modelling project which developed an Ecological Response Model (ERM) for Tuggerah lakes identified specific data gaps for better understanding of the driving influences of seagrass growth and linkages in the trophic levels of the foodweb specific to Tuggerah Lakes. The Stage 1.2 project: Tuggerah Lakes Ecological Response addresses these data gaps using a suite of complimentary monitoring programs, in situ field experiments, and ex situ laboratory mesocosm experiments.

Seagrass growth characteristics were found to vary spatially (within Tuggerah Lakes), seasonally, and over the depth range for seagrasses. Light, bottom stress and sediment redox have been identified as the main factors controlling seagrass distribution and health. These factors affect seagrass populations over different time scales (days to years) and are directly related to water clarity, site exposure and nutrient enrichment of the nearshore zone. Based on these data, a seagrass growth model was constructed and integrated into the ERM.

Analysis of the foodweb within Tuggerah Lakes showed clearly that algae provide the main source of plant production that sustains consumers (fish and macroinvertebrates). This algal dominance could signify a shift towards eutrophication of Tuggerah Lakes. The study also showed that plants and animals in Tuggerah Lakes contained relatively more nitrogen than in Lake Macquarie, suggesting that nitrogen is in greater supply in Tuggerah and providing further evidence of mild eutrophication.

*Assessment of ecological health can be effectively measured using specific ecological processes, or "ecoassays". Measures of rates of seagrass decomposition and scavenging were assessed to provide a greater understanding of rates of energy flow through systems. Rates of leaf production and biomass accumulation for *Zostera capricorni* were determined in order to better represent plant response to environmental drivers. High-frequency measurements of suspended material concentration and composition were used to assess the influence of storm events on light availability for seagrasses and benthic microalgae. The rate of epibiota colonization on seagrass fronds was determined to indicate the relative measure of available nutrients in the water column.*

The Streambank Rehabilitation program was estimated to prevent a considerable load of sediment into the streams and lakes; proportionally high compared to the contribution over the whole subcatchment. Stage 1 modelling predicted that fine sediment was the main source of pollution from the upper catchments. The fine sediments transported to the lakes have detrimental effects on the ecology of the system by reducing water quality and clarity and smothering seagrass beds. Streambank rehabilitation is an important management action and will reduce this major pressure on the lakes.

Condition assessments for Tuggerah Lakes indicated that water quality was good (rather than excellent) and that relatively high levels of chlorophyll contributed most to the slightly lower

score. Fish assemblages and seagrass and saltmarsh abundance were scored as good and very good respectively.

The on-going monitoring plan for Tuggerah Lakes should have two foci, long-term condition trend assessment and short term model verification. These should be done concurrently and should be structured to include the primary indicators that have been identified in the Ecological Response Modelling as being likely reactions to catchment stress.

Recommendations:

- *Better stormwater management to reduce loads of nutrients, sediments and organic matter to the nearshore zone. Consideration of a fewer number of discharge points in deeper water.*
- *Identification and remediation of sediment hotspots in the catchment, with an emphasis on riparian restoration.*
- *Local inputs: Aim for a maximum reduction (net decrease) in nutrient and sediment runoff through retrofit*
- *Non-local inputs: No net increase in nutrients and sediments entering the lakes*
- *Regrade and rehabilitate shorelines so that distribution of wrack can occur over low gradient beach or saltmarsh above the mean high tide mark*
- *Establishment of a monitoring programme as detailed above.*
- *Research into ooze formation and management.*
- *Communication of outputs and understanding from modelling studies to wider community*

Project 5: Environmental monitoring

Saltmarsh Rehabilitation Monitoring

Umwelt (Australia) Pty Limited were engaged by Wyong Shire Council to undertake the monitoring for active and passive saltmarsh locations rehabilitated under the first contract period, as well as baseline monitoring for some locations proposed to be rehabilitated under the second stage.

Below is a summary of Umwelt's report on the Monitoring, Evaluation and Reporting Project – Saltmarsh Rehabilitation Monitoring. The full report has been sent on CD as supplementary material.

