1-1-2005

Slag, steel and swamp: perceptions of restoration of an urban coastal saltmarsh

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Recommended Citation

Gill, Nicholas J.: Slag, steel and swamp: perceptions of restoration of an urban coastal saltmarsh 2005, 85-93.

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Abstract

A community group, in conjunction with local government and industry, has been working on aquatic and terrestrial restoration at a Wollongong saltmarsh, previously diminished in size and degraded by harbour reclamation and an urban rubbish tip. Students evaluate restoration progress to date and devise some interesting potential directions.

Keywords

swamp, restoration, urban, slag, coastal, perceptions, steel, saltmarsh

Disciplines

Life Sciences | Physical Sciences and Mathematics | Social and Behavioral Sciences

Publication Details

Gill, N. J. (2005). Slag, steel and swamp: perceptions of restoration of an urban coastal saltmarsh. *Ecological Management and Restoration*, 6 (2), 85-93.

Short code: EMR
Title: Ecological Management and Restoration
ISSN: 1442-7001
Created by: xxxx
Word version: 7.0a
BEES version: Version 2.42
Email proofs to: nicholas_gill@uow.edu.au
Copyright: 2005 The Ecological Society of Australia
Volume: 6 (Issue: 2)
Cover year: 2005 (Cover month: August)
Article no.: 224
DOI: 10.1111/j.1442-8903.2005.00224.x
Article type: XX (Feature)
Figures: 5; Tables: 1; Equations: 0; References: 12; Words: 5041; First Page: 000; Last Page: 000

SHORT TITLE RUNNING HEAD: FEATURE

AUTHORS RUNNING HEAD: FEATURE

ECOLOGICAL MANAGEMENT & RESTORATION VOL 6 NO 2 AUGUST 2005

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A community group, in conjunction with local government and industry, has been working on aquatic and terrestrial restoration at a Wollongong saltmarsh, previously diminished in size and degraded by harbour reclamation and an urban rubbish tip. Students evaluate restoration progress to date and devise some interesting potential directions.

Slag, steel and swamp: Perceptions of restoration of an urban coastal saltmarsh

By Nicholas Gill

Introduction

At Tom Thumb Lagoon (TTL) in Wollongong, NSW (Fig. 1), restoration projects have been undertaken since 1991. The setting is largely industrial as Wollongong is the centre of the steelmaking industry on the east coast of Australia. The creation of Port Kembla harbour, reclamation of land for industry, and the use of adjacent land as an urban rubbish tip over the twentieth century have severely diminished the lagoon's extent and degraded its remainder. In this setting, a community group, in conjunction with local government and industry, has been working on aquatic and terrestrial restoration at the site. In late 2002, University of Wollongong students became involved in restoration work at the site. Among other things, the students interviewed a range of people with connections to the lagoon and interests in the restoration work.

The students' initial task was to gather views about the work that had been done so far and about future directions for restoration and management of TTL. This paper aims to briefly outline the work that has been done so far and to discuss interviewees' perceptions and assessments of the restoration work to 2002, and their views regarding future directions for the management of the site. As there has been no systematic biophysical monitoring or evaluation of the restoration work, this article does not cover this aspect of the restoration work in any detail.

Development and restoration at Tom Thumb Lagoon

Prior condition and impacts

The modern TTL is an area of estuarine wetlands located adjacent to industrial areas in Wollongong on the coast of NSW. The current 9 ha of estuarine channel, remnant saltmarsh, and tidal mudflats are what remains of a 350 ha coastal lagoon (Chafer 1997). Since the early 1900s and particularly since the 1960s, it has been progressively dredged and filled (with material including steelworks waste or 'slag') to create a deep water harbour and land for industry (Fig. 2a,b).

