

TAKING CARE OF

# Wetlands

WHY AND HOW





### **Preface and Acknowledgements**

This booklet is part of a series to support a capacity-building initiative for Catchment Forums and Water Users Associations in the Olifants-Doorn Water Management Area (WMA). This initiative is a pilot, for possible implementation elsewhere in South Africa. The booklet is therefore designed to be used throughout the country. However, it serves a specific and limited purpose. It is a basic, practical introduction to wetland functioning and conservation, aimed at encouraging users to become involved in activities to better understand and manage a local wetland. As such the booklet is neither detailed nor comprehensive. It provides a bridge to more technical and regional materials available elsewhere.

WWF-SA initiated the project and produced the materials with partners including FETwater. The pilot programme is implemented in the Olifants-Doorn WMA by the Department of Water Affairs and Forestry (DWAF), Western Cape Region, with support from Danida.

For more information on the content and the capacity-building initiative, contact the office of the Olifants-Doorn WMA Manager in DWAF, Western Cape.

Artwork: Tammy Griffin



# CONTENTS

<b>1.</b>	<b>What are Wetlands?</b>	<b>4</b>
	Types of Wetlands	6
<b>2.</b>	<b>Why Care?</b>	<b>10</b>
	Wetland Benefits	10
<b>3.</b>	<b>How Do Wetlands Work?</b>	<b>16</b>
	How Do They Do This?	16
<b>4.</b>	<b>What Can Go Wrong?</b>	<b>21</b>
	How Do We Know That Something is Wrong?	22
<b>5.</b>	<b>How Do We Take More Care?</b>	<b>29</b>
	Tackle On-Site Activities	30
	Tackle Off-Site Activities	34
	Use The Law	38
	Get Help	40
<b>6.</b>	<b>Tools For The Job</b>	<b>44</b>
	Tools for Delineating a Wetland	44
	Tools for Assessing Wetland Goods and Services	45
	Tools for Rehabilitating a Wetland	46
	Tools for Clearing Alien Invasive Plants	47
	Tools for Monitoring	48
<b>7.</b>	<b>For More On Wetlands</b>	<b>49</b>

# What are Wetlands?

Wetlands are places where water and earth meet and mingle. Vleis, pans, swamps, floodplains and lakes are examples of wetlands. So are seeps and springs where rivers start. Rivers, river banks and estuaries are technically also wetlands, but they get special attention in other booklets in this series. (See *Taking Care of Rivers* and *Taking Care of Estuaries*.)

South Africa's only inland lake is Lake Fundudzi in the Northern Province. The Southern Cape Garden Route features a series of beautiful coastal lakes, the Wilderness Lake System. Even dry parts of the country have their wetlands. The Sandveld region of the Matsikama district can boast with a number of wetlands like the Wadrif Salt Pan, Jakkalsvlei and Verlorenvlei.

Some wetlands are seasonal and dry up naturally from time to time. When the rains come, they fill again. The plant and animal life in these wetlands can cope with the changing conditions. Bull frogs in Namibia's Etosha Pan can survive droughts for years under ground! Other species are not as tough, or cannot adapt quickly enough to the changes to which wetlands are being subjected.

Scientists estimate that we have destroyed or degraded more than half of South Africa's wetlands. Many are stinking, shrinking, or suffocating. But repairs may be possible. Better management is critical, if we consider the important role wetlands play in maintaining our water supply, and the other goods and services they provide.



**Verlorenvlei is an important feeding ground for the white pelican. It is one of the largest wetlands along the west coast of South Africa. A coastal lake and reed swamp are connected to the sea by a small estuary. The lake is about 14 km long and lies in a transition zone between two vegetation types, fynbos and karoo. Home to 14 fish species and a base for many rare and threatened birds, Verlorenvlei is one of 17 sites in the country declared 'a wetland of international importance' under the Ramsar Convention of 1971.**

---

A wetland is any part of the landscape where water collects for long enough and often enough to influence the soil, plants and animals that occur there.

---

Not sure if it's a wetland or not?

The South African National Water Act (Act 36 of 1998) says a wetland is 'land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water or would support vegetation typically adapted to life in saturated soils'.

What this means is that the Act defines wetlands in terms of three things:

- hydrology (water and its movement through and over land),
- soils (must be waterlogged, or show the characteristics of waterlogged soil), and
- vegetation types (water loving plants).

So there are three criteria for an area of land to be classified as a wetland:

- A **high water table** that results in saturated soil conditions.
- The **soil must be saturated** (waterlogged) for long enough for anaerobic conditions to develop, that is, there must be no or very little oxygen in the soil.
- These conditions favour the growth of **water loving plants** (hydrophytes).

This definition can be used to help us decide where a wetland's boundaries are, or whether a wetland is currently much smaller than it was originally. See Tools for the Job – Delineation (page 44).

## Types of Wetlands

The term 'wetland' is a generic or family name for a variety of water bodies. Wetlands are classified in various ways, which differ depending on who is doing the classification and the purpose of the activity. For example, the Ramsar Convention includes rivers in their classification of wetlands, but the South African Water Act treats rivers as a category of water resource, separate from (other) wetlands. This is not really important for the purposes of this programme, which gives attention to rivers and to (other) wetlands.

It is useful to consider the many different kinds of water bodies which can be thought of as wetlands:

In the upper catchment, one finds **stream sources** such as springs and seeps. These are easily overlooked as wetlands. Because they are often the only green 'oases' in the dry season, they are heavily utilised for water and grazing. The Drakensberg Park has many examples of stream source wetlands.

Further down in the catchment one finds the **depressions**, fringes and open water of pans, dams and lakes. These may not always be recognised as

wetlands, especially when they are dry. An example is the De Hoop Vlei in the Western Cape.

**Plains wetlands** have gentle slopes and can occur anywhere in the landscape except on top of mountains. They include swamps, vleis or wet meadows, marshes, and floodplains. An example is the Blesbokspruit in Gauteng.

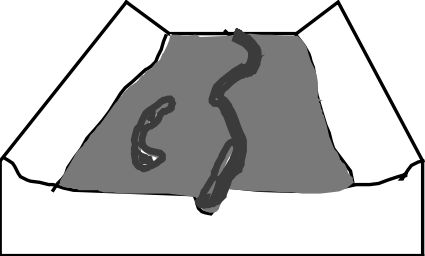
**Streambanks**, including channels, walls and forests along rivers and streams, are also wetlands. They are noted in this booklet as far as rehabilitation is concerned, but also in the booklet *Taking Care Of Rivers*.

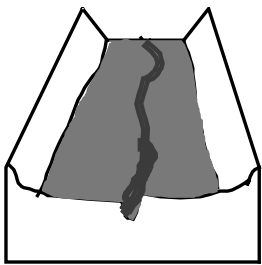
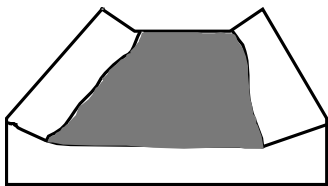
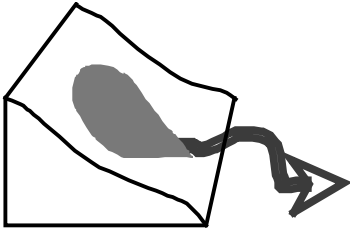
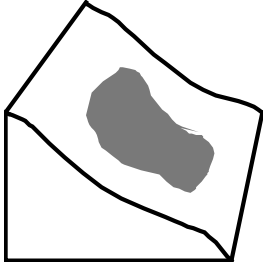
**Estuaries** (the tidal part of river mouths), lagoons (river mouths that are usually closed) and non-tidal open river mouths, are also wetlands, discussed in a separate booklet in this series. Ramsar sites include the Orange River Mouth (Northern Cape) and the St Lucia system (KwaZulu-Natal). Verlorenvlei is mentioned in this booklet as a wetland, but also see *Taking Care Of Estuaries*.

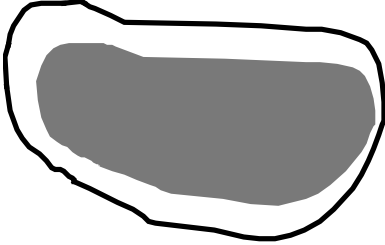
**Marine wetlands** include inter-tidal and sub-tidal zones, and coastal bays. Ramsar sites include Langebaan on the West Coast and the coral reefs of Tongaland.

The inland wetlands on which we focus here, can also be classified according to their hydrology (water and water flow) and geo-morphology (slope, substrate and shape). Table 1 is from *WET-EcoServices* (Kotze and others, 2007).

**Table 1: Wetland hydro-geomorphic (HGM) types typically supporting inland wetlands in South Africa (*WET-EcoServices*, modified from Brinson, 1993; Kotze, 1999; and Marneweck and Batchelor, 2002)**

Hydro-geomorphic types	Description	Source of water maintaining the wetland	
		Surface	Sub-surface
<p><b>Floodplain</b></p> 	<p>Valley bottom areas with a well defined stream channel, gently sloped and characterized by floodplain features such as oxbow depressions and natural levees and the alluvial (by water) transport and deposition of sediment, usually leading to a net accumulation of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.</p>	***	*

Hydro-geomorphic types	Description	Source of water maintaining the wetland	
		Surface	Sub-surface
<b>Valley bottom with a channel</b> 	Valley bottom areas with a well defined stream channel but lacking characteristic floodplain features. May be gently sloped and characterized by the net accumulation of alluvial deposits or may have steeper slopes and be characterized by the net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	* / ***
<b>Valley bottom without a channel</b> 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel entering the wetland and also from adjacent slopes.	***	* / ***
<b>Hillslope seepage linked to a stream channel</b> 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well defined stream channel connecting the area directly to a stream channel.	*	***
<b>Isolated hillslope seepage</b> 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***

Hydro-geomorphic types	Description	Source of water maintaining the wetland	
		Surface	Sub-surface
<p><b>Depression (includes pans)</b></p> 	<p>A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.</p>	<p>*/ ***</p>	<p>*/ ***</p>

Water source: \* Contribution usually small

\*\*\* Contribution usually large

 Wetland

\*/\*\*\* Contribution may be small or important depending on the local circumstances

This classification does not include ‘depressions linked to streams’, which is a rarely occurring wetland type, and ‘channels’ (i.e. streams and rivers).

Knowing what kind of wetland one is looking at, helps one to better understand the role the particular wetland might play, and the ecological services it can provide. The next section will explain these.

