# REVIVING WETLANDS

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## ABSTRACT

In the Sydney region, approximately 50% of the area of pre-European freshwater wetlands and 80% of the saltmarsh area has been lost in the past 200 years. Although direct and intentional destruction by drainage and filling has been the major cause, general degradation from the "unintentional" effects of urbanisation has caused the loss of many freshwater and saline wetlands. Wetlands in the urban areas exhibit symptoms of failing processes, limited functions and visual degradation.

There is considerable value in examining the decaying bodies of wetlands lying littered around our urban landscapes. A comparative survey of urban wetlands and their catchments, both the surface watershed and the catchment of stormwater drains, can provide empirical insight into wetland functions and processes, and the impacts of urbanisation on them. This paper identifies the common symptoms and causes of wetland degradation that must be addressed in any wetland rehabilitation strategy. The pathways by which the wetland is linked, and interacts with, its catchment(s) are modelled in conceptual diagrams to allow analysis of impact control and mitigation opportunities.

Historical information, in addition to contemporary data, is an important factor in defining appropriate objectives and the strategies to achieve them. Appropriate decision support systems or mechanisms are useful to resolve conflicts between the many possible objectives for wetland rehabilitation or creation. Planning and implementing the works for a wetland rehabilitation project requires effective and constant communication between all members of the project team, and particularly with the operators of any machinery used in the wetland. The success of the project may not be evident for years after the major work has been finished and the ease with which "success" is measured depends on how appropriate and well-defined are the objectives. The natural variation in time of many wetland populations complicates monitoring activities and fluctuations, due to natural perturbations, must be taken into account in the design of monitoring programs. It is the very quality of variation that gives many types of wetlands resilience and renders them amenable to rehabilitation.

## INTRODUCTION

Since European settlement of the Sydney region, approximately 50% of freshwater wetlands and 80% of saltmarsh have been lost (Stricker & Adam 1989). Although direct and intentional destruction by drainage and filling has been the major cause, degradation from the "unintentional" effects of urbanisation has caused the loss of many more wetlands. Wetlands in urban areas exhibit symptoms of failing processes, limited functions and visual degradation. It is this unplanned, generally unnoticed, slow death of wetlands on which we must focus if we are to understand how to reverse the trend of wetland loss.

## A WETLAND AUTOPSY

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### Symptoms

The symptoms of advanced wetland degradation are usually obvious, but early detection of symptoms requires good comparative data. Some of the obvious symptoms are:

* poor water quality; low oxygen, dirty water, green water, stagnant water;
* gross pollutants; litter, refuse;
* infilling;
* prolific growth of alien and environmental weeds;
* loss of indigenous plants;
* loss of native fauna;
* loss of visual amenity; and
* chemical contamination.

### Causes

Typical causes of wetland dysfunction and degradation are:

* altered flow regime, too much too soon, too fresh;
* siltation;
* cultural eutrophication;
* chemical or organic contamination of surface and groundwaters;
* foxes, rabbits and cats; and
* carp, goldfish and gambusia.

These are common causes of degradation. Often it is only a small change which is the trigger for degradation, for example, a small change in the catchment drainage that diverts run-off from a new development to a wetland. Within a short time this change amplifies into a cascade of degradation as the levels of silt, nutrients and other contaminants, as well as weed propagules, build up in the wetland. When the tolerance of the wetland to these inputs is surpassed changes in the processes within the wetland occur and functions become impaired.

## THE REVIVAL PROCESS

### Setting goals

Goal-setting for wetland recovery is a balancing act between community perceptions, what is achievable and sustainable, and often competing values of the wetland. Identifying the current and potential values of the wetland is a first step in goal-setting. Gathering historical and contemporary information is essential in gaining an understanding of the potential of the wetland for recovery. It is necessary to understand, at least at a gross level, how the condition of the wetland has changed over time. The rapidity with which change occurred and the duration of the change are as important as the trigger(s) of the change.

This historical view helps us to make judgements as to what is ecologically achievable and sustainable, and how long recovery may take. We also need to consider the community perceptions of the wetland and the current, or potential, use by the community.

Common goals that are set for urban wetland rehabilitation are to:

(1) Improve water and sediment quality;

(2) Maintain, and where possible restore, fauna and flora habitat (conservation of biodiversity) or we may need to give priority to a particular species or community;

(3) Provide opportunities for environmental education and passive recreation.

