SECTION EIGHT

Native Vegetation and Wetlands

Contents

SECTION 8: Native Vegetation and Wetlands

KEY CONCEPTS

Management of the native landscape has several important benefits. It helps:

- maintain a diversity of plants and animals;
- protect ecosystems;
- *improve water quality;*
- minimise erosion;
- create lower-maintenance landscapes;
- provide habitats in urbanised areas; and
- reduce mowing, chemical applications and water use.

Wetlands provide several benefits on golf courses:

- they are a source of irrigation water;
- they cleanse stormwater;
- they filter nutrients; and
- they create wildlife habitats.

All native landscapes and wetlands need to be managed so that they maintain their integrity and function.

Golf course construction that incorporates native landscapes and wetlands provides these very important functions:

- environmental,
- aesthetic, and
- golf strategy.

As well as these benefits there are cost savings through reduced maintenance, less chemical usage and lower fertiliser requirements.

8.1 INTRODUCTION

Golf courses encompass a wide range of environmental conditions from pristine woodlands to degraded farmland and include a diverse range of plant and animal communities. Wetlands, including coastal wetlands, bogs, swamps, ponds, rivers and some open drains, are also an important part of this landscape. Golf courses in urban areas can often represent the area's remaining examples of the indigenous flora and fauna, or can form a link between fragmented areas of bushland. While the golf course has to operate as a golf course and not a nature reserve, it still has a duty of care to manage these areas in a responsible and sustainable manner. They can be one of the significant features and attractions of the golf course and help maximise the environmental benefits of the golf course.

8.2 NATIVE VEGETATION

Management of the native landscape has several important benefits. It helps:

- create a healthier mosaic of land uses;
- maintain a diversity of plants and animals;
- maintain the gene pool;
- protect ecosystems and ecological communities;
- provide habitat and corridor linkages;
- improve water quality;
- minimise erosion; and
- create lower-maintenance landscapes, reducing the dependence on water and chemicals.

The introduction of locally native vegetation into 'no-play' areas enhances the landscape and reduces the mowing efforts. However care should be taken to only undertake plantings in areas where natural regeneration is likely (e.g. no-mow zones) and to use species that occur in the local area. Reasons for introducing native vegetation include:

- providing food and shelter for animals, birds, and insects currently threatened by loss of habitat;
- reducing mowing, chemical applications and water use;
- providing an effective alternative to turfgrass, reducing maintenance costs and resources required;
- promoting the opportunity to enhance biodiversity;
- providing the opportunity for community education and awareness, both for members and neighbours; and
- keeping nature's beauty close at hand.

Revegetating areas or allowing previously maintained areas to regenerate will provide excellent buffer zones and reduce maintenance costs. However, they should not result in deep roughs that inhibit play. It is also important not to place a regeneration area in the line of sight of a golf hole (Scenna and Morrison 1998) (see Figure 8.1). Appropriate placement areas may include behind tees and greens, beside cart paths, or bordering edges of a golf hole, including edges of forests, water courses and wetlands.

Creating buffer strips along the banks of rivers and streams serves the dual purpose of improving aesthetics and providing a functional component of ecosystem enhancement. In particular, they:

- filter runoff to reduce nutrient, sediment, pathogens and chemicals that may otherwise enter a water feature;
- provide a barrier between nutrient-rich grass clippings and the water feature;
- reduce labour required in hand trimming and hand mowing; and
- provide erosion control (i.e. trap sediment, reduce velocities of runoff and flood flows, and protect valuable soil by binding it with plant roots);
- provide shading of waterbodies with taller vegetation, which reduces favourable conditions for algal growth.

Golf courses need to try to link significant native vegetation establishments into the local scheme of parks and conservation areas. This provides green belts or wildlife corridors in the urban environment for the movement of native fauna and for maintenance of genetic diversity (AGU 1998).

CASE STUDY – NELSON BAY GOLF CLUB

The Nelson Bay Golf Club is a 27-hole golf course at Nelson Bay, Port Stephens, New South Wales surrounded by towering native trees set against the forested hills of the adjoining Tomaree National Park. The initial course was constructed about 40 years ago and is a coastal bushland course on sandy soils situated less than one kilometre from the Nelson Bay township. Whilst this location is an advantage for golfers to access the club, it creates many environmental challenges. During the past ten years the golf club has actively worked to improve and protect the golf course environment and its surrounds, by showing how a golf course can integrate the requirements of golf while preserving and improving the native flora and fauna.