# Why Care?



Wetlands tend to be small, scattered, and are not even visible all the time. So they may appear to be not all that important. But the World Conservation Strategy calls them 'the third most important life support system on the planet'. And locally, individual water users, agencies and government departments have come to agree that wetlands need special attention. Why?

Wetlands provide us with many important benefits:

## Wetland Benefits

### Suppliers – Wetlands Supply Water, both Directly and Indirectly

Wetlands are a vital part of the water resource. They are usually closely linked with the streams in a catchment and they strongly influence the quality, quantity and timing of the flow in rivers. Through direct abstraction with pumps or shallow wells, people use water from wetlands for domestic, agricultural and industrial needs. Many wetlands also maintain a downstream flow which in turn supplies people and natural systems.

Some wetlands have strong connections with groundwater. Either they are fed from groundwater (groundwater discharge), or they recharge (boost) underground water bodies. Wetlands can supply nearby areas from shallow aquifers, or provide a long-term water resource to more distant communities and natural systems, through the deeper groundwater system. (See *Taking Care of Groundwater*, in this series.)





### Purifiers – Wetlands Filter and Purify Water

Wetlands can trap sediment (suspended soil and other particles). In the process they can also trap and even remove toxic substances. These include excess nutrients (such as nitrogen and phosphorus, from fertilizer run-off, domestic and industrial waste and untreated sewage); disease-causing bacteria and viruses; heavy metals; and biocides (herbicides and pesticides). Such pollutants may be stored, transformed or absorbed by plants in the wetland, or simply retained in the soil.



### Sponges – Wetlands Reduce Flood Damage And Severity of Droughts

Wetlands regulate flows through a catchment. They can store floodwaters from heavy rains or high river flows. They do this in their porous soils or as surface water. Wetland vegetation also slows down floodwater. In these ways, downstream flood peaks are reduced. By retaining and then slowly releasing water, wetlands maintain river flows for longer periods. This reduces the severity of droughts. So wetlands make us less vulnerable to both floods and droughts.

**Table 2: Regulatory benefits provided by inland wetlands, by GHM type**

Wetland hydro-geomorphic type	Regulatory benefits potentially provided by the wetland	
	Flood attenuation	
	Early wet season	Late wet season
1. Floodplain	++	+
2. Valley bottom – channelled	+	0
3. Valley bottom – unchannelled	+	+
4. Hillslope seepage connected to a stream channel	+	0
5. Isolated hillslope seepage	+	0
6. Pan/ Depression	+	+

\*Toxicants include heavy metals and biocides

- Rating: 0 Benefit unlikely to be provided to any significant extent  
 + Benefit likely to be present at least to some degree  
 ++ Benefit very likely to be present (and often supplied to a high level)

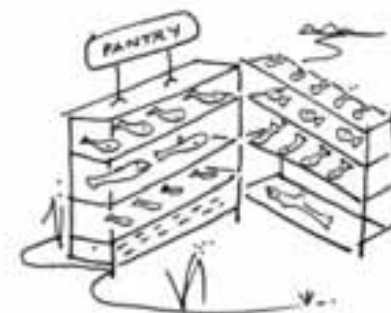
### Buffers – Wetlands Control Soil Erosion

Wetland (including streambank) vegetation prevents or reduces erosion of banks, shores and substrate. They bind and stabilise the soil with their roots and deposited plant matter, reducing the water flow speed and trapping sediments. This means that downstream flows are cleaner, and less likely to silt up dams and pumps, or require costly filtration.



### Pantries – Wetlands Provide Food Security

Wetlands are a direct source of food for many people, for example by providing fish. In times of drought, cultivation on the edges of wetlands can be a lifeline for people. Wetlands are however only suitable for the cultivation of crops specially adapted to water-logged conditions (such as rice and madumbes). Growing crops that are not suitable to these conditions can have negative environmental impacts, which is why cultivation of wetlands must be controlled by law and best practices.



Regulatory benefits potentially provided by the wetland					
Stream flow regulation	Erosion control	Enhancement of water quality			
		Sediment trapping	Phosphates	Nitrates	Toxicants*
0	++	++	++	+	+
o	++	+	+	+	+
+?	++	++	+	+	++
+	++	0	o	++	++
o	++	0	o	++	+
0	0	0	o	+	+



### **Warehouses – Wetlands Provide Useful Materials**

From wetlands people obtain building materials (like reeds), fuel, materials for crafts (like woven baskets and mats), natural medicines, animal fodder, and so forth.

### **Nurseries – Wetlands Maintain the Diversity of Life**

Some plants or animals may complete their entire lives in a particular wetland. Other species may depend on wetlands for part of their life cycle. Many fish spawn and/or develop as juveniles in the sheltered habitats of a wetland. Vleis and pans feed and shelter migratory birds and many other species. Because they are so rich in life forms, and because so many wetlands have been lost, many of the remaining wetlands have high rarity value, as they feature rare plants, animals, ecosystems or processes. People not only benefit from the food and raw materials these plants, animals and ecosystems provide; we also appreciate the beauty of nature in all its diversity, as a legacy for coming generations.



### **Retreats – Wetlands have Spiritual, Recreational and Tourism Value**

Water bodies and plants such as reeds, have long been associated with spiritual values and traditional practices, across cultures. Today people are still drawn to wetlands, for traditional rituals, but also for peace and tranquillity, or sport and recreation. Some will even pay more for living near a scenic stretch of water. Wetlands therefore also hold tourism and income-generating value. Investing in wetland management has benefited the local authority in Cape Town through higher rates from properties near these sought-after landscapes.



Not all wetlands provide all these services in equal measure. The services they provide relate to the wetland type, as well as the degree to which they have been modified. Refer back to Table 1, and see **Table 2**, which indicates some of the ecological services provided by different wetland types (excluding rivers and estuaries). This table is not comprehensive in terms of the services provided by wetlands, as it only lists regulatory benefits (e.g. flood control and water quality improvement).

So, there are plenty of reasons to take good care of wetlands!

Both internationally and in South Africa scientists, government departments and many farmers and other water users agree that wetlands must be protected for our own benefit and for future generations. The Ramsar Convention on Wetlands, signed by 136 countries including South Africa, promotes the wise use and protection of wetlands. South African legislation backs this up (see Section 5). The National Water Act (Act 36 of 1998)

recognises wetlands as a critical part of the country's water resources, and affords it the same protection as estuaries and rivers.

To summarise, wetlands contribute significantly to ...

- water quality
- water quantity
- wildlife habitats

... all of which are directly and indirectly in the interest of people, their livelihoods, well-being and prosperity.

To provide these goods and services, free of charge, wetlands must remain healthy and functioning. No-one wants to visit a lake foul with pollution. A vlei without its natural vegetation will struggle to contain a flood. A pan invaded by thirsty alien plants may no longer replenish underground aquifers.

When wetlands are not well managed ...

- water quality can become poorer
- downstream floods can become more frequent and more severe
- dry season flows can become shorter and water supplies more erratic
- there is often a loss of agricultural productivity
- plant and animal species are increasingly threatened.

In the long run, natural systems become more fragile, less able to adapt and less likely to bounce back from extreme conditions. They lose their resilience and people, whether we realise it or not, come to be at greater risk of the unpredictable and unmanageable in nature.

What does 'well managed' mean? The basic requirements for a wetland to remain healthy is water: (1) enough water, (2) of adequate quality, (3) arriving at the right rate. This sounds simple enough, but it does mean that we must manage the wetland itself, *and* the surrounding catchment. What happens higher up in the catchment, can affect the wetland – just like changes to the wetland, can affect downstream areas, as Section 4 will show.

To better manage the wetland and its catchment, we all need a better understanding of how wetlands work. The scientists are hard at work and much information on wetland functioning and management is already available (see CD and list of resources at the end of the booklet). This booklet provides a basic introduction to the ways in which wetlands work to provide their benefits, the topic of the next section.



# How Do Wetlands Work?

Wetlands play an important role in the water cycle in various ways:

- slowing down water, thus reducing floods and erosion, and regulating flows,
- providing food and habitats for numerous living things, and
- filtering and purifying the water that flows through them.

## How Do They Do This?

Water that falls as rain or snow moves through a catchment to the sea.

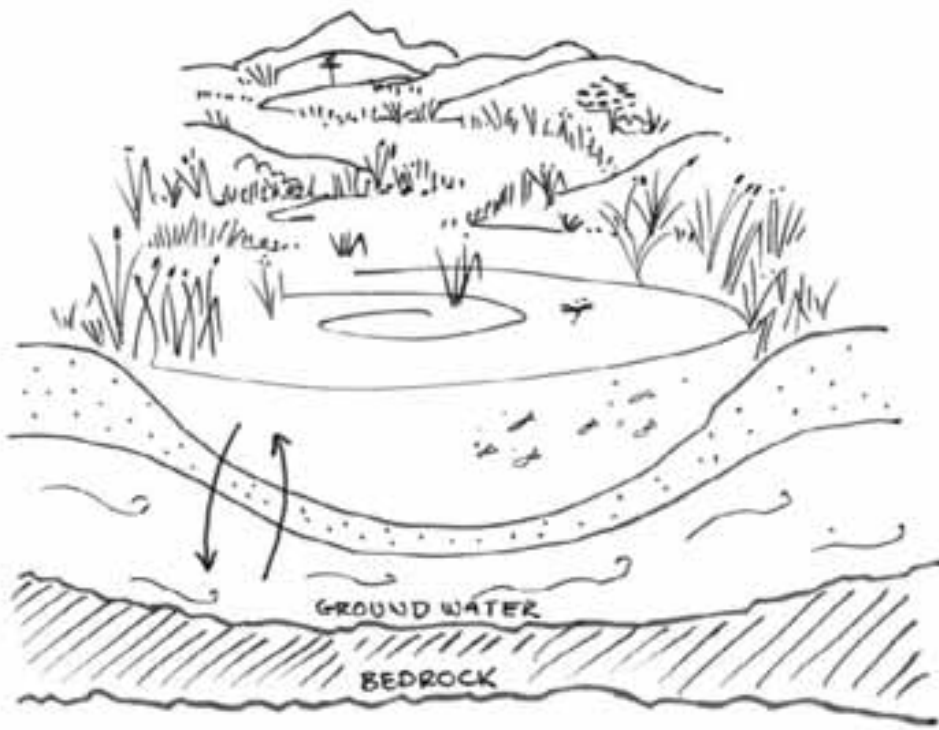
Wetlands are formed where the landforms or rocks slow down or obstruct the movement of water through the catchment, for example, where the land is very flat.