Goal (2) is almost invariably dependent on (1) and may have inherent conflicts between flora diversity and the provision of habitat for certain groups of waterfowl that require expanses of open water of particular depths. Generally both can be accommodated in any wetland of reasonable size, although at the Botany Wetlands near Sydney Airport, there is an additional external constraint of not increasing populations of flocking birds such as ducks, or large-bodied slow birds such as Black Swan and Pelicans which may be a hazard to aircraft.

### Selecting objectives

The next stage of the process is to transform these goals into objectives. In order to restore or rehabilitate a wetland, the factors and processes by which a wetland becomes degraded must be identified. The pathways along which pollutants travel must be clearly marked, at least in conceptual diagrams. The use of conceptual models facilitates analysis of the issues and the practical considerations of feasibility and cost. For Botany Wetlands, which are a relatively large (62 ha) and complex system of modified wetlands in a 20 sq. km urbanised surface water catchment and a significantly larger groundwater catchment, we needed to carefully define the boundary conditions for each issue. That is, defining all the factors which influenced that issue. Figures 1-4 are

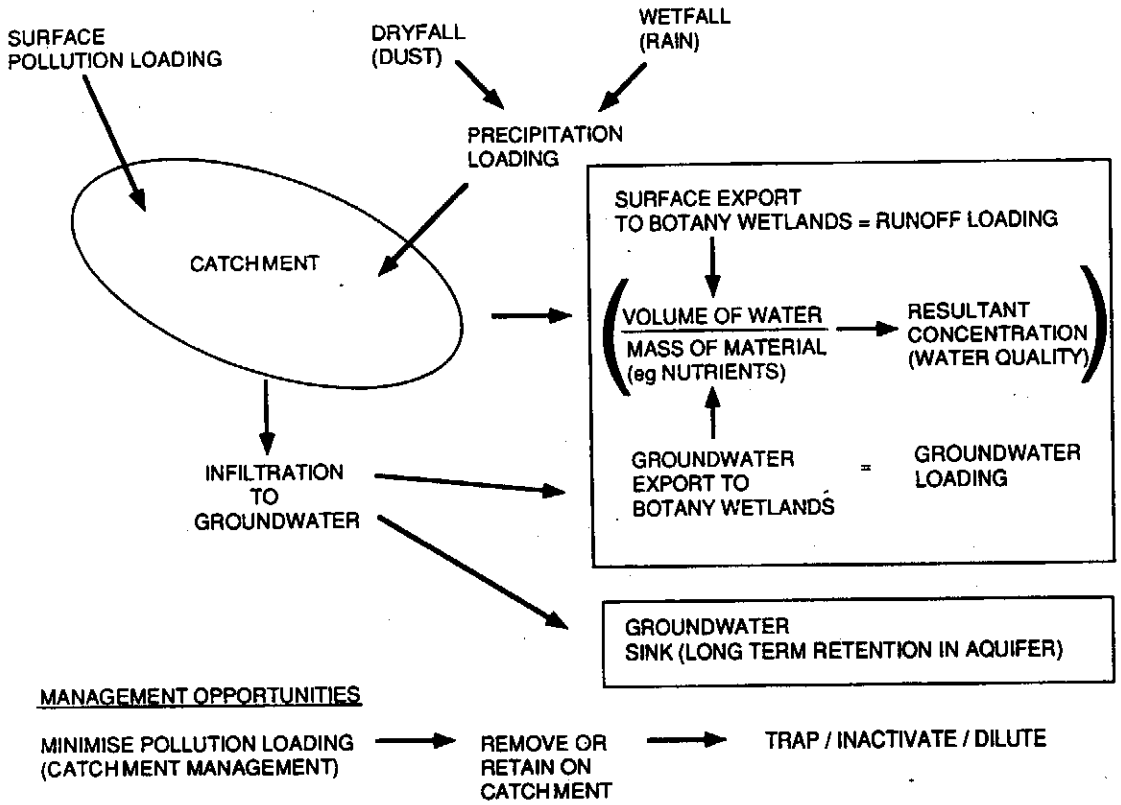


**Figure 1** Catchment - major factors influencing Botany Wetland water quality. (Source for Figures 1 to 4: Department of Water Resources Consulting Services 1992).