Such activities have seen up to 70% of the Illawarra's wetlands destroyed (Merrin & Chafer 2000). In 1997, Chafer (1997) noted that the lagoon was one of the significant losses of wetland in the Illawarra region. Until the 1960s, the lagoon was significant as habitat for

waterbirds. It contained a large breeding colony of Little Terns (*Sterna albifrons sinensis*) and flocks of over a thousand Black Swans (*Cygnus atratus*) were recorded in the 1950s and 1960s (Chafer 1997). Neither of these species are found there today. Coastal saltmarsh was recently listed under the NSW Threatened Species Conservation Act 1995 as an endangered ecological community.

The remnant lagoon is bounded by a freight rail line into Port Kembla, the transport operations and coal truck wash facilities of the Port Kembla Coal Terminal, and the former Wollongong Builders Refuse Tip. The lagoon receives storm water and other effluent from the nearby steelworks and also other run-off from its largely urbanized catchment via major drains. In addition, a sewage line runs through the wetland and, at times of high rainfall, this discharges sewage into the area.

Restoration activities

In this difficult and highly modified environment, volunteers have been implementing restoration projects (Fig. 3). These projects have included a range of objectives such as rehabilitation of degraded and filled sections of the wetland, reintroduction of estuarine saltmarsh vegetation, increasing habitat diversity, and removing and preventing weed infestations (D. Deighton, unpubl. data, 1995, *Submission to Commission of Inquiry: Proposed Boat Harbour and Marina Development by Shellharbour City Council at South Shellharbour*; SWC Wetlands and Ecological Management Consultancy and WCC 1993).

The initial restoration work was undertaken by Wollongong City Council (WCC), the Water Board, and neighbouring industry. Since then, much of the impetus for restoration work has come from Friends of Tom Thumb Lagoon (FTTL) who have been supported by WCC's Bushcare program and NHT and other funding. In 1998, Conservation Volunteers Australia (CVA) became involved in work at TTL. Today, with support from BHP Billiton and also from the Southern Rivers Catchment Management Authority, TTL is one of 10 restoration projects in CVA's national 'Revive Our Wetlands' program (Conservation Volunteers Australia, cited 1 December 2004). More recently, Bluescope Steel has also begun to include TTL as a key part of its weekly environmental workshops for staff. Since the student work described here, there has been a partnership between the University's Centre for Student Development and CVA in which students have worked on CVA projects in the region.

Hydrological and other works

A number of earlier projects were particularly significant in terms of reshaping the lagoon to allow tidal water movement to facilitate the formation of tidal pools, mudflats and recolonization by saltmarsh vegetation (Fig. 4; D Deighton, unpubl. data, 1995). In 1993, landfill materials, such as slag and rock, were removed from the wetland and its margins. Inflow and outflow levels were set so that the ponds remained permanently inundated with brackish water and were flushed during peak tides, and shallow benches were created slightly above pond water level to allow mudflats to develop and to facilitate regeneration of saltmarsh vegetation (D Deighton, unpubl. data, 1995). Other early work included: development of noise abatement mounds adjacent to Springhill Road; creation of island refuges (Fig. 1), removal of weeds; construction of boardwalks, access paths, a cycle way, wetland vantage points, and interpretive signage; and revegetation involving mangrove and thousands of native trees at the wetlands margins. More recently, work has included further tree planting, the removal of Spanish Reed (*Arundo donax* L.) and bank stabilization (Fig. 5).

Outcomes to date

While formal monitoring has not been carried out, many have observed a relative improvement in the health and extent of saltmarsh vegetation, a reduction in weeds such as Kikuyu (*Pennisetum clandestinum*) throughout the site and particularly in the saltmarsh, and extensive regeneration of native trees particularly Casuarinas (*Casuarina glauca*). Dense stands of these trees now line much of the lagoon and tidal ponds. The casuarinas have been observed providing perches for raptors. Black Shouldered Kites (*Elanus notatus*), Peregrine Falcons (*Falco peregrinus*), and Sea Eagles (*Haliaeetus leucogastel*) have been observed at the site (S McGregor, pers. comm., 23/3/2005), the latter two not previously listed for the site. While the establishment of Casuarinas and mangroves may have reduced the habitat of wading birds, they have probably benefited other species such as Yellow Thornbills (*Acanthiza nana*; C Brandis, pers. comm., 7/4/2005). Migratory waders seen in the 1960s have not returned.