This causes the surface layers of the soil in the wetland to be wet – either temporarily, seasonally, or permanently. Different wetlands have different water regimes ('water regime' is a term for how the wetness of the soil changes over time). Wetlands range from permanently waterlogged areas, which remain flooded for the entire year, to temporarily waterlogged areas, which are flooded or saturated close to the soil surface for only a few weeks in the year (but still long enough to develop anaerobic conditions and encourage the growth of water loving plants).

This 'wet land' creates a place where plants that are specially adapted to wet conditions (e.g. reeds) tend to grow in abundance. The plants, in turn, affect the soil by further slowing down the movement of water and by producing organic matter that may collect in the soil. The plants and their watery surroundings provide shelter and food for many different kinds of creatures.

The gentle slopes of wetlands, together with the dense wetland vegetation, slows and detains the water moving through the catchment. In this way wetlands are like sponges which:

- reduce floods,
- prolong stream flow during the dry season, and
- replenish underground water systems.



Wetland vegetation also helps to reduce evaporation through which much water would otherwise be lost to the atmosphere. Although some water is lost through transpiration from wetland plants, the plants also shelter the waterlogged soils from wind and sun, and this prevents the high levels of evaporation that we see in dams. Dead plant materials add to this effect, without losing any water to transpiration.

Wetlands can improve water quality by modifying or trapping a wide range of substances which are or become, in high quantities, pollutants. These include:

- suspended sediment (silt and clay),
- excess nutrients (most importantly nitrogen and phosphorus, e.g. from fertilizer run-off or untreated sewage),
- toxicants (e.g. pesticides and heavy metals), and
- disease-carrying bacteria and viruses.

---

Geology plays a role in the formation of wetlands in two main ways:

- A geological obstruction may resist downward erosion, resulting in extensive flat areas where water accumulates if there is enough surface or groundwater. This obstruction often consists of very hard rock, such as dolerite, but alluvial soil deposits may also act as an obstruction. An obstruction may even be caused through geological faulting, as is the case in the Okavango Delta.
  - Solid material close to the surface forces groundwater to discharge upwards. Wetlands that form around these areas are called seeps.
-

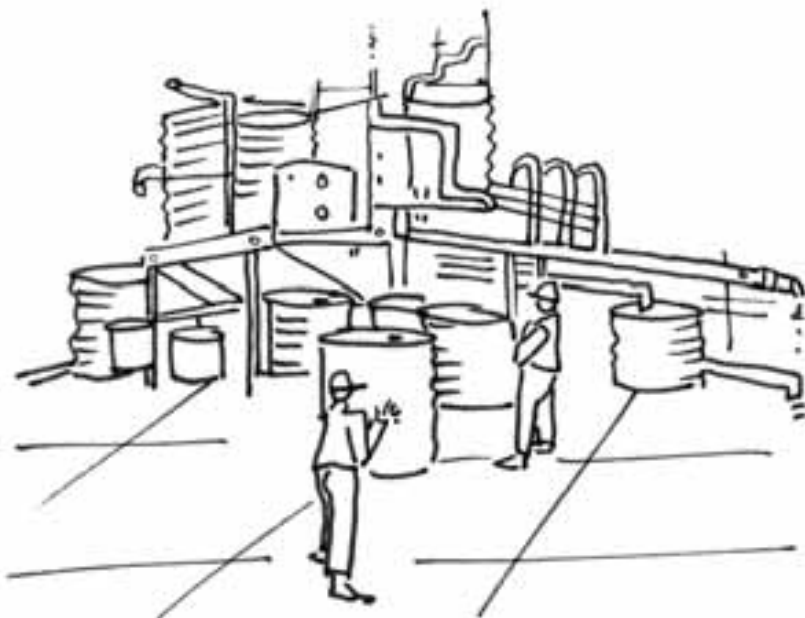
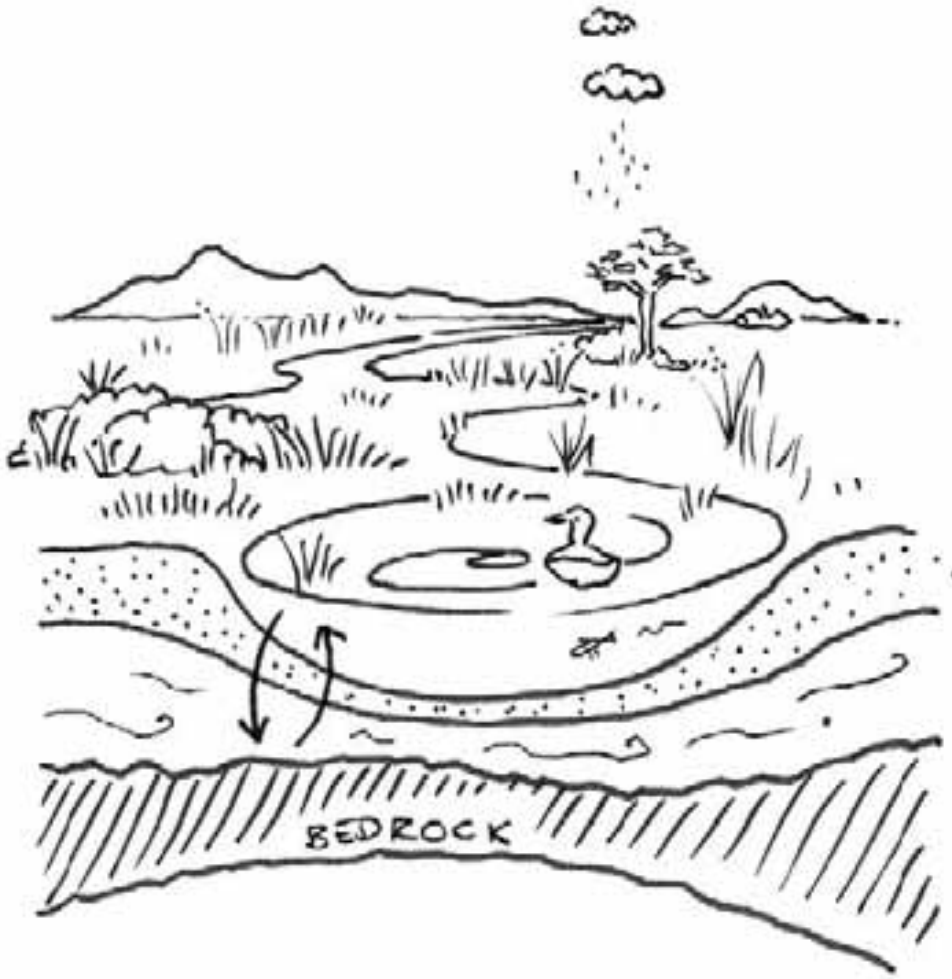
How do wetlands clean water? This is how wetlands act as nature's own water purification works:

- As noted, water slows down when flowing through a wetland, both because the water is spread out in a flat area, and because wetland plants offer resistance. When water flows more slowly, suspended particles (like soil) settle out, and remain at the bottom of the wetland.
- As the soils become water logged they turn anaerobic (no or little oxygen present – the 'bad egg' smell of the mud in some wetlands). These saturated conditions are good for certain plants (like sedges, bulrushes and reeds) and micro-organisms, including useful bacteria. The decomposition of the soil's organic matter is also slowed down. All this set the scene for numerous chemical processes that help to trap and reduce pollutants.
- Because the water is spread out over a large area (in most wetlands), the purifying exchanges between soil and water are optimised.
- Many kinds of micro-organisms flourish in the habitats provided by the high number of wetland plants, especially around the roots. Some of them remove excess nitrogen from the water, converting a potential pollutant to harmless atmospheric nitrogen, and preventing the over-growth of slimy green algae (eutrofication).
- The presence of aerobic and anaerobic soil zones, next to each other, encourages the process of de-nitrification, or removal of excess nitrogen.
- Heavy metals precipitate and are trapped in the sediment.
- Fast growing wetland plants absorb certain levels of nitrogen and other minerals (nitrogen being a plant nutrient).
- Wetland micro-organisms can also decompose synthetic organic pollutants like pesticides, and pathogens (small organisms that carry diseases like cholera).
- Pathogens often have a short life span and if contaminated water is forced to slow down in the wetland, there is also a chance that they may die off before entering downstream water supplies.
- The ultra-violet radiation in sunlight also has a chance to penetrate the shallow wetland water body and kill some pathogens.



All this means that water flowing from a wetland (into underground aquifers or surface streams) is often cleaner than the water which flows into it. Users are provided with cleaner water – in a cost effective way. Municipalities build artificial wetlands to treat polluted water. Dams can fulfil some of the functions of wetlands (water storage and sediment trapping) but are not able to purify water naturally and cheaply. (They also don't have the same biodiversity benefits.)

It costs much more to build purification works, than to maintain a healthy wetland. In 1990, the US Environmental Protection Agency showed that without the Congaree Swamp in South Carolina, the area would need a \$5 million waste water treatment plant. The restoration of wetlands in Gotland,



Sweden, was substantially more cost effective in reducing nitrogen levels than expanding sewage treatment plants, even when taking into account the lost opportunity costs from agriculture foregone when the land was restored back to its original wetland state.

Two points are important:

- The faster the rate of through flow (i.e. the more channelled the flow through the wetland, or the steeper its gradient) the lower will be the extent of pollution storage.
- Wetland storage compartments (soil, plant tissues, microbial tissues, etc) have their limitations and once they are full, pollutants will no longer be transferred into storage. This applies to excess nutrients, sediments and toxicants.

Wetlands alone cannot solve all our water pollution problems. Every wetland has a limit for absorbing pollutants, and overloading it, will reduce its ability to perform this and other functions. The wetland must be protected and used wisely, or its benefits will be lost. This implies looking after its physical structure and flow regimes, as well as the load of pollutants we allow into the wetland.

# What Can Go Wrong?

It is only quite recently that the benefits of wetlands to society became more widely recognised. People the world over have historically thought of wetlands as valueless wastelands, with little productive use to society and no economic value to landowners. So little did we think of them in South Africa, that we talked about destroying wetlands as 'reclaiming' the land, to increase what we could get from them. But until around the mid-1980s, we didn't take into account what we were losing.