Executive Summary

Saltmarsh habitats are an important component of coastal estuaries in Australia. Despite their widely recognised value, the loss and degradation of saltmarsh habitats in some areas has been severe. NSW in particular has suffered a distinct decline in the abundance and distribution of saltmarsh habitat and has therefore afforded protection to the habitat as an endangered ecological community under the NSW Threatened Species Conservation Act 1995.

In more recent times the particular saltmarsh focus of land management agencies has been on the rehabilitation of estuarine areas as a management option to compensate for the loss of these important coastal resources. As part of the Tuggerah Lakes Estuary Management Plan, Wyong Council has identified specific areas for rehabilitation to re-establish saltmarsh to the shores of the Tuggerah Lakes Estuary (Dickinson et al. 2006). This initiative will see the re-introduction of saltmarsh to several areas around Tuggerah Lakes using a range of passive and active rehabilitation techniques.

This document outlines the initial monitoring of the rehabilitation initiatives instigated by Wyong Shire Council. The data presented are intended to be used as a basis for future monitoring and also to improve future monitoring so as to achieve the best outcomes for the rehabilitation.

The desire to rehabilitate saltmarsh in Tuggerah Lakes is two-fold. Firstly to increase an important natural habitat that has been in decline around the lake foreshore and secondly to facilitate seagrass wrack dispersal. Seagrass wrack presently accumulates on the shoreline where it breaks down producing a smell that is a nuisance to local residents and thereby a management concern for Council.

Unfortunately many rehabilitation efforts go unmonitored so that their success, or otherwise, cannot be gauged. Therefore, the success of these programs at Tuggerah Lakes will be reliant on a scientifically rigorous monitoring program. In general, monitoring of any rehabilitation in a natural setting should follow the 'Beyond BACI' (Before, After, Control, Impact) approach as modified by Underwood (1991, 1992). This incorporates samples taken before the rehabilitation is commenced (baseline) as well as in other areas that are considered controls and references. Control sites are chosen to represent the 'before' condition of the potential restoration site in order to track the changes occurring at the restoration site with some degree



of confidence. The reference site should be chosen to approximate the condition that will be reached by the restoration site once fully restored.

Wyong Shire Council has initiated active and passive saltmarsh rehabilitation works in several locations around the Tuggerah Lakes estuary and has also identified further sites for future active rehabilitation. As part of this, three sites (Berkeley Vale, Long Jetty and Lake Munmorah) have already undergone active rehabilitation and one site (Chittaway Point) is undergoing passive rehabilitation (by way of mowing exclusion), and the preliminary results can be discussed for these locations. Three sites at Tuggerah Lake have been identified for future active rehabilitation works and this report offers baseline information on the condition of these.

Completed Active Saltmarsh Rehabilitation

The completed active rehabilitation sites (Berkeley Vale, Long Jetty and Lake Munmorah) have had their shoreline lowered in elevation to facilitate the periodic inundation of lake water. In addition, the areas have been planted with a variety of saltmarsh tube-stock and transplanted local saltmarsh salvaged during preconstruction. The sites have had between three to twelve months to establish since being planted and the results show that the rehabilitation is more successful in the upper zone than the lower zone. At Long Jetty (after 12 months growth), the lower shore has only achieved on average 2.7 per cent saltmarsh cover while in the upper shore there is 60 per cent saltmarsh cover. At Berkeley Vale (11 months growth) the rehabilitation is more successful on the lower shore (22 per cent), but not so successful on the upper shore (49 per cent). At both locations, the upper shore is showing successful growth of some of the tube-stock species such as *Sesuvium portulacastrum*, *Sporobolus virginicus* and *Paspalum vaginatum*, all of which are more suited to drier sandier conditions within a saltmarsh. The lower shore, in contrast, is showing a low survivorship of tube-stock and small plots of transplanted *Sarcocornia quinqueflora* are the only plants surviving in this zone. This could be attributed to the amount of water that lies on the lower shore in this rehabilitation location. The lower shore has been inundated (by lake water) on every visit to the site (J. Jelbart personal observation). It remains to be seen if the transplanted *S. quinqueflora* can survive and thrive in the lower shore because previous research has shown that *S. quinqueflora* takes 14-17 months to recover on the lower shore (Laegdsgaard 2002).