Ongoing issues

There is a range of ongoing management issues for TTL. These include weeds, rubbish, management of fishing and lobster pots, water quality, and the presence of feral animals such as cats. Weeds in particular require constant intervention and their origins include diffuse sources in the catchment. Other issues, such as arguably excessive establishment and growth of mangroves at the expense of mudflats, embody significant choices regarding restoration objectives and their ecological consequences.

Survey of participants in the project

As part of their assessment for a third year environmental management subject, students were required to participate in workdays at TTL and to critically reflect upon participatory environmental management. In addition, in late 2002, they undertook interviews with 18 key

respondents (all involved in the project in some way) about their perceptions of TTL and their views about its past, present and future management. These respondents included staff from WCC, Sydney Water, the Department of Land and Water Conservation, and employees of BHP Steel, Port Kembla Copper, and the Port Kembla Port Corporation. These individuals were chosen according to a purposeful sampling approach – in which information-rich interviewees are selected for in-depth interviewing (Patton 1990). In this case, the interviewees were chosen on the basis of their role in environmental management within their organization or on the basis of their involvement in projects at TTL.

Students conducted the interviews using a semistructured approach with a consistent set of questions (summarized in Table 1). The interviews were recorded and students prepared transcripts and reports of their interviews. For this article, the interviews were then subject to formal analysis using coding methods to examine and categorise the interview data (Ritchie & Spencer 1994). The results are discussed below in sections that cover perceptions of TTL, assessments of restoration work, the future role of TTL, and key management issues for the future. Part of the purpose of this investigation was to elicit perceptions or visions of TTL from a range of interviewees. Interviewees' views were sought on general perceptions of wetlands and of TTL in particular, views on rehabilitation efforts undertaken to date, and views as to the future role or roles of TTL.

Responses regarding visions of Tom Thumb Lagoon

Interviewees were asked questions that aimed to elicit their general perceptions and impressions of wetlands and of TTL in particular. Three themes emerged from their responses: perceptions of the site's *ecological value*; perceptions of *loss* arising from its degradation; and reflections on problems arising from the site's *isolation* (Table 1). All three have implications for approaches to management of TTL.

Ecological value

Interviewees believed that the key value of TTL lay in its ecological functions and habitat value. The wetlands' influence on water quality was a key issue here, particularly for industry interviewees. Most interviewees, however, saw TTL's key role as lying in its ecological conservation values as a remnant representative of coastal wetland ecosystems under pressure in NSW. Interviewees particularly cited the saltmarsh and mudflats as important habitats:

Especially with the mudflats, there's not a lot of that available down here at all, or saltmarsh. I think that to basically have a bird habitat near the centre of Wollongong is fairly important to the ecology of the region. (Industry interviewee.)

It was not clear from the interviews how respondents saw the retention of open habitats in contrast to mangrove regeneration or revegetation. Overall, however, their comments indicated that they saw the current open nature of the TTL mudflats and saltmarsh as a key feature of the site.

These perceptions of TTL as a precious remnant and an asset to Wollongong exist despite its highly modified state. There were no illusions among interviewees that TTL can be restored to a condition approximating that existing prior to industrial development in the area. Interviewees did, however, see great potential for restoration work. They thought that TTL could be of considerable terrestrial and aquatic habitat value, potentially functioning to provide ecological and water quality benefits.