Today wetlands are among the world's most threatened ecosystems, due mainly to ongoing drainage, conversion, pollution, and over-exploitation of the resources they yield. In South Africa we have a legacy of extensive drainage and conversion of wetlands for infrastructure, urban development, agriculture and dams. Up to 50% of our original wetlands have been destroyed. Many others are being poorly managed or neglected.

To re-cap from Section 2, when wetlands are not well managed ...

- water quality can become poorer,
- downstream floods can become more frequent and more severe,
- dry season flows can become shorter and water supplies more erratic,
- there can be a loss of agricultural productivity, and
- plant and animal species are increasingly threatened.

To prevent this from happening, wetlands need basic care from land – and water users. Past neglect must be rectified, both at the wetland itself, and in the wider catchment. Since wetlands cannot speak to tell us that they're struggling, we need to look for various signs that this is the case, then take appropriate action to fix things – if we still can!



## How Do We Know That Something is Wrong?

- The wetland is no longer able to purify water. This is evident, for example, when high nutrient levels cause the overgrowth of green slimy algae. Wetlands have a threshold above which their ability to absorb pollutants and purify water will decrease.
- Water tables fed by the wetland or wetland system, have dropped, and the supply and/or quality from underground water sources is becoming poorer.
- Streams downstream of the wetland have dried up, or flow for shorter periods than they did before.
- Increased water flows from the wetland, during peak rainfall events, and no flow after the event.
- Indigenous wetland plants and animals which have historically occurred in an area, are no longer around.
- The wetland area has been reduced. This can be detected by testing soils around the remaining water body to see whether they were previously waterlogged (soils retain this characteristic for centuries) and checking if wetland plants currently grow in them. The loss of wetland plants from soils which were previously part of a wetland, can be used as an indicator that the wetland is shrinking, if one doesn't have accurate records or memories to access!



Pressures that can harm wetlands come from two places: from **on-site** activities within or near the wetland itself (such as drainage or grazing), and from **off-site** activities taking place elsewhere in the catchment (such as planting up natural veld to exotic timber, erosion from surrounding farmland, which increase sediment load, or excessive nutrient levels in the groundwater or surface run-off from poor sewage treatment).

Changes in the weather, and unusually dry or wet years, also have an influence on wetlands, but here we are interested in those aspects about which we as human beings can do something directly.

### Examples of Wetland Injuries

#### *1. Not enough water to maintain the wetland as a functioning ecosystem*

##### **This happens when ...**

- More dams, or direct abstraction, for example for irrigation, reduce the flow into the wetland.
- Natural droughts occur.
- Groundwater feeding the wetland is used up (water table dropping).
- More water is used in the catchment upstream of the wetland, e.g. by alien invasive plants or exotic timber plantations. As a general rule, trees

use more water than grasslands, and exotic trees use more water than indigenous species. Gum trees (eucalyptus) use the most water, followed by black wattle and pine.

**As a result ...**

- The wetland is less able to regulate flow and feed downstream and underground water bodies, making the area more water stressed and vulnerable to (further) drought.
- Pollutants in the wetland are concentrated.
- Certain wetland species die out locally, while others start to dominate, thus reducing biodiversity.
- The wetland is less able to clean the water flowing into it.
- The wetland is less able to support agriculture and food security.

*2. Too much water or water at the wrong time*

**This happens when ...**

Upstream sewage plants, dams or inter-basin transfers release a constant amount of water during the year, and thereby disrupt natural seasonal flows.

**As a result ...**

- Soils can become more prone to erosion.
- There may be changes in the wetland plant species because some plants, such as reeds, are adapted to seasonal flows; this has a knock-on effect on purification and biodiversity.

*3. Drainage and other changes in flow patterns*

**This happens through ...**

- Drains dug through wetlands.
- Roads built through wetlands.
- Dumping of rubble and other solid waste in the wetland.
- Earthworks in the wetland.

**As a result ...**

- The flow of water through the wetland becomes more channelled or concentrated and less spread out; this makes the water flow faster through the wetland, weakens most of the wetlands' functions and reduces its benefits.
- The wetland is less able to prevent erosion.
- Concentration of flow at a crossing site leads to gully erosion and threatens the road itself, as well as the wetlands' flow and functions.
- Flood damage increases, both at the site of the wetland, and downstream.
- The wetland is less able to cleanse water. Water filtration and purification are much less effective if the water is drained through single canals, resulting in poorer water quality downstream. Toxic substances which have previously been taken out of the water can be released back into the water column if the sediments are disturbed, or if flow patterns

change. Drains which speed up the flow of water reduce the level of soil saturation, plant growth, and water-logged conditions. This in turn reduces the levels of organic matter in the soil, and many of the chemical processes that remove pollutants. These are all examples of how the different components of the wetland – like water flow, plant life, soils and organisms – are all connected. Interfering with one component can disturb the overall balance and the functioning of the others.

- Drainage dries out the wetland, thus reducing soil organic matter. This can increase the risk of underground fires and increase soil acidity.
- Channels and the resulting head-cuts or gully erosion essentially drain the wetland, dry it out and ultimately destroy it.

#### *4. The wetland is physically damaged*

##### **This happens through ...**

- Infilling for roads or housing developments.
- Flooding when an upstream dam wall breaks.
- Road construction, earthworks and dumping.
- Inappropriate cultivation, overgrazing or excessive trampling by livestock (see also point 7 on page 26).

##### **As a result ...**

- All of the impacts of drainage (Point 3 above) can come into effect.
- Some wetlands erode easily when disturbed by grazing and excessive trampling by livestock. This is particularly those wetlands with unstable soil and where water has been diverted into channels, rather than spread out evenly over the wetland.
- Increased amounts of sediment reduce water quality.
- The habitat required by specialised wetland species may be lost.
- Increased sediment reduces the amount of light which filters through the water; as a result plants photosynthesise less, and produce less oxygen.
- The load of sediment or silt increases downstream of the wetland.
- Downstream dams receive more sediment and silt up faster, which reduces their useful lifespan.
- The cost of filtering downstream water for domestic and other uses increases.
- Overstocking the wetland can lead to hardening of the soil and reduced plant cover, which in turn reduces the amount of infiltration of water, in turn reducing groundwater recharge, increasing flood damage and reducing dry season flows.
- Erosion, especially in the form of head-cuts (erosion which eats uphill towards the flow of water, leaving a gully behind it) drains and ultimately destroys the wetland.



### 5. Wetlands are dammed

#### **This happens when ...**

- Dams are built above the wetland.
- Dams are built in the wetland.

#### **When this happens ...**

- Dams can perform certain wetland functions (e.g. sediment trapping and water storage) but they are not good at other functions (such as water purification and accommodating plants and animals).
- The habitat required by specialised wetland dependent species is frequently lost when a wetland is dammed.
- The vegetation which develops around the shoreline is limited in many dams by sudden fluctuations in the water level and by the steep sides of the dam.
- Where a series of dams have been built along a stream, their add-on effect in reducing the streamflow may be considerable, particularly where water is pumped out of the dams.

- The effects of dams are usually most noticeable in the early wet season, when dams are at their lowest levels after the dry season, and retain the early flows.

## 6. The water in the wetland is increasingly polluted

### This can happen when ...

- Crop production causes higher levels of chemicals like pesticides and fertilizers in the run-off or groundwater that feed the wetland.
- Cultivation, over-grazing, earthworks and mining increase sediment loads (see Point 4 on page 24).
- Informal settlements with poor sanitation, faulty sewage works and intensive animal production can all allow untreated effluent to contaminate the wetland; this can include not only very high levels of nutrients (which then become pollutants) but also disease-carrying bacteria and viruses.
- Mining and other industries create chemical discharges that contaminate the wetland's inflow.
- Water quality standards set by DWAF are exceeded, and poorly regulated.



### As a result ...

- Some common wetland plants may out-compete and eliminate less common species, thus reducing habitats and biodiversity.
- The wetland becomes a stinking sewer, unable to maintain life. The ability of a wetland to purify water, has limits. Once the levels of pollutants in the wetland are above these limits, the wetland will no longer be able to do the job of purification.
- Higher levels of nutrients like phosphates and nitrates cause overgrowth of algae (algal bloom) and water weeds such as water hyacinth; this in turn reduces the oxygen levels in the water, reduces the habitat available for useful wetland species, and makes the water unsuitable for domestic or recreational use.
- Downstream ground water and surface flows become polluted.
- The cost of water purification escalates.
- Agricultural production is affected.
- Humans and animals consuming water from the wetland, or downstream, can be affected by pollutants, ranging from stomach bugs (which do kill many children in South Africa) to complex systemic diseases like cancer or abnormal off-spring, that are hard to trace back to a cause.

## 7. Wetland vegetation is damaged or removed

### This happens when ...

- Streambank vegetation is removed for various purposes.
- Land-users plough or plant too close to the wetland (closer than the recommended 20-40 metres).



- Wetlands or wetland edges are heavily grazed.
- Indigenous wetland plants are replaced by non-indigenous species, e.g. invasive trees or exotic timber plantations (see also Point 8 below).
- Disturbances in the upper catchment, e.g. a burst dam wall, floods the wetland.

**As a result ...**

- Erosion follows, causing deep gullies which drain the water rapidly, thus dramatically reducing all of the major benefits from wetlands. Cultivated crops and most alien vegetation do not bind wetland soil as well as the natural wetland vegetation, thus the wetland becomes less effective at preventing erosion.
- Erosion leads to increased sedimentation downstream.
- Downstream dams may silt up more quickly, reducing their lifespan.
- As a result of buffer vegetation being removed, more of the fertilizer used near the wetland leaches into the water body, especially when used in high quantities, and it will eventually overload the wetland's ability to cleanse water.
- Heavy grazing can cause valuable grazing species to be replaced by less valuable or palatable species. (Moderate grazing can increase the diversity of plants in some wetlands, and decrease it in others.)



### 8. Wetland vegetation is replaced by non-indigenous species

#### This happens when ...

- Wetlands are planted up with exotic timber plantations.
- Alien species invade the indigenous vegetation. Examples include black wattle, Port Jackson, oleander and mesquite.