An extensive native tree-planting program has been undertaken over the past 10 years with more than 5000 indigenous trees planted in the first stage, including *Eucalyptus robusta*, *Eucalyptus nicholii*, *Eucalyptus botryoides*, *Acacia spp.* and several *Callistemon* species. Areas between fairways have been left to regenerate wherever possible and a campaign to re-introduce native animals to the area has commenced. Wallabies, koalas and kangaroos have been released onto the course as part of the WIRES Program (a program for the rehabilitation of injured native animals).

In 1996, the Club decided to embark on the development of a further nine holes. One of its priorities was the retention of important indigenous vegetation. Pacific Coast Design (PCD) was engaged to develop the master plan to link the three proposed nines into the club zone and to ensure balance within the three nines. Prior to finalising the design and obtaining the appropriate planning permits, an environmental report was undertaken and used as the basis for a final routing of the new holes by PCD. Using a combination of aerial photography and ground survey to pinpoint nominated trees, the routing specifically protects habitat areas (selected trees) for Squirrel Glider and the Masked Owl. The wildlife survey report noted that the only koala population found during the report study was on the existing golf course. Native corridors, approximately 30 metres wide have been left between the fairways and around the perimeter of the new area.

Incorporated in the new nine holes is an area consisting of two lakes where the fringes have been planted with native wetland plants to encourage bird life. An area of approximately two hectares, in the north-east corner, has been retained as a native reserve. Some 20,000 tubes of native grasses and approximately 2000 trees have also been planted as part of this project. A feature of the new nine is the spectacular Gymea Lily (*Doryanthes excelsa*), one of the most conspicuous of New South Wales native plants. It is found in

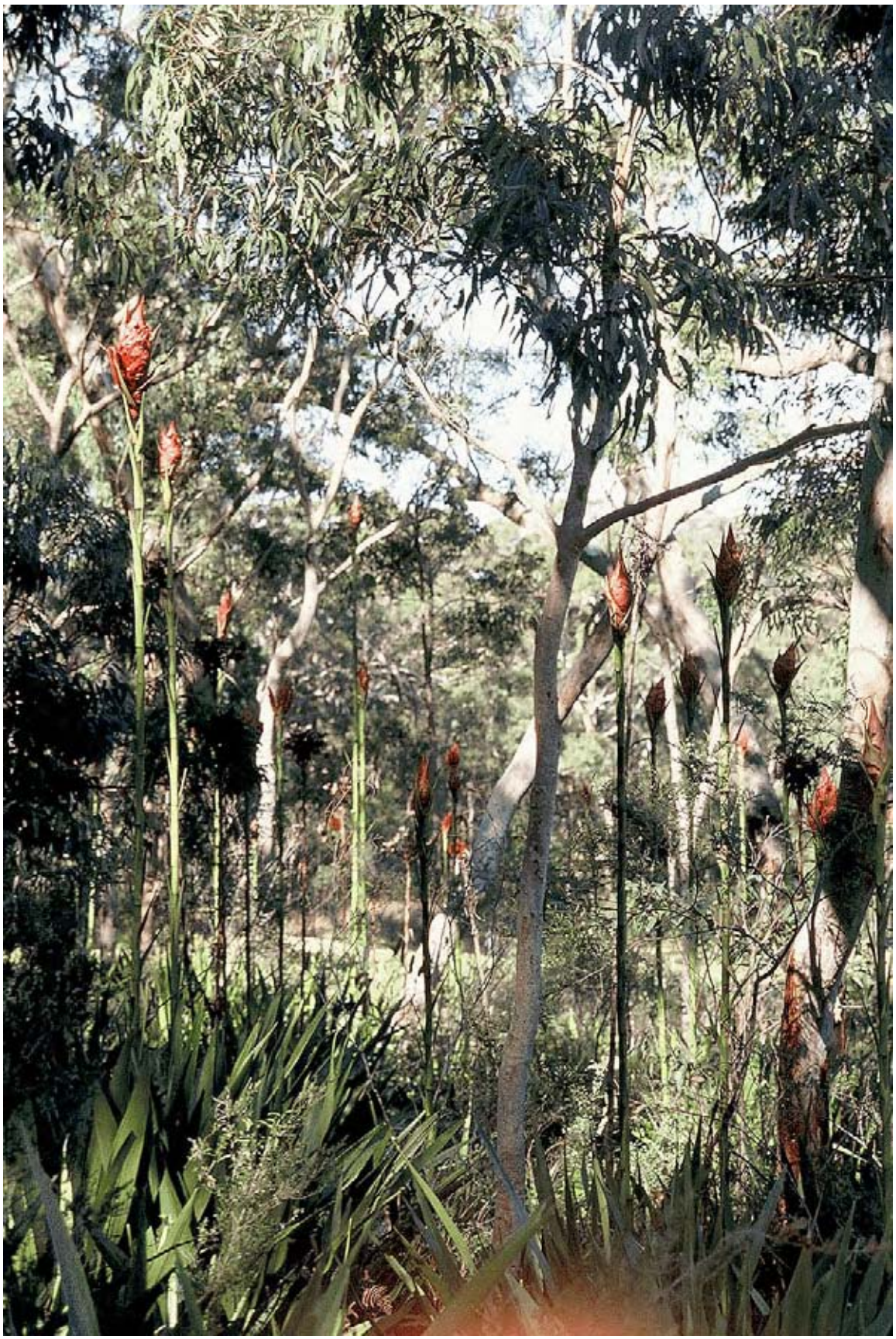
open forest, on sandy soils with its most outstanding feature being the stem that can be up to 4 metres long with a compact head-like panicle of red flowers.