Loss

A sense of loss pervaded many interviewees' comments in relation to wetlands and TTL. As Fig. 2a shows, the original TTL was a significant part of the Wollongong landscape and interviewees' comments reflected a sense that the loss of TTL was both aesthetically and ecologically significant. More generally, interviewees saw preservation and conservation of the limited remaining wetlands in coastal NSW as the most important overall wetlands management issue. In the context of widespread wetland loss in coastal NSW, they saw TTL as a site worthy of conservation efforts and one that Wollongong is lucky to have given the history of the site:

It's a wonderful thing, that we actually have a thing called Tom Thumb wetland. Something people wouldn't have even thought had any value at all, an area that could have easily been a car park. (State government employee.)

Isolation

One of the most important points identified by interviewees was that TTL is separated from the nearest residential areas by a railway line and a busy main road (see Fig. 2b). As a consequence, interviewees saw TTL as a 'remote' site without residential neighbours who might form a source of volunteers for Bushcare projects. Suggesting that TTL is viewed as an unattractive and polluted area (creating psychological barriers to participation), they saw this isolation as adding to the difficulties of recruiting volunteers to restore and manage natural areas. For these reasons, management strategies at TTL have included developing links with industry and 'importing' CVA teams to undertake work on the ground.

Responses regarding perceptions of the restoration at Tom Thumb Lagoon (1991–2002)

Sense of achievement

The overwhelming response to questions regarding the restoration work at TTL was that a great deal had been achieved after decades of industrial development and neglect (Table 1). Interviewees, however, acknowledged that no systematic empirical measures of improvements in ecological function had been carried out at TTL.

This sense of achievement was echoed in the satisfaction expressed by volunteers at their achievements. For example, one of the original members of Friends of Tom Thumb Lagoon said:

If I look at how it was 10 years ago when I started working on it... when it was a clay pan, it had no water, and the saltmarsh was almost nonexistent, I think in the last 10 years it has improved... things are really looking up.

Volunteers' sense of achievement was, however, accompanied by indications that the limits of their contribution were being reached. Much of the credit for the perceived achievements was given to two individuals who have, until the more recent involvement of CVA, been largely responsible for coordinating and doing much of the work at TTL and who remain central to any work at TTL. Industry interviewees expressed concern about the reliance on these two key individuals; WCC was seen as 'lucky' to have had the benefit of their commitment.

Responses regarding future management directions

Interviewees' views regarding specific issues that require increased attention and the strategic approach required to address them are summarized in Table 1. While there was unanimous support for the continuation of the current site-based restoration program, particular emphasis was placed on the need to reduce causes of pollution, litter and weed invasion in the catchment rather than addressing on-site symptoms alone. This focus led to discussion of the relationship of the site to its catchment, both in ecological and sociological terms. Central to this discussion was the need to re-examine and redefine the future role of TTL in relation to the surrounding landscape and community.

Future roles of Tom Thumb Lagoon

Consistent with the value of TTL as habitat, interviewees saw the primary role of TTL as protecting ecological values. Interviewees did canvas a recreational role for TTL, but almost unanimously they believed that this should be passive in nature and should draw on and nurture the value of TTL as habitat.

Interviewees also thought that TTL had an important role to play in education. Most significantly for discerning future management directions, several thought that this role should focus on portraying TTL as an example of what can be achieved in rehabilitation of a highly modified site:

I see TTL as being a restored, rehabilitated wetland that will provide opportunities for the communities to learn about wetlands and wetland processes, a demonstration site next to an industrial area. (Local government interviewee.)

Education was also commonly identified as being a key to the long-term success of management at TTL. This was considered the case both in terms of attracting future volunteer interest and leadership, and in terms of altering the behaviour of residents in the catchment. Some interviewees perceived, however, that education as a component of management of TTL has been neglected.

This concern was not simply a matter of educating people in the area about the role and value of wetlands or about the transmission of information. A local government interviewee expressed deeper concerns that TTL had been 'alienated' from people and that there had been an overemphasis on the idea of a 'precious wetland' rather than a focus on getting people into the area to demonstrate the values it embodies and what has been done.