#### As a result ...

- Wetland functions are reduced, as the displaced indigenous plants are critical to wetland purification processes.
- The shade created in plantations can reduce the vigour of indigenous plants which grew in the area before, which can then be out-competed by invasive weeds.
- The value of the wetland is reduced for those species that are dependent on the natural plants, and for grazing.
- The amount of water that the wetland can release into streams or aquifers, may be reduced. Exotic timber plantations considerably reduce the available water because the exotic trees use and lose significantly more water through transpiration, than the indigenous vegetation.
- Erosion can increase, as many exotic species like black wattle are less effective in binding the soil, than indigenous wetland species.

### 9. The wetland becomes overgrown with single species

#### This happens when ...

- The flow of water into the wetland is reduced.
- The levels of nitrogen (e.g. from fertilizer or sewage) rise in the water. Extra nutrients make the plants grow faster than what nature can keep them in check.
- The wetland is invaded by alien weeds (see above).

#### As a result ...

- Other species are out-competed, or lose their habitats.
- Valuable fish and plant species may be lost to the area and biodiversity is reduced.
- The ability of wetlands to purify water is reduced.
- The wetland may be less able to control flood damage.

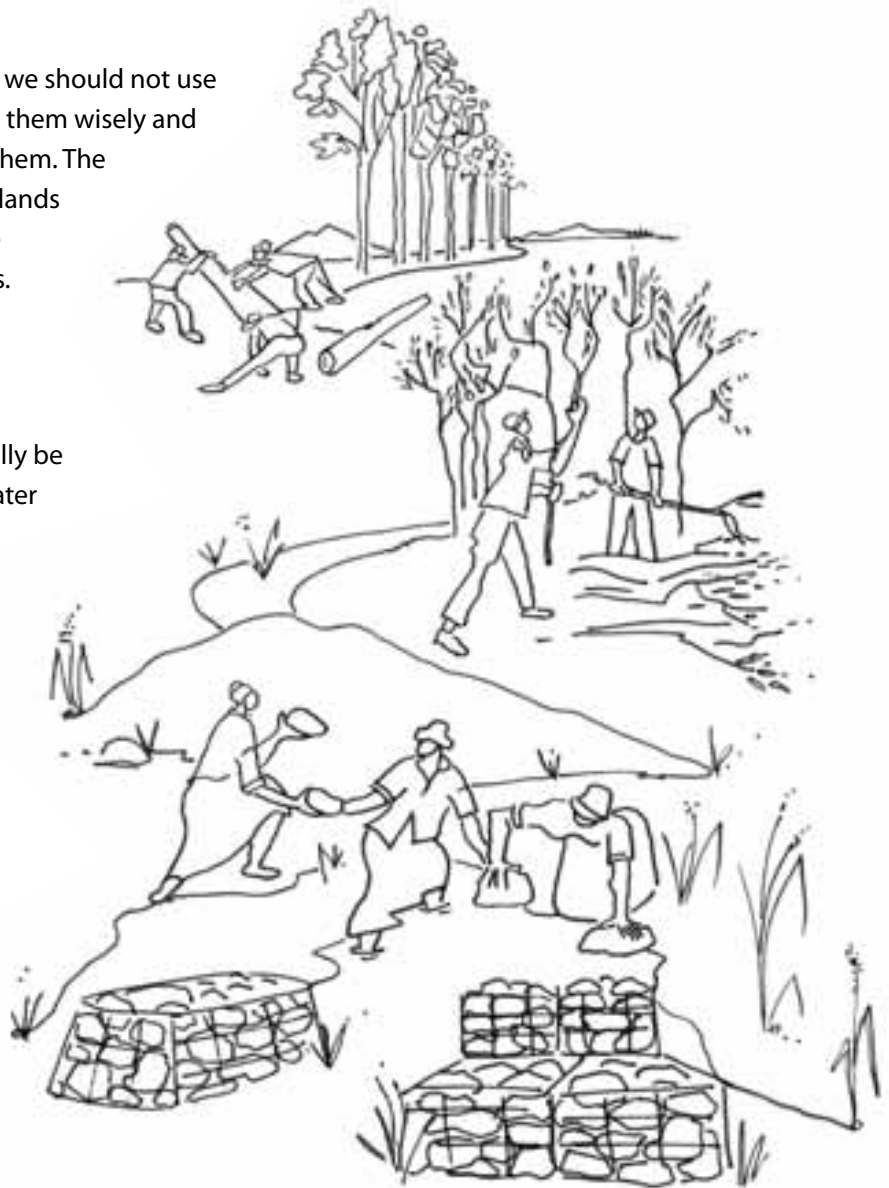
# How Do We Take More Care?

1. Tackle On-Site Activities
2. Tackle Off-Site Activities
3. Use The Law
4. Get Help

Wetland *conservation* does not imply that we should not use wetlands at all. It means that we must use them wisely and *sustainably*, and manage our impacts on them. The impact that human activities have on wetlands is determined by the way in which we use the wetland, and the scale of our activities. These activities can be on-site (in or near the wetland), or off-site (elsewhere in the catchment, upstream of the wetland).

**Impacts from on-site activities** can usually be addressed by on-site action. Land- and water users themselves can take action to reduce their own impacts, using a variety of tools for the job and asking for advice or assistance. Sometimes one will have to resort to the law, if other parties refuse to join in corrective actions.

**Impacts from off-site activities**, that take place elsewhere in the catchment, almost always require collective action, and may also need reference to the law.



## Tackle On-Site Activities

How can the individual land- and water-user reduce the impact of on-site activities which affect the functioning and benefits of wetlands? Below are a number of problems and suggested solutions. The particular nature of the problems in your wetland, and how you tackle them, will vary from area to area, and you may need to call in a specialist or two to advise and/or assist. See therefore also *Get Help* (page 40). There is much that individuals and local groups can do to take better care of their wetlands.

### Problem: Changes to flow patterns

As we saw in Section 4, many activities, such as drainage, can lead to the flow in a wetland becoming more concentrated in channels and less spread-out. We noted that when this happens, most of the wetland's functions are weakened. It is then unable to control floods, prevent erosion, cleanse water, and recharge streams or aquifers.



#### Management solutions:

- Don't change the flow pattern in the wetland. If you have no other option, do so without concentrating the flow of the water – this is the golden rule! Allow the water to spread out as much as possible.
- If you have to build a road through a wetland – first try to find somewhere else! If not possible, then distribute the flow as widely as possible across the whole wetland, rather than in a single channel or two. This would mean, for example, an adequate number of culverts or pipes under the road. For more on what to take into account when building roads near or through wetlands, see *Guidelines for Managing Wetlands in Forestry Areas* (Kotze, 2004). Also bear in mind that under the National Environmental Management Act, application must be made to the relevant authority before a road can be built through a wetland.
- If flow patterns have already been changed, investigate rehabilitation or mitigation of further problems. For details on this, also see *Guidelines for Managing Wetlands in Forestry Areas* (Kotze, 2004).

### Problem: Dams and Weirs

Dams and weirs in or above the wetland lead to a number of problems associated with the availability of water to the wetland – either too little, or too much and at the wrong time.

#### Management solutions:

- Avoid damming wetlands. If you decide to go ahead, you must apply for permission to the Department of Water Affairs and Forestry.
- Place the dams at the lowest part of the wetland so that the rest of the wetland can still perform its functions.
- The number of dams in the wetland and indeed the catchment as a whole, will have an add-on effect on the wetland, so build as few as possible.

- Build the dam wall and spillway to withstand one in fifty year flooding. If not, the bursting of dams usually has a high impact in the form of increasing flood peaks, sediment load and stream bank erosion (not to mention a waste of money).
- Build weirs and spillways to allow for the movement of aquatic species. Consult the local Department of Agriculture soil conservation officer or an engineer to plan the dam wall and spillway.
- The main factor within your control once the dam or weir has been built is the outflow control. The first wet season flows from a dam's catchment are often retained in the dam because levels are depleted at the end of the dry season. This may impact both on the wetland and downstream plants and animals and domestic and agricultural users. Release at least 50% of the early season flow.

### **Problem: Disturbances to the soil and vegetation (e.g. earth works, grazing or cultivation)**

These make the wetland more susceptible to erosion, as discussed in Section 4. A partly disturbed wetland might still function, but a totally disturbed wetland can't. Erosion of wetlands may result in deep gullies which drain the water rapidly, thus dramatically reducing all of the major benefits from wetlands.

#### **Management solutions:**

Erosion must be prevented in the first place – or rehabilitated! It's always easier to fix a small erosion problem, and prevent further erosion, than to fix big erosion problems.

- Reduce the impacts of cultivation by following low-input cultivation practices: plant crops tolerant to waterlogged soils, thus reducing the need to drain; tillage and harvest by hand to reduce soil compaction; use organic fertilizer and pesticides; do not plant extensive areas and leave indigenous vegetation between cultivated patches.
- Keep cattle and stock away from steeper slopes, the wettest part of the wetland, channels, drains, head-cuts and swamp-forest eco-tones. Wetlands, such as those with gentle gradients that are large and not prone to erosion, can be grazed. Stop all grazing when the soils are waterlogged (as this is when erosion is most likely to set in). For more, see *Six Wetland Foes Which Can Become Friends* and *Guidelines for Managing Wetlands in Forestry Areas* (2004), both available from [www.mwp.org.za](http://www.mwp.org.za) and on the CD.
- Do not remove vegetation from the edges of the wetland; leave a buffer zone of 20-40 metres from the edges of the wetland (as determined by delineation – see page 44).
- Where wetland vegetation has been removed, re-establish indigenous vegetation (see *Taking Care of Rivers*, for more information.) Such buffers not only protect the wetland from erosion and leachates, but also help



to link them with other natural areas and thus provide corridors for the movement and dispersal of wildlife.

- Where erosion has occurred, reduce the grazing pressure (where relevant) and stabilise or rehabilitate the area using indigenous vegetation, land nets, gabions and so on (see Rehabilitation, page 46).

### **Problem: Replacement of the natural vegetation by introduced plants**

This reduces the value of the wetland for those species that are dependent on the natural plants, and can also reduce the amount of water that the wetland can release into streams or aquifers, especially if replaced by thirsty exotic species such as eucalyptus, pines and wattles.