During clearing for the new nine, an environmental consultant was on site to ensure any native wildlife disturbed was either relocated to the adjoining national park or the existing golf course. The PCD designers visited the site during this phase to modify the routing of the new holes to further protect any significant sites found within the area.

Dead trees have been retained as nesting sites unless they are a potential danger. As part of the ongoing management of the course and surrounds a management plan was developed and includes water testing in conjunction with the Hunter Water Board and soil sampling on a regular basis. There is strict control on nitrogen and phosphorus applications and no fertilisers are applied near native bushland areas. Since 1993 there has been a 45% reduction in the use of nitrate and phosphate fertilisers.

Native Bushland — Nelson Bay Golf Club

Gymea Lily



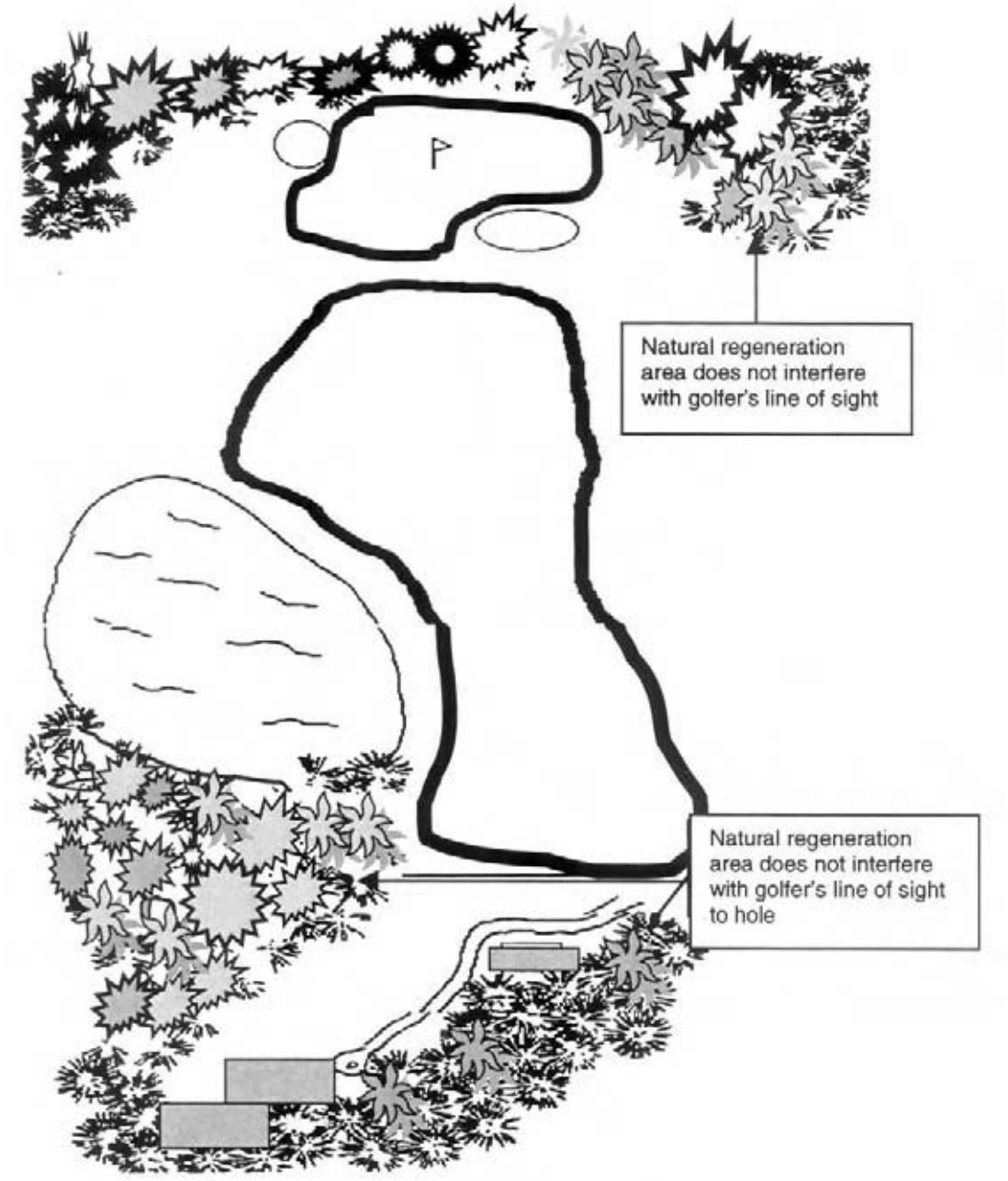
8.3 PONDS, LAKES AND WETLAND AREAS

8.3.1 Function

Wetlands include coastal wetlands, bogs, ponds, swamps, river margins and some open drains. Wetlands on golf courses:

- create a focal point in the landscape;
- are a source of irrigation water;
- cleanse stormwater by allowing settling of sediments, thereby protecting downstream water quality;
- filter nutrients, thereby protecting downstream water quality; and
- create or provide wildlife habitats.

Figure 8.1: Natural Regeneration Areas on a Typical Golf Hole



Adapted from Scenna and Morrison *1998*

Natural wetlands on and off-site should be protected in accordance with the goals and principles of the NSW Wetlands Management Policy (see NSW Government 1996). These principles include: discouraging the construction of purpose built wetlands on the site of viable natural ones; ensuring water entering wetlands should be of sufficient quality so as not to degrade the wetland; actively rehabilitating degraded wetlands and their habitats and processes as far as practical; conserving wetlands of regional or national significance (e.g. SEPP 14 wetlands).

For new golf course developments, there may be wetland protection provisions in LEPs or local wetland plans of management that should be taken in to consideration, in addition to the NSW wetlands policy.

The design and construction of ponds, lakes and wetlands is a specialist area and appropriate advice is always required. However, the first step in design is to specify the purpose and function of the wetland or water feature. Is the feature to be ornamental, a water storage for irrigation, a stormwater-control structure, a nutrient-stripping pond or wildlife habitat? Once these questions are answered, then the shape, size and profile of the water body can be determined, as well as the plant species to be used.

From an environmental management perspective, water conservation is probably the single most important reason for constructing a water body. However, another important reason for enhancing water bodies and improving their function is to improve water quality both for use on the golf course and to minimise the development of aquatic weeds that require costly control methods. While the construction and management of the water body is very important, it is also equally important to determine the influence of the watershed on that water body. The rate of sediment and nutrient input into a pond and into water bodies in general depends on the land uses within the watershed. Because of the link between ponds and watersheds, management of ponds must take into account the watershed. The construction of the pond itself can also influence water quality, particularly on acid sulfate soils or where there is a shallow, saline aquifer. Design must also ensure adequate environmental flows below the retention area.