Regardless of the low survivorship of the tube-stock at the rehabilitation locations in the lower shore, the community composition of the rehabilitation locations are showing vast improvements since the rehabilitation works. Before the rehabilitation commenced the rehabilitated location resembled the control locations in community composition and species abundance at both the low and high shore zones. However after the rehabilitation works, the saltmarsh community at the high shore resemble more the reference locations. However the low shore saltmarsh community after rehabilitation does not resemble either the reference or control locations due to the poor cover of either saltmarsh plants or weeds.

Proposed Active Saltmarsh Rehabilitation

The three sites selected for the next round of saltmarsh rehabilitation are elevated above the saltwater inundation due to past foreshore reclamation works and therefore they lack the inundation of saltwater to maintain saltmarsh beyond a very narrow band on the foreshore.



Consequently, where no rehabilitation has occurred to date the sites resemble the control locations at the high shore zones as predicted. However at the low shore, the rehabilitation locations are different from the control locations in that they have a greater amount of saltmarsh cover. For example, on the lower shore zone of the proposed active rehabilitation sites in Tuggerah Lake (TL19, TL20) *Paspalum vaginatum* was the dominant saltmarsh plant with small amounts of *Chenopodium glaucum* (up to 95 per cent saltmarsh cover). However the upper shore before the rehabilitation was completely dominated by buffalo grass with up to 94 per cent weed cover. In particular the saltmarsh at TL19 and TL20 are more expansive and appear in better condition than most other proposed rehabilitation locations. However, the majority of these saltmarsh remnants lack the diversity of natural saltmarsh communities occurring at reference locations.

Passive Saltmarsh Rehabilitation

The passive rehabilitation at Chittaway Point has been in place since February 2010 and most (but not all) local residents have ceased mowing the saltmarsh. However, the extent of saltmarsh recovery is still preliminary. The total area of saltmarsh in the rehabilitation location has not changed. Similarly, no change has occurred in the cover of saltmarsh plants before and after rehabilitation measures commenced. However, what is noticeable is the regrowth and flowering of saltmarsh plants that has occurred since the cessation of mowing. In fact, just reducing mowing may not increase the amount of saltmarsh at this site but it may show an improvement in condition. It may also favour increased diversity of saltmarsh plants. Monitoring at this site should ideally include some measures of plant condition as well as extent and diversity.

Seagrass Wrack Accumulation

At present seagrass wrack accumulates at the foreshore edge of several locations around the lake. The wrack accumulation breaks down and rots and contributes to smells which are not appealing to local residents and thus comprise a management issue for local Council.

The amounts of seagrass wrack accumulating at the different locations across the estuary were highly variable making predictions about the rehabilitation process extremely difficult. It is also too early to make any seasonal predictions. The majority of the data at this stage purely provides baseline information to which future data can be compared. In addition, presently the rehabilitated sites (Berkeley Vale, Long Jetty and Lake Munmorah) have barrier nets in place preventing wrack accumulation on the shoreline. These will be removed once the saltmarsh plants have had the opportunity to expand and establish. Once this occurs the data may begin to reflect changes.

The outstanding preliminary finding from the wrack accumulation study is that the amount of wrack accumulating at the controls and references are not as different from one another as would be expected. At this stage the assumption that there will be a difference in the accumulation of wrack at control and reference locations is not being supported by the data collected. At best the wrack accumulation results are inconclusive.

Long-term Water Quality Monitoring

The methodology for the long-term water quality monitoring program for the lakes and catchment is being developed in conjunction with OEH and will be implemented as part of the Stage 2 works.

The indicators and sampling frequency shown in the following table are being considered as part of this program.