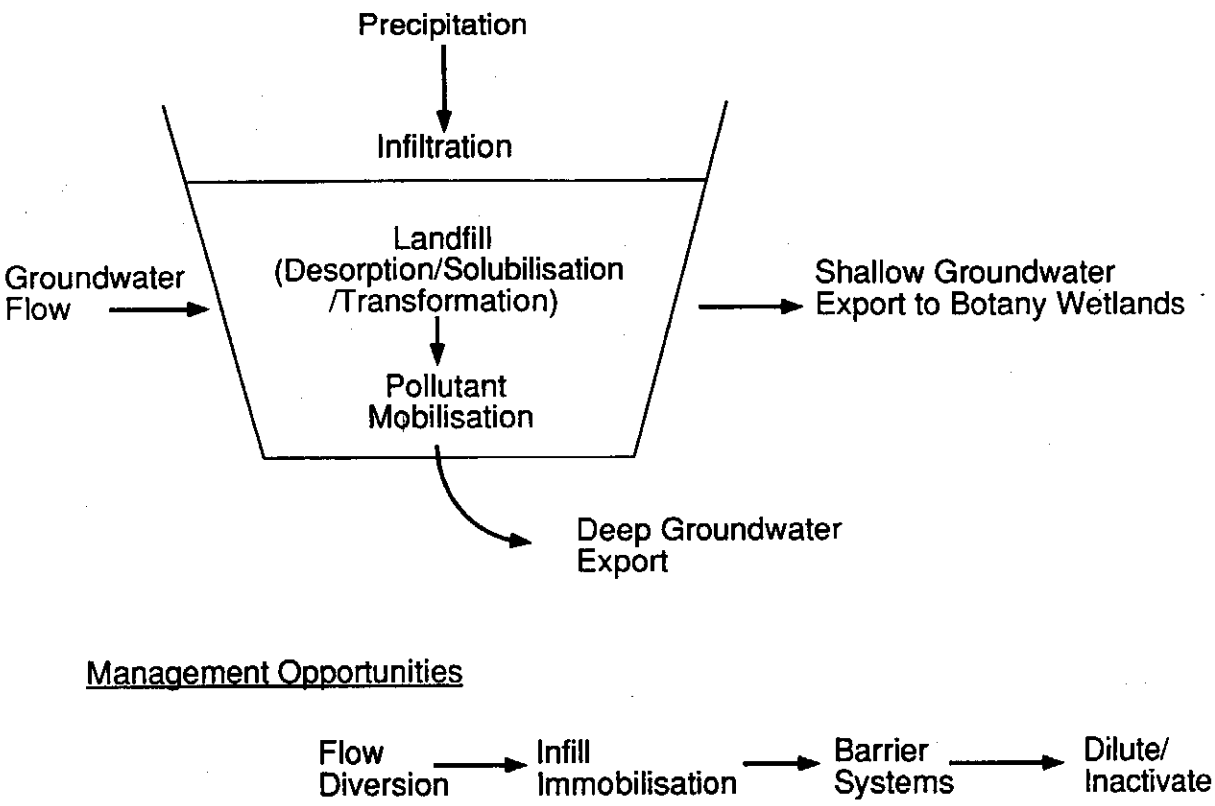


**Figure 2** Landfill - wetland interaction.

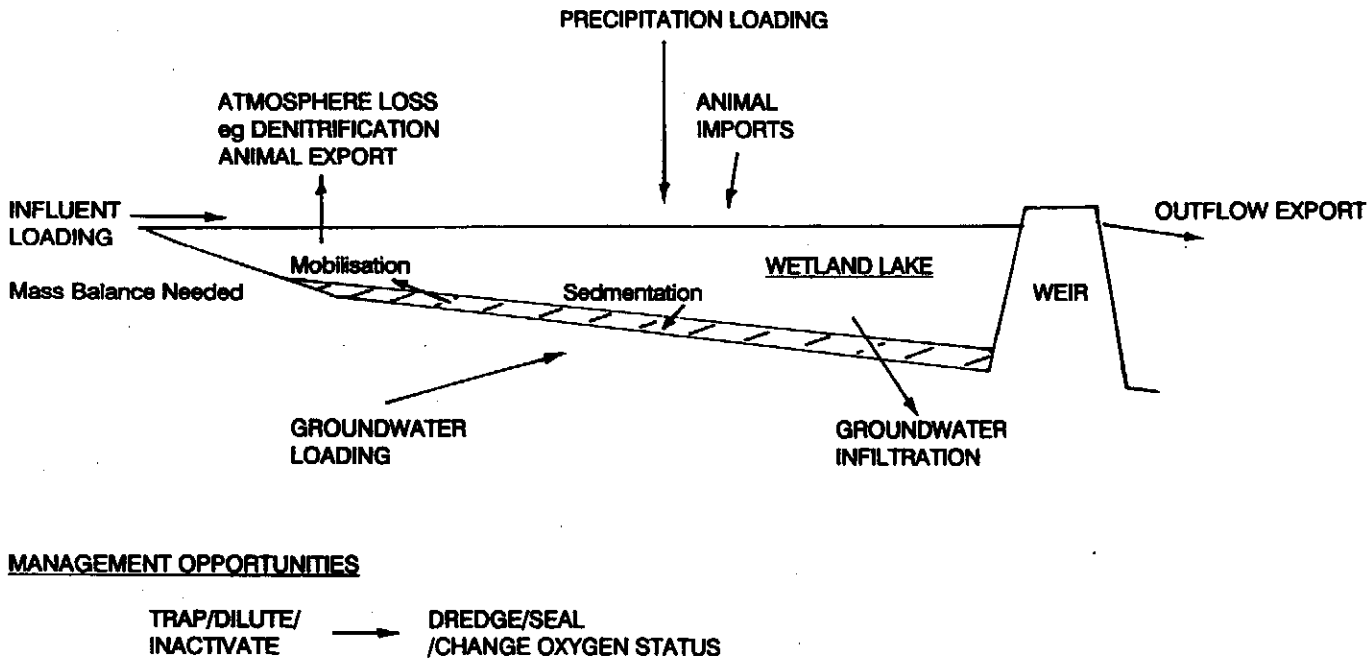


**Figure 3** Wetland water quality - major material pathways.

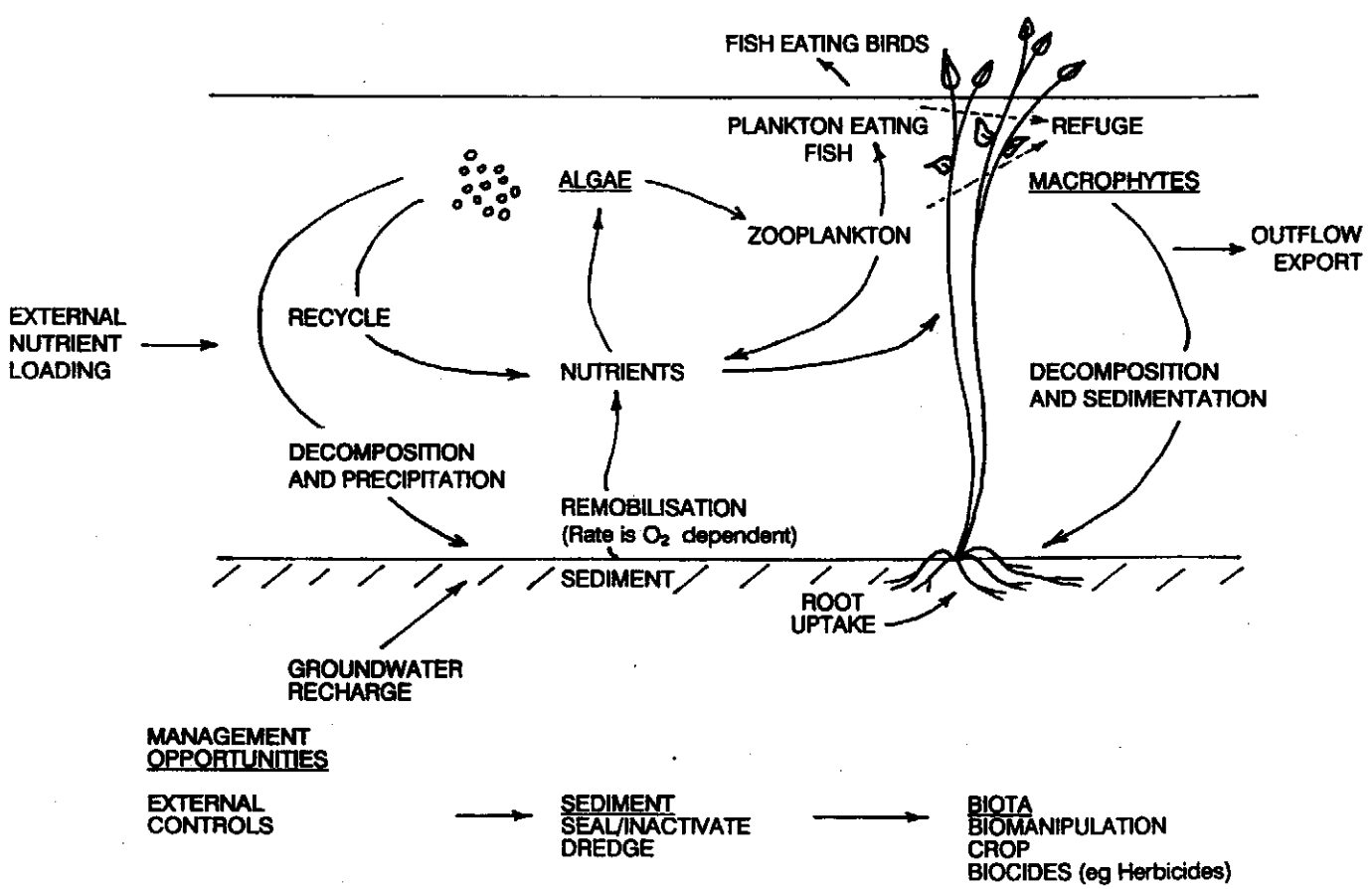


**Figure 4** Wetland - nutrient/biota interrelationships.

examples of conceptual diagrams that were used in the initial planning of management strategies for the Botany Wetlands (Department of Water Resources Consulting Services 1992).

These concept diagrams, along with desk-top water quality modelling using water quality data, assisted in the identification of management opportunities for the issues. From the results of the water quality modelling, we concluded that the phosphorus influx from both surface and groundwater to the upper pond system should be reduced by 60% to achieve long term nutrient levels that would not support prolific weed or algal growth. This, and other conclusions, were then discussed at a one day forum of community and stakeholder groups to develop catchment-wide action plans which, combined with in-system strategies, contributed to a draft management plan. Currently Sydney Water is undertaking trials of control mechanisms for the aquatic weed Primrose Willow (*Ludwigia peruviana*) at Botany Wetlands.

Eve Street Marsh at Arncliffe is tiny by comparison, being a little less than 4 ha in area. The wetland is a tidal marsh linked to the Cooks River by a mangrove-lined channel and it receives stormwater from a small catchment via a drain entering the wetland on the upstream side. The area was once part of the extensive brackish wetlands of the lower Cooks River and is part of