CASE STUDY: LONG REEF GOLF CLUB

Long Reef Golf Club is situated on the northern beaches of Sydney, surrounded by the ocean on three sides. The area covers 55 hectares with an additional 60 hectare aquatic reserve. Over recent years the club has taken an interest in conservation and land management and many innovative projects have been undertaken. A number of areas in which Long Reef demonstrates best practice include:

- wetland rehabilitation
- wildlife management
- community education and involvement
- co-operative work with other government and non-government organisations

Wetland Rehabilitation

In 1995 Long Reef applied for a NSW Environmental Trust Grant (administered by the NSW Department of Environment and Climate Change) to assist in the construction of a series of wetlands on the course.

The purpose of these wetlands was:

- restoration and enlargement of the existing wetland area
- prevention of untreated stormwater flowing to nearby Fisherman’s Beach and the Aquatic Marin e Reserve
- recreation of a wetland ecosystem to treat urban runoff
- extension of the wildlife corridor by complementing Dee Why Wildlife Refuge
- utilisation of the enlarged area as a water harvesting resource.

Extensive areas of the golf course were regenerated as a series of wetlands. These wetlands have been designed for stormwater treatment, decreasing the flow and pollutant load of discharges to nearby Fisherman's Beach. The stormwater entering the first two wetlands carries significant nutrients, road grit and rubber. Water exiting the series of ponds is clear and wetland plant growth has been aggressive, with over 9000 wetland plants eg *Baumea articulata* and *Carex apressa* having been planted. The re-use of this stormwater for irrigation now sustains the majority of the needs of the golf course, in lieu of potable water previously supplied at the rate of one megalitre per day at peak periods.

Observations to date indicate that many species (e.g. native macrophytes, frogs, snakes, waterfowl and fish) have benefited from the wetland construction. Regular monitoring for water quality and fauna diversity and abundance is conducted by the golf club's environmental officer.

Wildlife Management

In 1997 approval was given by the NSW National Parks and Wildlife Service for the translocation of eggs, tadpoles and frogs of the endangered Green and Gold Bell Frog to the wetland habitat at Long Reef Golf Club. This was possible due to support from the Australian Museum, Taronga Zoo, the Natural Heritage Trust and Warringah Council.

In 1998, 1400 Green & Gold Bell Frog tadpoles (from a breeding program at Taronga Zoo) were released into 4 of the 7 wetland ponds, with two other wetland ponds being especially created for the frogs. In the first year, over 110 frogs were counted. A community group, the Long Reef Frog Conservation Group was set up to conduct monitoring of frog populations through regular surveys. They have approximately 80 members and are coordinated by a student at the University of NSW. Scientists, researchers and volunteers continue to monitor the frogs and tadpoles in and around the ponds on a regular basis.

Long Reef Golf Club has also been active in increasing the numbers and diversity of birds on the site. It constitutes a unique area of remnant coastal bushland, with banksia trees and other native trees and shrubs forming a fragmented chain of vegetation traditionally home to a variety of birds, some of which are migratory. Full-time 'residents' include the Australian wood duck, Pacific black duck, black swan, Australasian Grebe, dusky moore hen, purple swamp hen, masked lapwing, Richard's pipit, superb fairy wren, reed warble, red wattle bird, nankeen kestrel, noisy minor, brown thornbill and the bush stone curlew. Visiting birds include the white face heron, Eastern reef egret, black shouldered kite, white bellied sea eagle, yellow tailed black cockatoo, galah, sulphur crested cockatoo, corella, rainbow lorikeet, common koel and the kookaburra.

Black swans were once numerous around Dee Why Lagoon, but due to urbanisation they have all but left. In the spring of 2001, with a Section 120 licence from the NSW National Parks and Wildlife Service and assistance from Featherdale Wildlife Park, a pair of black swans were released into the wetlands. The birds have been pinioned and so are unable to fly, hence an island habitat in the wetlands was very important. The pair are monitored regularly and have settled into their new home well, grazing on the native aquatic vegetation. It is hoped they will start breeding in the following years.