In addition to education, the other issue that interviewees identified as requiring greater attention was waterborne pollution – weeds and rubbish – coming into TTL. The continual input of weeds into TTL, in particular, frustrates restoration efforts. One interviewee expressed their frustration succinctly:

We have weeds coming down through the catchment in the water, and rubbish...we have tampons, nappies, condoms. How people can jam a nappy down the toilet I don't know. (NGO Interviewee.)

Discussion of possible future pathways

Expanding funding to better suit ecological restoration needs

An obvious shortfall identified in the survey was that key elements of restoration practice have not been integrated into the funding of the restoration projects. Funding allocations have not provided for adequate monitoring of the ecological outcomes of restoration work and of the large amount of volunteer labour that goes into them. A further significant problem noted at TTL and elsewhere in Wollongong, is

that the duration and timing of grants means that work such as weed control is often not followed up and the effectiveness of the work is limited as weeds then re-establish. These issues raise questions as to whether resources such as funds and labour are being used to maximise both site and strategic outcomes in the Wollongong area. These observations point to a need for a shift to include funding for monitoring in future budgeting, as well as the need to ensure greater continuity of funding for on-ground works.

This also raises issues about the choices to be made regarding ecological management of TTL. If management for habitat is to be a key objective, then more detailed consideration of what sort of habitat is to be created will be needed. At least a notional ecological reference community (or communities) needs to be identified in a planning process. The contribution of TTL to regional and/or state wetland management goals should be assessed and the site's potential role and the tradeoffs between relative choices should be made explicit.

Need for dealing with issues at a catchment level

Biodiversity goals are not the only issues that need to be considered at a regional level in order to meet management goals. Concerns expressed about the ingress of weeds from outside the site and the need for education of the broader community point to a sense that future efforts to successfully manage TTL have to focus outside the site as well as on the site. A shift in effort from the site to the catchment, including the social setting of TTL, therefore, appears an appropriate change in future direction. In addition, reaffirming or re-establishing community and individual links with TTL may constitute a key issue for management of TTL, given the need for volunteer leadership succession and the need to involve residents from the TTL area.

The establishment of such links is problematic and can require long-term effort that is often difficult with funding cycles and their unpredictability. Attracting and retaining volunteers for participatory natural resource management is difficult (Curtis 2000). Furthermore, TTL is also probably disadvantaged by its location and relative remoteness, as indicated above.

There are, however, some grounds for tentatively questioning the 'isolation' assumption. Three industry interviewees have encountered 'fond' recollections from older residents in the area of past uses of, and links with, TTL. To what extent these links between TTL in its former state can be translated to the contemporary TTL is not clear. Nonetheless, there is a small amount of evidence that some 'traditional' use of TTL (e.g. for crabbing and harvesting of plants) is continuing, which, if borne out, would indicate that the isolation of TTL is not complete.

Participatory planning and management

The current development of a new management plan could represent an opportunity to direct greater investment into the social capital needed for the future of TTL. For example, a planning process that engages with existing community networks, explores existing views and uses of TTL, and facilitates active engagement with TTL stands a better chance of attracting ongoing community support and commitment than a plan created in a more conventional manner. In addition, the process may well also result in new networks of interest and communication characterised by ongoing activity.

In terms of principles and suggestions for how to proceed with managing the social and biophysical elements of the catchment of TTL, the developing literature on urban participatory environmental management offers some potentially useful insights beyond the common injunction that community involvement is desirable. A valuable point to begin with is that managers cannot presume that the public's view of nature is consistent with the categories and concerns that the scientific and land management communities take for granted (for example see Slattery 1998; Woolcott Research & NSW National Parks and Wildlife Service 2002). Slattery (1988) revealed that the concept of ecological communities had little meaning to many of those interviewed and that weed growth, whether in or out of gardens, can signify a vigorous and healthy state of nature to many. This can translate into ambivalence and even antipathy towards restoration work that focuses on weed removal (Slattery 1998).