the diminishing habitat for migratory wading birds in the Botany Bay region (Stricker & Adam 1990). For many years, the wetland area had been illegally used as a landfill for building rubble and general rubbish. The wetland area was diminishing, and had become isolated from the tidal flow, because the bed level had been raised by siltation and the cutting of an informal stormwater drain along one side had drained the wetland.

The primary objectives for the project were to:

* Increase the area of wading bird habitat so that a minimum average depth of 5 cm of water was retained in the pond areas at all times;

* Maintain the indigenous salt marsh flora;

* Provide safe community access for passive recreation and environmental education.

Using a long-reach excavator, the fill and 5 - 10 cm of silt was removed from the wetland and the pond reshaped to provide tidal mudflats for wading birds and deeper areas for ducks and Chestnut Teal. The terrestrial areas have been planted with indigenous stock and the wetland plants have regenerated naturally, encouraged by a control program for the invasive weed *Juncus acutus* which replaces the native *Juncus kraussii*.

A water level control structure was needed to achieve the first objective. Without such a structure the wader area is exposed to the summer sun for about nine days during periods of neap tides and low water spring tides. Many of the wading birds had to move to other wetlands during these periods as the dehydration of the mud flats rendered them unsuitable for foraging.

A low weir, placed in the tidal channel close to the wetland, was chosen as the most appropriate water level control. To determine the height of the weir crest, daily peak tide levels were converted to Australian Height Datum (metres AHD), for comparison with the wetland bed levels. The area of the wetland inundated at different tide heights could then be calculated and plotted diagrammatically. A weir crest height of 20.5 m below Sydney Water Datum (approximately 0.5 m AHD) was selected as the appropriate height to allow frequent ingress of tides, while containing a minimum average depth of 5 cm across most of the wading bird feeding area.

The third objective was easy to achieve and to measure. Safety fencing was installed along the sewer carrier, which provides an overview of the wetland area while being far enough away not to disturb the birds feeding in the wetland. The walkway also provides access to the banks of the Cooks River, which is a favourite walk of some local residents. The site is regularly used by school groups for various aspects of their science and geography curricula. The use of the wetland by the community has been monitored as one of our performance measures. Similarly, the regeneration of the

salt marsh flora and the use of the wetland by both migratory and non-migratory populations have been monitored as our measures of success. The results to date have confirmed that Eve Street Marsh is a wetland of value to the community and that it provides valuable habitat for flora and fauna. Notwithstanding the success of this project, the primary focus of all efforts to "reverse the trend" of wetland loss should be to better conserve the remaining wetlands.

## REFERENCES

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