Community Education and Support

Long Reef Golf Club has realised the importance of good communication and community involvement in the various aspects of the club's environmental management. As noted above, volunteers have been crucial in assisting with the Green & Gold Bell Frog program and have also been involved in bush care and regeneration. The successes of the programs have been communicated to the public through the local newspapers, community radio, school tours and the golf club's regular newsletters. The club has established strong links with the Australian Museum, Taronga Zoo, Warringah Council, universities and local schools.

8.3.2 Management of water quality

Managing the water quality of the water, such as wetlands within the golf course, is very important as it will have an impact on turf quality, performance of the water bodies and water quality downstream. Under the *Protection of the Environment Operations Act 1997* (POEO) it is an offence to pollute waters (Section 120). It is also an offence to cause or permit water pollution. 'Waters' means the whole or any part of:

- any river, stream, lake, lagoon, swamp, wetlands, unconfined surface water, natural or artificial watercourse, dam or tidal waters (including the sea) or
- any water stored in artificial works, any water in water mains, water pipes or water channels, or any underground or artesian water.

Therefore, it is an offence to pollute stormwater. Pollution includes substances mistakenly viewed as harmless because they are 'natural' such as leaves, grass or soil as well as chemical and other substances. The use of additives such as dyes or other chemicals in ponds needs to be minimised and managed to ensure there is no polluted run-off to receiving water bodies as this may constitute a breach of POEO.

A three-year study of the water quality on 44 golf courses in NSW demonstrated that the quality of the water flowing through the golf course was improved (Kaapro 1999). Detailed research sponsored by the United States Golf Association (USGA1995) has demonstrated that:

- turfgrass is a very effective filter for nutrients and pesticides and far more effective than cropland;
- most fertilisers and pesticides showed little potential to affect groundwater and surface water quality. Turfgrass managers can take a few simple steps to further reduce the chance of groundwater or surface water contamination;

- more research is needed to investigate a wide range of soil/pesticide interactions; and
- each product on the golf course must be carefully evaluated.

Eutrophication of water bodies on golf courses is a constant management consideration. It is linked to high nutrient levels and increased suspended sediment in the water due to wind turbulence, stormwater or death of bottom-rooted plants. Eutrophication can be reduced by:

- keeping water temperatures lowered by having some deepwater areas and covering up to half the water with emergent or floating plants. Very often the worst-affected ponds are shallow, are close to maintained turf areas, are small in area and have very little circulation;
- including a well-vegetated buffer and/or filtering vegetation around the water body. Grass buffers in particular act as very efficient filters;
- periodically removing rotting vegetation;
- not using fertilisers within 15 metres of the water body (Connolly 1990); and
- on golf courses that use recycled wastewater for irrigation not allowing sprinklers to spray into ponds and ornamental lakes.

While a range of factors contribute to favourable conditions for nuisance algae and aquatic plant growth, it is important to note that the levels of nitrogen and phosphorus required to cause algal blooms are very low. The risk of nuisance aquatic algae/plant growth is increased when ambient nutrient levels in the waterbody exceed the 'trigger values' given below.

Table 8.1: Default ANZECC & ARMCANZ (2000) 'trigger values' for nutrient stressors for slightly disturbed aquatic ecosystems in NSW.

Ecosystem type	TP (mg P L^{-1})	FRP (mg P L^{-1})	TN (mg N L^{-1})	NO_x (mg N L^{-1})	NH_4^+ (mg N L^{-1})
Upland river	20	15	250	15	13
Lowland river[a]	50	20	500	40[o]	20
Freshwater lakes & Reservoirs	10	5	350	10	10
Wetlands	no data	no data	no data	no data	no data
Estuaries[p]	30	5	300	15	15
Marine	25	10	120	25	20

a = values are 3 μgL^{-1} for Chl a*, 25 μgL^{-1} for TP and 350 μgL^{-1} for TN for NSW east flowing coastal rivers. TP = total phosphorus, FRP = filterable reactive phosphate, TN = total nitrogen, NO_x = oxides of nitrogen; NH_4^+ = ammonium; DO = dissolved oxygen*

It only takes a careless application of fertiliser or relatively small amounts of contaminated stormwater runoff from urban areas to add sufficient nutrients to cause an algal bloom. Where water is taken from urban catchments, the first wave of drainage water should be diverted away from the main irrigation dam. This initial nutrient-enriched 'slug' of water can be diverted through a wetland filter before entering the main water bodies.