Habitat	Type	Indicators	Frequency
Central Lake	Water Quality	Chlorophyll	Apr – Nov – 4 times ; Dec-Mar - 5 times
		clarity	Apr – Nov – 4 times ; Dec-Mar - 5 times
		bottom dissolved oxygen	Apr – Nov – 4 times ; Dec-Mar - 5 times
	Biological	Epiphyte assay	Dec-Mar - 3 times
Edge	Water Quality	Chlorophyll	Apr – Nov – 4 times ; Dec-Mar - 5 times
		clarity	Apr – Nov – 4 times ; Dec-Mar - 5 times
		bottom dissolved oxygen	Apr – Nov – 4 times ; Dec-Mar - 5 times
	Biological	Seagrass extent	Bi annual
		seagrass condition	Annual - summer
		epiphyte assay	Dec-Mar - 3 times
		ooze volume	Apr – Nov – 4 times ; Dec-Mar - 5 times

Streambank Rehabilitation Monitoring

The photo point monitoring of streambank rehabilitation reaches is continuing – a number of these photographs have been included in this report.

Project 6: EMP Education/Communications

The education and communications works under this contract centred on the development of fresh resource materials and new wetland programs to enhance ecological literacy of residents by providing easily accessible, free information and training opportunities to local groups. Engagement activities with local media such as radio and newspapers, community events, websites and displays were used to promote and increase awareness of the EMP and have assisted local communities to access knowledge and skills in managing natural resources in the Tuggerah Lakes estuary.

Funded activity	Program achievements
<p>Design, production and distribution of 5 new factsheets as part of a comprehensive Tuggerah Lakes Estuary Management Plan brochure. New fact sheets address knowledge gaps in relation to value of undertaking works and promoting the suite of works currently underway.</p>	<p>Design and production of 5 new fact sheets. Reproduction and distribution of 2500 factsheets to residents, Councillors, schools and event patrons.</p> <p>Key messages</p> <ul style="list-style-type: none"> • This is a long term plan to improve the health of the lakes. We are addressing the key areas identified as part of the plan (hot spots) • The works are treating the cause; not the effect • The plan and the works are based on years of independent scientific research
<p>Reproduction and distribution of 7 WetlandCare Australia brochures.</p>	<p>Reproduction 7 WetlandCare Australia brochures. Distribution of 600 brochures to residents, Councillors, schools and event patrons including Wetlands Workshop participants.</p> <p>Key messages</p> <ul style="list-style-type: none"> • What, Why and How Wetlands Work • Wetlands for the Future: Managing Coastal Wetlands • Saving Streambanks: Essential for Healthy Wetlands • Wetlands on your Farm • Information Bulletin: Downstream Benefits of Wetlands • Information Bulletin: Localised Benefits of Wetlands • Information Bulletin: Why Water Plants are the Good Guys
<p>Design, development, and distribute Tuggerah Lakes Wetlands brochure to assist in raising the awareness of the community about the values of the neighbouring wetlands using information from Tuggerah Lakes Wetland Management Plan.</p>	<p>Design, production and distribution 1000 educational factsheets on wetlands within Wyong Shire.</p> <p>Key messages</p> <ul style="list-style-type: none"> • Wyong Shire wetland facts • What is being done to fix the problem • What can I do to help wetlands? • Illustrated map of wetland locations



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Development, coordination and delivery of 4 workshops targeting rural and urban audiences about wetlands, based on their functions of providing clean water, flood protection, carbon sequestration, biodiversity and places to learn and enjoy, in order to capture attention about their importance, vulnerability and ways to get involved in conserving them.

Development, coordination and delivery of **4** wetland education workshops

Workshop invites distributed to;
42 local environmental groups, 360 volunteers.
420 residents with wetlands on private property.
Wider public through Council Rates Notices.
Shire Wide newspaper editorials.

168 participants attended workshop.

The workshops involved project partnering with NPWS, Birds Australia, CEN, Wycare, WetlandCare Australia and Australian Wetland Alliance and University Newcastle.



Design and development of **EMP Resources Kit** to engage the local community and improve its skills to deal with natural resources challenges. In addition to its high aesthetic and scientific value, the Wyong Shires biodiversity is critical to human health, soil fertility, erosion control and water quality.