#### **Management solutions:**

- Consult with others in your area involved in clearing invasive aliens, for advice and to link up your operations, should this prove practical and useful.
- Determine the boundaries of the wetland (see Delineation, page 44).
- Remove all alien trees and plants from the wetland, bearing the following in mind:
  - Identify your aliens: appropriate pre-treatment, initial treatment and follow-up treatments vary from species to species. Consult one of several manuals available on alien clearing operations, available from DWAF ([www.dwaf.gov.za](http://www.dwaf.gov.za)), Working for Wetlands ([www.sanbi.org.za](http://www.sanbi.org.za)) or the Water Research Commission ([www.wrc.org.za](http://www.wrc.org.za)).
  - You may need to use pre-treatment in the form of cutting or burning before applying herbicide where alien plants are too tall or too dense to reach.
- Initial and follow-up treatments may be carried out through:
  - Application of herbicide to growth or re-growth.
  - Cutting or grazing to deplete the nutrient reserves of the plant; this will then require several follow-up treatments.
  - Hand pulling removing the roots, especially for young plants.
  - Ring- and strip-barking.
  - Felling trees.
  - Burning (but see guidelines on burning, below).
- *Always conduct follow up operations*, otherwise clearing is unsuccessful and a waste of money.
- Monitor your progress.
- Don't establish timber plantation in a wetland; because of its high impact in a water-stressed country, this practice is against the law. Weigh up the income from timber against the numerous benefits of a healthy wetland system.
- Withdraw existing plantations (See *Guidelines for Managing Wetlands in Forestry Areas* (Kotze, 2004)).



**Problem: Burning**

Burning wetlands can have positive and negative effects. It is important to plan carefully.

**Management solutions:** See *Guidelines for Managing Wetlands in Forestry Areas* (Kotze,2004); this document is also useful outside forestry areas.

**Problem: Overgrazing**

While some wetlands tolerate certain levels of grazing well, others are more sensitive to the impact of grazing, and all wetlands can be overgrazed and trampled at some point.

**Management solutions:**

This document is also useful outside forestry areas. See *Guidelines for Managing Wetlands in Forestry Areas* (Kotze,2004).

**Problem: Over-harvesting of wetland resources**

Many rural communities use wetlands for fishing and other sources of food and income; reeds and other wetland plants are used for building, crafts and medicinal purposes, to name a few. With growing numbers of users and fewer numbers of healthy wetlands to harvest from, we need to give more attention to the rates at which we can collect resources from our wetlands.

**Management solutions:**

See *Guidelines for Managing Wetlands in Forestry Areas* (which also applies outside forestry areas) and *Wetland-Use* (both available on [www.wetlands.org.za](http://www.wetlands.org.za)).

**Problem: Inappropriate cultivation**

Cultivating the wrong species and using farming techniques which cause compaction and erosion, can damage wetlands. Certain wetlands can however tolerate the cultivation of appropriate crops (rice, madumbes in South Africa) if low-impact agricultural practices are followed.

**Management solutions:**

See *Guidelines for Managing Wetlands in Forestry Areas* (which also applies outside forestry areas) and *Wetland-Use* (both available on [www.wetlands.org.za](http://www.wetlands.org.za)).

**Problem: Infilling for development**

Developers may look at a wetland and see an opportunity to make money by filling it in and building a housing complex, golf estate, shopping mall or other money making enterprise on it. The problem is that this approach overlooks and destroys the many other benefits the wetland provides.



**Management solutions:**

Take stock of the many other benefits that wetlands provide in their healthy, functioning state, mostly to the wider society rather than a specific beneficiary, and mostly over the longer term. Consider research internationally and in South Africa which has calculated the benefits to local authorities, and numerous services to broader communities, and found them to be most productive in their healthy state. See for example *Wetlands and Water Quality Enhancement*, by Dr Don Kotze ([www.wetland.org.za](http://www.wetland.org.za)) and *The Costs and Benefits of Urban River and Wetland Rehabilitation Projects with Specific Reference to Their Implications for Municipal Finance: Case Studies in Cape Town*, by Hugo Van Zyl and others (see Section 7 for reference).

**Problem: Pollution**

In Section 4 we saw that there are various forms and sources of pollution which can affect wetlands, including:

- sediment (silt) resulting from activities and factors which increase erosion,
- increased nutrients, mainly nitrates and phosphates, which leach from farmland, golf courses, faulty sewage treatment plants and informal settlements,
- synthetic organic biocides (herbicides and pesticides used on farms),
- heavy metals (from mining operations and other industries), and
- pathogens (micro-organisms which carry diseases such as cholera).

Wetlands have a valuable ability to reduce the levels of these pollutants in the water, but their capacity to do this has a limit, which must not be exceeded. This limit can be reduced by activities which disturb the wetland, flow and vegetation.

**Management solutions:**

See the section below, in relation to *Catchment-wide activities which reduce the quality of water flowing into wetlands*. Most of the pointers there also apply to on-site pollution.

Besides reducing the amount of pollution that flows into the wetland, any action you take to:

- reduce and stabilise erosion in the wetland,
- restore and protect indigenous vegetation,
- manage the flow into and through the wetland, and
- reduce disturbance in the wetland itself

will improve the wetland's ability to contain and filter out pollutants.

## Tackle Off-Site Activities

In the past, conservation institutions focussed more on the on-site conditions of wetlands, and less on the management of off-site factors, such as inflow. The National Water Act of 1998 broke new ground in this respect, by giving us a framework for addressing this neglected aspect of wetland conservation. The Act indicates that any significant water resource, or part thereof (such as a wetland) must have an Ecological Reserve. This means that a significant wetland is allowed the amount and quality of water that will keep it functioning, as a priority. This Ecological Reserve must be allocated, along with the Reserve to meet basic human needs, ahead of allocating water for other purposes. For more information, see another booklet in this series, titled *Catchments, Sustainability and the Ecological Reserve*.

The Ecological Reserve consists of two requirements: the *quantity* (amount) of water, and the *quality* (purity) of water that must be left in the wetland.

### Catchment-wide activities which reduce *the quantity of water* flowing into wetlands

Many wetlands are unable to function properly because they receive too little water, due to activities and conditions elsewhere in their catchment. The concept of the Ecological Reserve is a way of determining how much water a wetland should receive, to allow it to function as a wetland, and to maintain the benefits it provides.

The Ecological Reserve should be determined for all significant water resources in the catchment, including wetlands, included in the Catchment Management Strategy for the particular Water Use Area in which it falls, and implemented. Implementing the Reserve in terms of the *quantity* of water, means limiting the level of use of water upstream of the wetland to a suitable level, and/or releasing enough water, at the right times, from upstream dams.

Determining exactly what the Reserve should be for a particular wetland is not an easy matter. It requires considerable scientific expertise (See *Catchments, Sustainability and the Ecological Reserve*). It depends on many factors, including the type of wetland, and its particular ecological character or features. Many of our wetlands are poorly understood, in terms of their particular individual characteristics. One management strategy is to classify wetlands according to ecological types. The Working for Wetlands programme coordinates two tools to assist with this process. These are the National Wetland Classification System and the National Wetland Inventory. The former will form part of a system of eco-typing wetlands that will allow scientists to apply the data from well-studied wetlands, to wetlands that have not been studied. The Inventory will help them to rapidly locate and assess the status of wetlands. All this will help inform the process of



determining the Ecological Reserve for a particular wetland. Determining the Reserve should take place within the broader vision for the catchment as a whole.

**What you can do:**

- Participate in the Catchment Forum for your area, and Water Users Association, where appropriate.
- Find out what progress has been made with the determination of the Reserve for the water resources in the catchment. Identify researchers or DWAF officials leading the process.
- Provide information about your wetland, which can be used in this process.
- Use information about the Reserve to ensure the catchment-wide management of activities affecting the wetland.
- Help to monitor the implementation of the Reserve.

**Catchment-wide activities which reduce *the quality of water* flowing into wetlands**

The Ecological Reserve for wetlands includes an element of quality: a wetland may receive an adequate amount of water, but if it is heavily polluted, the wetland may be over-burdened and therefore still unable to function.

**What you can do – Assess the situation:**

- Find out what the pollutants are that affect the wetland.
- Identify their sources, e.g. over-stretched sewage plants, informal settlements, housing developments, factories or farms.
- Determine the levels or concentrations of pollution, bearing in mind that this may vary greatly over the course of, say, a year.
- Find out whether the water quality standards of DWAF are being met by each of the point sources of pollution (see *Use the Law*, and the booklet *Summary of Key Legislation*).
- Determine how close to the wetland the pollution sources are: the closer they are, the bigger their impact is likely to be.
- If the source of pollution is not a point source, but rather spread out over an area (e.g. a number of fields), determine the extent in the catchment of the area generating the pollutant (the greater the area occupied by the land-use, the bigger the potential impact).

**What you can do – Take action:**

- Increase buffer zones – streambank and wetland vegetation help to reduce the concentration of pollutants before water enters the stream.
- Upgrade sewage treatment facilities.
- Upgrade sewage facilities in informal settlements.
- Include these and other water pollution measures in the Integrated Development Plan (IDP) and district municipal operations.



- Improve domestic and industrial waste management in urban areas, including waste reduction and recycling initiatives.
- Improve waste management on farms, for example to handle discarded containers, crop residues and the like. Start recycling ventures, for example depots for used oil.
- Carefully manage the use of fertilizers. Use only as much fertilizer as the crops need during a particular growth stage, and fertilize for a realistic rather than an optimistic yield. To be specific, one needs to analyse the soil and ideally the plants, too. Take particular care with the storage and handling of large volumes of liquid fertilizer (used for fertigation). For example, liquid fertilizer tanks must not be located within the 1:100 year floodline, or within a distance of 100 m of a watercourse or wetland, whichever is the greater. Consider an organic approach, or a mix of organic and synthetic fertilizers. For more, see *Biodiversity Best Practice Guidelines for Potato Production in the Sandveld. A Joint Venture Between Potatoes South Africa and CapeNature, 2007*. Contact Johan Burger, jburger@capenature.co.za.
- Reduce synthetic pesticide use – consider organic options as part of integrated pest management, and apply the SANS standards (SANS 10206) to the storage and handling of pesticides – see *Biodiversity Best Practice Guidelines for Potato Production in the Sandveld, Appendix 2* (reference above).
- Manage the levels and timing of inflow into the wetland as well as the water quality – see above.