8.3.3 Water quality monitoring

Golf courses are part of much larger catchment areas that can have a significant influence on the water quality coming into the golf course. All golf courses should have a water testing program to monitor water quality and be able to initiate early remedial action if a problem appears to be developing. This is not only a sound environmental practice, but also an important agronomic practice. Regular checking of water quality for salinity and pH will ensure that turf damage does not occur inadvertently. The monitoring of nutrients (particularly nitrogen and phosphorus) provides valuable information on the quality of:

- the incoming water supply;
- the function of wetland systems;
- the condition of ponds and lakes; and
- water leaving the golf course.

STRATEGIC SAMPLING POINTS

Strategic sampling points should be identified on the golf course, for example:

- where a river, stream, or stormwater pipe enters the golf course;
- each pond or lake; and
- exit point from the golf course.

The Department of Planning, local councils and other groups monitor water quality in many rivers and waterways and there are numerous reports available. The NSW Department of Environment and Climate Change has recently released its *State of the Environment 2000* report which has a comprehensive review of the condition and future management of New South Wales water resources and catchment areas (refer to: www.epa.nsw.gov.au/soe/soe2000/cw/). It is important that golf clubs have some general knowledge of their catchment area, particularly as it relates to water quality. Some knowledge of the wider catchment area provides golf courses with valuable information on potential sources of pollutants that may affect the golf course and conversely down stream areas that may be impacted by golf course activities. It is very useful to establish a good relationship with your local council, especially the environment staff. They can help with local catchment knowledge, as well as knowledge of local flora and fauna, construction issues etc.

WATER TESTING

Regular water testing should include the following parameters:

- pH and electrical conductivity (EC);
- phosphorus, nitrate, nitrite, TKN;
- sodium, chloride, calcium, magnesium and bicarbonate/carbonate for irrigation waters; and
- heavy metals where there may be a source of such contaminants.

The frequency of testing should be 2–4 times a year.

8.3.4 Plant selection for ponds/lakes/wetlands

When designing wetland areas and water bodies it is necessary to consider the plant species available or suitable for your particular area (Dowling and Stephens 1995). Using plants that occur naturally in the area is always preferred. Again, talk with your local council. Plant selection requires specialist advice, however, *Waterplants in Australia – A Field Guide* (Sainty and Jacobs, 1994) is an excellent reference. Another useful reference is the newly formed national program, *Flora for Fauna.* See the Nursery and Garden Industry Australia website, www.ngia.com.au for further information. This program will help you source plants indigenous to your local area.

Water bodies on golf courses can often be neglected or disregarded unless a specific problem occurs and the following checklist is provided as a prompt to check the function, purpose and maintenance inputs of these water bodies.

Table 8.2: Checklist — water body management

Item	Comment
1. Size of water body • Area (ha) • Volume • Average depth	
2. Purpose/function • Irrigation • Ornamental • Nutrient stripping • Stormwater control • Other	
3. Sources of water • On course (%) • Off course (%)	
4. Proximity to high-maintenance turf areas (metres)	
5. Vegetation • In water body • In riparian zone	
6. Is water body interconnected with other water bodies?	Yes No
7. Is water tested regularly? • parameters tested	Yes No
8. Average water quality	
9. Watershed/catchment **Outside the golf course** • Grazing • Horticulture • Shopping • Urban • Industrial **Inside the golf course** • Carpark/hard areas • Turf areas • Drainage • Watertable	

10. Sources of water • Bore • Rainfall • Wastewater • Runoff (on course) • Stormwater (off course)	
11. Water body management issues • Algal blooms • Excessive aquatic growth • Poor water quality (e.g. salinity) • High nutrients • Sedimentation	
12. Maintenance **Maintaining edge of ponds** • Equipment • Labour • Frequency • Weed control • Chemicals **Removal /control of water plants** • Labour • Equipment • Frequency • Emptying/cleaning ponds	

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