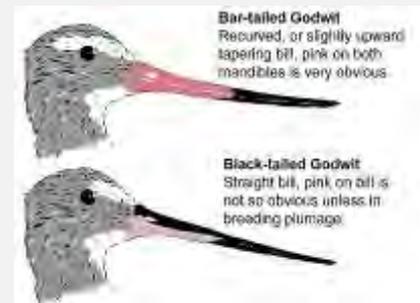
The Resource Kit promotes interest about the importance of wildlife and biodiversity conservation, encouraging community involvement in NRM activities.

Development, maintenance and improvement of website functionality for EMP knowledge management and communications.

Educational products include biodiversity survey reports, datasets and information suitable for use by school groups, residents and conservation programs.

Website encourages residents to participate in local NRM volunteer groups including Pioneer Diary Trust, Central Coast Group of Birding NSW, Water Watch, CoastCare, Landcare and Bushcare groups.

Information sheets showcase local biodiversity including threatened species, mammals, reptiles, frogs, freshwater fish, birds (including migratory birds) in alliance with CFOC objectives.

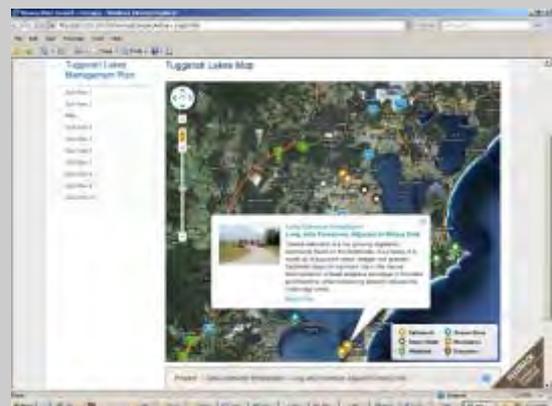


Website encourages residents to record local fauna and flora using 'ATLAS of Living Australia' and is strategically linked to local, regional and state NRM data providers including Office of Environment and Heritage, Birds Australia, Frog and Tadpole Society, NSW Department Primary Industries, Australian New Guinea Fishers Association, Australian Museum, Central Coast Environmental Network, Water Watch and Wycare.

Collation and uploading of Stage 1 and current EMP information to connect people with environmental knowledge and current status of EMP.

Website improvement plan prepared (upgrade to presentation, content, functionality, administration and integration of websites), plan implemented and website utilisation monitored.

EMP information and knowledge reference webpage listing known published and grey literature including the status of knowledge projects and, where possible, examples of practical application.





Engagement with local media such as radio and newspapers to promote the project.

6 media releases/ editorials published in the local newspaper, Express Advocate, with follow up radio interviews aired on 2GO and STAR to promote the activities and achievements of the EMP. Articles and editorials focused on the following themes;

- The Australian Government investment \$2 million through the *Caring for our Country* initiative.
- Implementation of EMP works finalist in Local Government environment awards.
- The money we spend protecting, repairing and restoring our natural resources is an investment in Wyong Shire's social, economic and environmental wellbeing.
- Government, industry, Indigenous people and the wider community must working together to manage natural resources wisely.
- Land managers are already doing natural resource management, such as fencing off waterways, spell grazing and off-stream water points.



Displays and Estuary exhibition to engage the community and raise awareness about the benefits of the project.

Display of 17 canvas photographs, interpretive panels, interactive touch screen, kids activities and coordination of education activities for school holiday period – commencing 25 Sept – 10 Oct 2011.



Events celebrating EMP and Caring for Our Country.

Community events actively encourage community dialogue and raise community awareness to achieve positive environmental outcomes at a local level.

The relationship between Tuggerah Lakes natural environment and the community contributes to a sense of identity and belonging and is an integral part of what makes Wyong unique.

Community events have been used as an effective means to disseminate key messages of the EMP to a broad and diverse audience. Information about the Lakes special biodiversity values and of the work being carried out for the sustainable management of its resources has been widely promoted at these events to inspire and promote involvement in local NRM activities.



The EMP has been celebrated at **4 community events** including;

Flora Festival – September 2010

Kids Day Out – November 2010

Warnervale Fair – March 2011

Family Day Out – May 2011

56,000 people attended these events.

4,200 EMP factsheets and brochures were distributed to attendees.