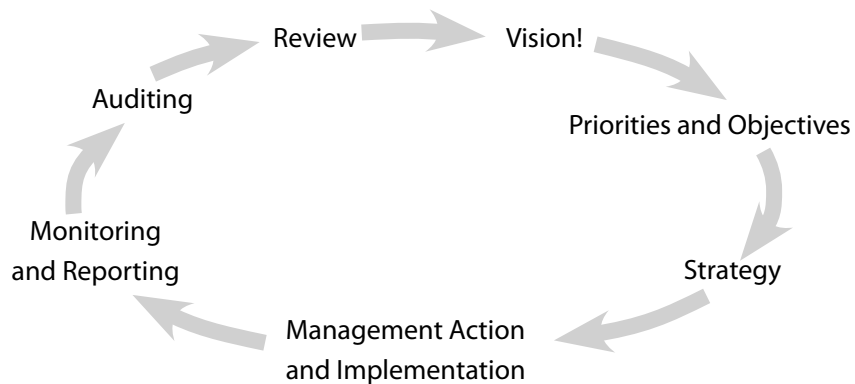
## Plan For Wetland Protection On A Catchment-Wide Basis

The Water Research Commission (see *Guidelines For Integrating ... Wetlands Into Catchment Management Planning* on CD, or access at [www.wetlands.org](http://www.wetlands.org)) proposes a six-step plan for water managers to implement, in relation to wetlands:

- Elevate the status of wetlands in land, water and catchment management and planning. In particular, ensure that the conservation, wise use and management of wetlands are specifically addressed in Catchment Management Strategies.
- Elevate the status of wetlands in environmental management and development planning decisions.
- Ensure that all responsible parties agree on common land and water management objectives which will ensure the protection of wetlands.
- Define and confirm the responsibilities for implementation, and allocate the resources necessary to do the job.
- Refer to the guidance give by Ramsar's Wise Use Concept, "The wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".



- Implement the full cycle of management from vision through to implementation, monitoring and review as follows:



## Use The Law

Several laws support the protection and proper management of wetlands:

**The National Water Act** (Act No 36 of 1998) includes wetlands in the definition of water resources, and provides for the determination and implementation of an Ecological Reserve for significant wetlands, in the form of an adequate amount of water, of adequate quality, to maintain the wetland's functioning (see *Catchments, Sustainability and the Ecological Reserve*). The Act is founded on four key ideas:

- Water belongs to all people
- Participation
- Water resources protected and managed as a whole
- Sustainable use for the benefit of all.

**CARA**, the Conservation of Agricultural Resources Act (No 43 of 1983, administered by the National Department of Agriculture) aims to provide for control over the utilization of the natural agricultural resources of South Africa in order to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants. Under CARA it has been illegal, since 1983, to drain or cultivate any wetland areas without a permit, and permission is also required for the removal of river bank vegetation and disturbance of the river bank itself (for example all river crossings). All disturbances have to be appropriately rehabilitated.

**The Forest Act** of 1986 (Section 75) prevents the planting up of wetlands to timber.

**NEMA**, the National Environmental Management Act (Act No 7 of 2003) is an over-arching law concerned with the protection of all aspects of the natural environment against threats such as damage to natural resources through poor development, pollution, bad management, or over-exploitation.



Some key principles of NEMA include:

- Sustainable development requires the consideration of all relevant factors...including:
  - i. That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
  - ii. that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
  - iii. that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;
  - iv. that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised.
- Environmental management must be integrated; acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.
- The environment is held in public trust for the people. The beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.
- Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

New **Environmental Impact Assessment (EIA) regulations** were published in 2006 under Chapter 5 of NEMA. They list activities that require either a Basic Assessment or a Full Assessment, as well as the relevant authorities. Activities such as the construction of roads through wetlands require an environmental impact assessment. The Department of Environmental Affairs and Tourism (DEAT) has principal responsibility for implementing the EIA regulations (and NEMA).

The **Biodiversity Act** also falls under NEMA (National Environmental Management: Biodiversity Act, No 10 of 2004). It defines threatened and endangered ecosystems and species, and indicates how they should be managed and protected. It also prescribes how alien invasive species, which threaten biodiversity, should be controlled. The Act does not have a preservationist stance, but promotes the wise use and protection of ecosystems (such as wetlands) and their biological resources. DEAT has principal responsibility for implementing the Biodiversity Act.



DWAF's Directorate of Water Quality Management publishes guidelines on various requirements to protect water quality, including *the South African Water Quality Guidelines (1996)*, *Waste Management: Standard Permits, Regulations for the Purification of Waste Water and Effluent (1984)* and the management of waste disposal sites (Environment Conservation Act, Act 73 of 1989). These are all on the Directorate's website which can be accessed via [www.dwaf.gov.za](http://www.dwaf.gov.za).

The Ramsar Convention lists wetlands which are of international importance, and provides guidelines for their management. This is not legally binding, but places an international obligation on South Africa to take particular care of those wetlands with Ramsar status.

For more on legislation related to water resource sin general, see the booklet *Summary of Key Legislation concerning Water/Catchment Protection and Management* in this series. If you want to further explore legislation with particular relevance to wetlands, see *Guidelines for the Integration of Wetlands in Catchment Management Strategies*, pages 34–42.

## Get Help

As ecosystems wetlands fall in the transition zone between terrestrial (land-based) and true aquatic (water-based) ecosystems. They occur in urban areas and rural areas, in protected areas and on private land. As a result, several government departments have responsibilities regarding wetlands, and it can be difficult to find out who is responsible for what. To make sure that wetlands don't fall through the cracks, it is important that locals keep an eye on their wetlands and call in the authorities when necessary.

Below we provide some general, national contacts, but various agencies will be more or less active in a particular water management area. Make an effort to get to know your local agencies and set-up, and find the individuals with whom you can form working relationships. If this is not possible, call on national authorities.

## Working for Wetlands

### What do they do?

Working for Wetlands combines the rehabilitation of wetlands with poverty relief employment and training. Throughout the country, teams are hired on short- to medium-term basis to help clear aliens, build anti-erosion structures, undertake re-vegetation and bio-engineering, or other steps to rehabilitate selected wetlands. A guiding principle is to raise awareness and influence practices impacting on wetlands, rather than focussing exclusively on engineering solutions. WfWet also funds research, and plans to extend

its rehabilitation work, to support wise use of wetlands. Initially a sub-programme of Working for Water, WfWet is now a stand-alone programme in the Department of Environmental Affairs, housed within SANBI (the South African National Biodiversity Institute). Each province has a coordinator, and the national office is in Pretoria. Working for Wetlands also supports the South African Wetlands Action Group and provincial wetland forums.

**Where to reach them?**

[www.sanbi.org/research/wetlandprog.htm](http://www.sanbi.org/research/wetlandprog.htm)

**Tel:** (012) 843 5200

## **Department of Environmental Affairs and Tourism (DEAT)**

**What do they do?**

They are responsible for administering and overseeing the Environmental Impact Assessment regulations, the implementation of the National Environmental Management Act in general, and the Biodiversity Act. DEAT also initiates and/or supports various poverty relief initiatives which provide employment to the needy through various environmental projects, such as the CoastCare initiative. SANBI is affiliated with DEAT, and so is the Working for Wetlands programme. Provincial environmental departments may be involved in the implementation of wetland rehabilitation initiatives.

**Where to reach them?**

Private Bag X447

Pretoria 0001

**Hotline Number:** 0800 205 005 (toll free)

**Tel:** (012) 310 3911

**Call Centre:** 086 111 2468

**E-mail:** [callcentre@deat.gov.za](mailto:callcentre@deat.gov.za)

**Website:** [www.environment.gov.za](http://www.environment.gov.za)

The website has contact details for provincial departments.

## **Working for Water**

**What do they do?**

The Working for Water (WfW) programme is administered through the Department of Water Affairs and Forestry. It spearheaded the drive to remove invasive alien plants in South Africa, and can provide much technical advice in the identification of invasive plant species, and methods for their control. The programme works in partnership with local communities, to whom it provides jobs as part of the government's poverty relief initiative, and also with Government departments including the Departments of Environmental Affairs and Tourism, Agriculture, and Trade and Industry, and provincial departments of agriculture, conservation and environment. Currently WfW currently runs over 300 projects in all the provinces.

**Where to reach them?**

Private Bag X4390

Cape Town 8000

**Hotline Number:** 0800 005 376 (toll free)

**Tel:** (021) 441 2700

**Fax:** (021) 441 2781

**E-mail:** wfw@dwaf.gov.za

**Department of Water Affairs and Forestry (DWAF)**

**What do they do?**

The Department of Water Affairs and Forestry is the custodian of South Africa's water and forestry resources. It is primarily responsible for the formulation and implementation of policy governing these two sectors. It also has override responsibility for water services provided by local government.

**Where to reach them?**

**Address:** Private Bag X313

Pretoria 0001

**Fax:** +27 12 324 6592

**Toll Free Number** (Enquiries): 0800 200 200

The website, [www.dwaf.gov.za](http://www.dwaf.gov.za), has contact details for regional offices.

**LandCare South Africa**

**What do they do?**

LandCare South Africa is a programme of the National Department of Agriculture. It involves "local people taking local action in their local area" to achieve sustainable land use and management, addressing issues like wetland and water course rehabilitation, soil erosion and bush encroachment. LandCare supports local landholders to take a leading role in planning and undertaking activities to conserve their most important assets. It also encourages the formation of LandCare groups which assess local problems, determine priorities and undertake action. LandCare can provide financial and/or technical or other support.

**Where to reach them?**

National LandCare Secretariat

Private Bag X120

Pretoria 0001

**Tel:** (012) 319 7685

**Fax:** (012) 319 7566

**E-mail:** SMLUSM@nda.agric.za

Or

**The LandCare Helpdesk**

DELPEN Building (cnr. Union & Annie Botha St.),  
Pretoria

**Tel:** (012) 319 7553

The website [www.nda.gov.za](http://www.nda.gov.za) has contact details for LandCare coordinators in each of the provinces.

**Wildlife and Environment Society of South Africa (WESSA)****What do they do?**

Various non-governmental organisations (NGOs) are involved in campaigning for wetlands that are threatened, initiating activities and raising awareness about the importance of wetlands. WESSA is one such NGO. Others are the Southern African Crane Foundation and WWF SA. Among WESSA's wetland-related projects is the Mondi Wetlands Project (funded by Mondi Business Paper through WWF SA's Freshwater Programme). The Mondi Wetlands Project (MWP) works closely with land users (for example forestry, commercial sugar cane growers and communal land users) to improve the outlook for wetlands. WESSA and the MWP also convenes W.A.T.E.R., an alliance that supports education, training and research related to wetlands and other freshwater resources.