Even where there is general agreement about managing land for conservation, subtle variations in views can make decision-making complex. For example, Gobster (2001) discerned among interest groups four 'visions of nature' embodying various ideas as to how an urban park should be managed. All four visions included positive valuations of the natural elements of the park such as bird and plant life. Yet, due to variation in associations between these elements and broader interpretive frameworks, the precise managerial prescriptions arising from each vision were divergent. Resolving these differences involved considerable efforts such as workshops.

Tailoring public communication to specific ends

What these brief excerpts alert us to is that appealing to the ecological values of TTL in order to attract interest may not by itself be sufficient for many people. In fact, it is possible that it will alienate people and, if a catchment approach is adopted for management, it may be important to expand the focus to attract greater engagement. This may mean greater management emphasis on codevelopment of future conservation management goals and community relationships, rather than the community elements being 'tacked on'. For example, it has been shown that the provision of environmental information, education and experience of restoration can play a role in altering human attitudes and behaviour in relation to restoration projects (Casagrande 1997; Slattery 1998). The difference between alienation and attraction can pivot, then, on the terms on which managers engage with members of the public.

The concept of 'vernacular ecological knowledge' coined by a group of British geographers working on urban green space (Degen *et al.* 2003) may be useful here. Vernacular knowledge refers to the

intimate knowledge of the history and culture of these ecological sites and communities [that are] vested in particular kinds of practical knowledge that consist of more than scientific ways of knowing and are distributed through a diversity of skills and know-hows amongst those that make the city their home (Degen *et al.* 2003).

What this suggests is that it is not simply that people can be reconnected to nature through participation in restoration but that diverse connections to urban open space often already exist. Understanding the extent and nature of these connections is likely to be important in restoration projects. In relation to TTL, interviewees spoke of various uses of the lagoon such as fishing and harvesting of plants. To what extent these activities speak to significant connections to TTL is unclear, however, these practices may be starting points to understanding how a range of people already engage with TTL. Extending this perspective to the catchment may throw up unexpected ways of seeing TTL and connections to it.

There are several concrete steps that could advance this process and form part of the future of restoration at TTL. First, interviewees commonly made reference to how people remember TTL prior to the 1960s. A publication that focused on these recollections could assist in examining and building connections with the contemporary TTL. Second, specifically engaging users through a combination of conversations, surveys or observations will contribute to understanding existing connections outside the restoration community. Third, action research (Patton 1990) to establish attitudes, perceptions and behaviour in relation to TTL, rubbish disposal, and gardening practices would form the basis for community engagement, including with local schools. Fourth, further biophysical and visual information about the progress and achievements of restoration and ongoing problems such as weed management should be compiled. This will not only assist with future management and project planning but will also provide the basis for information to be made available to the community in a manner that makes clear the connections between TTL and people and their activities. Moreover, such evaluation would assist in meeting restoration principles such as setting objectives, linking these to selected ecological variables, and establishing monitoring programs. The achievements to date at TTL are at the very least visually impressive. Extending on this in accessible formats that make clear what can be achieved through volunteer input should form part of the future of management at the lagoon.

Acknowledgements

I am grateful for assistance from the following people in the preparation of this paper: Sue McGregor and Dan Deighton (Friends of Tom Thumb Lagoon), Damion Stirling and Anna Grounds (CVA), Chris Brandis (Illawarra Bird Observers Club), the WCC Local Studies Library, Chris Doyle (Port Kembla Port Corporation), and Cassandra Harris.

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- Figure 1** Aquatic and terrestrial restoration projects have been undertaken at Wollongong's remnant saltmarsh, Tom Thumb Lagoon, NSW, since 1991, including the creation by volunteers of island refuges for birds (Photo: Friends of Tom Thumb Lagoon/Conservation Volunteers Australia).
- Figure 2** (a) Tom Thumb Lagoon with Wollongong, NSW, immediately to the north, c. 1930 (Photo: Wollongong City Council Library/Illawarra Historical Society). (b) The inner harbour at Port Kembla looking north, 1996. The current Tom Thumb Lagoon is circled. Much of the land immediately to the south of Tom Thumb Lagoon was reclaimed from the original lagoon and some of the harbour area was created by dredging the lagoon (Photo: Port Kembla Port Corporation).
- Figure 3** Restoration projects at Tom Thumb Lagoon, Wollongong, NSW (Source: Friends of Tom Thumb Lagoon). Projects in the early mid 1990s focused on creating the foundations for today's varied aquatic and terrestrial habitats. More recent projects build on these foundations with specific revegetation aims. The establishment of mangroves is still debated as they potentially impact on the more open habitat provided by mudflats and saltmarshes.

Figure 4 Channels and other features were created in 1991 (Photo: Friends of Tom Thumb Lagoon/Conservation Volunteers Australia). These channels and other features such as tidal pools were constructed to facilitate recolonization by saltmarsh vegetation and formation of tidal pools and mudflats.

Figure 5 University of Wollongong students removing and bundling Spanish Reed in 2002 (Photo: N Gill). These reeds were to be used in a Coastcare bank stabilization project. Weeds were identified as a major issue by interviewees. Their presence in the gardens and open spaces in the catchment of Tom Thumb Lagoon, Wollongong, NSW, is a major challenge for future approaches to management.

Table 1. Summary of interview questions and the themes and specific points that emerged from the evaluation of the Tom Thumb Lagoon Project

Questions	Themes that emerged	Specific points made by respondents or arising from interview analysis
Visions of TTL. Respondents were asked seven open-ended questions about the values of wetlands, of the site, and about constraints to its conservation management. (Open-ended questions facilitate structured and consistent interviewing while allowing interviewees to answer discursively in their own terms.)	Isolation. A major constraint to support is that TTL is isolated, without 'community', and does not conform to conventional aesthetics	TTL is cut-off from neighbours by transport corridors. Industry is TTL's neighbours so different approach required compared to many urban areas. Volunteer recruitment difficult due to isolation. Significance and extent of past and present uses by locals is unclear.
	Loss. Represents a diminished ecological and cultural landscape.	Loss of a significant element of Wollongong's ecological aesthetic landscape. TTL a key remainder of depleted NSW coastal wetlands – it is an asset to wollongong.
	Values. TTL nonetheless is valued as an important component of ecological system.	Industry, NGO and government staff prioritised TTL's ecological role. Influence on water quality is the main value of wetlands. Saltmarsh and mudflat habitats are a key attribute of TTL.
Perceptions of Restoration at TTL. Respondents were asked eight open-questions about whether they considered the current approaches appropriate, productive and sustainable.	Progress. Perceived as high on some measures, unmeasured on others.	Progress visually impressive. Progress in ecological terms less clear/undocumented. High level of volunteer satisfaction with achievements.
	Volunteers' role. Important but sustainability issues present.	Achievements of FTTL significant; concern at reliance on small core of individuals; volunteer burnout present.
Future Management Directions. Respondents were asked four open-questions about potential future directions for management strategies and project design.	More strategic approach needed. for example manage the biophysical/social catchment not just the site.	More work in local schools; resident and business behaviour; upstream sources of weeds and rubbish.
	Clarify broader ecological significance of TTL to guide management.	Clarify role of TTL in regional/state wetland management objectives. Clarify ecological tradeoffs between management options.
	Determination of future role of TTL. Need to consider potential for multiple complementary roles.	Habitat; passive recreation not active recreation or use; education and demonstrating the potential of urban/industrial restoration.
	People issues. Ensure ongoing involvement.	Succession management and generating the next generation of volunteers; how are people using TTL?

FTTL, Friends of Tom Thumb Lagoon; NGO, ; TTL, Tom Thumb Lagoon.