**Where to reach them?**

WESSA

PO Box 394

Howick, 3290

**Email:** [pat@wessa.co.za](mailto:pat@wessa.co.za)

**Website:** [www.wetlands.org.za](http://www.wetlands.org.za)

# Tools For The Job

A growing community of conservationists, researchers and farmers in South Africa are working out how to better manage our impacts on wetlands. Together they have produced a number of tools and tests which can be used to:

- decide exactly where a wetland starts and ends (delineation),
- assess the nature and extent of the damage to a wetland,
- better understand the services that a particular wetland provides, and
- restore and rehabilitate wetlands.

## A Basic Management Framework

1. Delineate the wetland of concern.
2. Assess the condition of the wetland.
3. Assess the present management of the land in terms of the possible impacts.
4. Source information from organisations that can help.
5. Develop wetland management objectives from the information gathered from the wetland assessment if needed.
6. Rehabilitate problem areas.
7. Monitor the wetland and the rehabilitation sites.
8. Ensure that the correct legislation is being adhered to.



## Tools for Delineating a Wetland

Delineation means determining where the boundaries of the wetland are. This is useful for various purposes, for example, if one wants to determine where to plough or not to plough (not within 30 metres from the wetland boundary), where to place a liquid fertilizer tank (not within 100 m of the wetland), where to plant buffer vegetation, and so on.

How do we determine a wetland boundary? Digging into wetland soils will reveal a distinct appearance of what scientists call hydromorphic soils

(which may be, for example, greyish and mottled). These are soils which have been saturated in a wetland, either recently or in the distant past. Soils retain their hydromorphic characteristics for hundreds of years! This means that by digging and looking for wetland soils, one can find out whether there has been a wetland, even when the surface is dry for some time, and even if typical wetland plants have disappeared due to prolonged droughts or drainage of the wetland.

The process of delineation involves walking around the wetland and finding where the dryland soils stop and the wetland (hydromorphic) soils start. This is done by sampling the soil along a transect (line) through a wetland using a soil auger. The process is described in *A Practical Guide for the Identification and Delineation of Wetlands and Riparian Areas*, 2003. This is on the CD, or available from DWAF, Sub-Directorate Stream Flow Reductions.

## Tools for Assessing Wetland Goods and Services

*WET-EcoService*: A technique for rapidly assessing ecosystem services supplied by wetlands, developed by Don Kotze and others (see Section 7 for reference) is a tool to assist decision-makers, government officials and educators in undertaking rapid assessments of wetlands and identifying the goods and services they provide, so as to inform



planning and decision-making. A cornerstone of this tool is describing the geo-morphological features of the wetland, which greatly influences the functioning of the wetland and the kinds of goods and services it provides (refer back to Table 1 on page 7). For a copy, contact the Water Research Commission, [www.wrc.org.za](http://www.wrc.org.za).

## Tools for Rehabilitating a Wetland

Before we rush in to rehabilitate problems in a wetland, we should consult a good manual for guidance on the following:

- Understanding the processes underlying the formation of wetlands, including the deposition and erosion of sediment within these systems.
- Prioritizing wetlands for rehabilitation – as rehabilitation can be a costly process.
- Identifying the type and severity of erosion in the wetland and choosing measures that are suitable for the particular erosion problem and the wetland's catchment and management context.
- Monitoring the success of wetland rehabilitation.
- Understanding the legal context within which rehabilitation takes place.

### Some Principles of Successful Wetland Rehabilitation

- Remove the cause of the damage (for example the drains or cattle).
- Re-establish the natural water flow patterns within the wetland, or at least aim to spread out rather than channel the water.
- Re-establish the vegetation.
- Monitor and follow up.

Rehabilitation is about promoting the recovery of ecosystems and functions in a degraded wetland, to move the system closer to what it originally was. Key problems that are addressed through rehabilitation are erosion and artificial drainage, but rehabilitation also involves addressing invasion by alien plants. This is discussed on pages 47–48 and page 32. Here we focus more on measures to stabilise erosion and drainage.

Simple methods of rehabilitating these aspects of wetlands include:

- closing drains
- placing plugs in gullies
- fencing off sensitive areas to keep grazers out.

These measures will all help wetland plants to re-establish themselves. Plants are vital to the functioning of wetlands. Wetland and riverbank plants prevent erosion, play a crucial role in the purification of water, reduce the severity of floods and regulate water especially during droughts. When the

plants go, these valuable functions disappear, and bringing them back, makes a big difference.

**Plug the drains and gullies:** It is important to stabilise gully sides and to stop the vertical erosion in the gully. You may use a variety of materials: herbaceous or woody plants, hay bales, clay plugs, gabions filled with rock, a geo-textile lining, soil, or even just packing loose rock against head-cut faces. Your choice will depend on the availability of resources and finances.

**Stabilise the banks:** Plants are the most effective and also the cheapest solution to solving erosion of river and wetland banks. But which plants should you use?

On gentle and shallow banks and flat areas, use herbaceous plants, such as bulrushes, reeds, sedges and couch grass. A large variety of herbaceous plants with rapidly spreading capabilities and dense near surface root mat, and surface cover, would be effective. Herbaceous plants protect against the scouring of riverbeds and wetlands, and enhance the stability of gentle or shallow banks. The plant stems induce sediment deposition, which tends to raise the floor of eroded channels, even widening the channel profile. Herbaceous plants absorb the energy of fast flowing water rather than reflecting it. The combination of these factors, plus the ability of many herbaceous plants to thrive in direct sunlight, of being fire tolerant and having strong regenerative powers, makes them ideal for rehabilitating banks. However, their roots are too shallow to improve the stability of steep banks.

On steep banks, trees will fare better. Trees contribute cohesion and stability to steep banks – providing the roots reach down to full bank height, and the toe-holds and bank face are protected from undercutting by tree roots and an established cover. In some instances, such as in KwaZulu-Natal coastal regions, certain tree species grown in narrow channels will develop entwined root ‘weirs’, forming an effective channel plug for gully and channel erosion. Unfortunately, unlike herbaceous plants, trees grow slowly and do not generally tolerate frequent fires.

It is important to select and correctly place plants with vigorous rooting growth characteristics that will accelerate natural plant succession. Local species which grow on streambanks and wetlands should be used. Look around and see what indigenous species are growing in areas similar to the one you are about to rehabilitate. Also look around for experts to consult, on suitable trees and plants.

## Tools for Clearing Alien Invasive Plants

Alien clearing in and around the wetland has been discussed earlier. Here we have in mind alien clearing in the catchment above the wetland.

The same guidelines apply, but here it is even more important to link up to existing clearing operations and agencies, for advice and possible cooperation.

Involve the Departments of Water Affairs and Forestry (Working for Water Programme), Environmental Affairs and Tourism (Working for Wetlands), and/or Agriculture (LandCare). They can provide guidance, financial and other resources.

## Tools for Monitoring

Monitoring your rehabilitation efforts helps to ensure that it is successful. You will be interested in two aspects:

- monitor the structures' effectiveness at stopping the erosion, and
- a vegetation assessment to reflect the return of the water table. This involves assessing the change in the species composition from dryland species to wetland species, as the rehabilitation becomes more successful.

Monitoring involves regular site visits to assess progress and to repair any damage to the soil conservation measures. Methods to use for monitoring include:

- **Fixed-point photography** – Take pictures at the same sites at certain fixed times of the year (for example, a set before the rains and a set afterwards). This will help you assess the effectiveness of any structures built and the development of wetland vegetation, or the effectiveness of alien clearing operations. Remember to take some 'before' pictures to use as a benchmark.
- **Placing stakes in the field** – The rehabilitation site can be measured and staked accordingly in the field.
- **Visual checks** – Rehabilitation structures should be monitored for stability. If damage is detected, take action.

# For More On Wetlands

## References and Further Reading

- *A Practical Guide for the Identification and Delineation of Wetlands and Riparian Areas*. 2003. DWAF, Sub-Directorate Stream Flow Reductions, Pretoria.
- *WET-EcoServices: A Technique for Rapidly Assessing Ecosystem Services Supplied by Wetlands*, 2007. Kotze, D C, Marneweck G C, Batchelor A L, Lindley D S and Collins N B. Water Research Commission, Pretoria ([www.wrc.org.za](http://www.wrc.org.za))
- *Guidelines for Integrating the Protection, Conservation and Management of Wetlands into Catchment Management Planning*. 2003. Dickens, C., Kotze, D, Mashigo, S, MacKay, H & Graham, M. Water Research Commission (WRC) Report No.TT 220/03. Useful in planning a Catchment Management Strategy which integrates wetland management.
- *The Costs and Benefits of Urban River and Wetland Rehabilitation Projects with Specific Reference to Their Implications for Municipal Finance: Case Studies in Cape Town*. 2004. Van Zyl, H, Leiman, A & Jansen, A. WRC PROJECT NO. K8/564.
- [www.wetlands.org](http://www.wetlands.org) – Site of the Mondi Wetlands Project, from where one can obtain several user-friendly resources on wetlands, their functioning, wise use and management, for example:
  - *Wetlands And People*  
A useful and user-friendly booklet compiled by Prof Charles Breen and Dr Donovan Kotze of the University of KwaZulu-Natal.
  - *Emerging Farmers*  
A series of four articles on how small-scale farmers can manage their land. Compiled by the Mondi Wetland Project.
  - *Wetland Fix*  
A six-part field guide for the identification, restoration and management of wetlands. Compiled by the Mondi Wetlands Project.

- *Basic Training Manual*  
Covering the basics of wetland management. Compiled by the Mondi Wetlands Project.
- *Wetland Use Manual*  
A detailed field guide for management of South African wetlands, compiled by Prof Charles Breen and Dr J Klug, University of KwaZulu-Natal.
- *Wetlands and Water Quality Enhancement. 2000.*  
Article by Dr Don Kotze, prepared for the Mondi Wetlands Project. Explains in clear detail how wetlands operate as nature's purification works. Includes overseas findings.
- *Guidelines for Managing Wetlands in Forestry Areas. 2004*  
Article by Dr Don Kotze, prepared for the Mondi Wetlands Project. Has valuable information on the practical rehabilitation, wise use and management of wetlands, and is *also applicable outside forestry areas.*



