Aquatic

ecosystem management plan: western cape

Prepared for:

Western Cape Conservation Stewardship Association (WCCSA) & CapeNature

By:

The Nature Conservation Corporation

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This Ecosystem Management Plan forms part of a set of 7, with an EMP Guide Tool for the implementation of these, all available from C.A.P.E. at Kirstenbosch, Cape Town.

NCC Environmental Services (Pty) Ltd trading as
The Nature Conservation Corporation
Reg. No.: 2007/023691/07
P O Box 30223 Tokai 7966
Republic of South Africa
Tel: 021 702 2884
Fax: 021 701 5302
info@natureconservation.co.za
www.natureconservation.co.za

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Cover Photograph: A fynbos stream in the Hottentots Holland Mountain range.

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introduction

Water is essential for life on earth. Regardless of our apparent technological advance we are not independent of it. It sustains all and from mountain top to sea, it shapes all that lies in its course.

Aquatic ecosystems are recognised for the natural capital they provide as well as their splendour. We all appreciate the beauty of a pristine aquatic system and yet one cannot travel the full length of any river and describe it as such. Only at their source are most rivers pristine or nearly so. Their splendour rapidly declines as they approach human habitation and are put to work – transporting our waste and by-products of agriculture and industry. They are canalised and re-routed in an attempt to tame them. They have suffered the most ignoble of fates.

We have lost our connection to that cycle which replenishes this resource, its very origin. Instead we take it for granted, receiving our water through taps, assuming it to be an infinite resource. We don't stop to consider the fate we bestow upon our aquatic ecosystems and ultimately, our future.

Aquatic ecosystems are highly productive and dynamic, yet vulnerable to degradation by inappropriate and environmentally insensitive activities. We are compelled to ensure the required ecological functioning of these delicate systems. Through this Ecosystem Management Plan we hope to encourage communicable awareness and reverence for this most essential of ecosystems.

ecosystem description

landscape features

Essentially, aquatic systems *are* landscape features. Rivers and streams carve a channel that they flow in and are continuous longitudinal systems that are also recognisable by their lateral dimension, the actual water and the riparian zone.

Wetlands, although obvious during the rain season, are somewhat more amorphous. They are more easily recognised by their vegetation, as supported in the National Water Act (36 of 1998) "…*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, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*."

In order to avoid constant repetition and referral, the morphology and vegetation are discussed together.

vegetation description

The table below lists the vegetation units incorporated in this Aquatic Ecosystem Management Plan. Vegetation units highlighted are those sampled during the biodiversity and management assessment programme.

Table 1 List of Aquatic Vegetation Units in the Western Cape Province

Reference [1]	VEGETATION TYPES & UNITS	Status [2]	Target [3]
	Freshwater Wetlands		
AZf 1	Cape Lowland Freshwater Wetlands	-	24%
AZf 2	Cape Vernal Pools	CR	24%
	Alluvial Vegetation		
AZa 1	Fynbos Riparian Vegetation	-	-
AZa 2	Cape Lowland Alluvial Vegetation	CR	31%

[1] Sourced from The Vegetation of South Africa, Lesotho and Swaziland (Mucina & Rutherford 2006)

[2] **Conservation Status of vegetation units defined as** LT = Least Threatened; VU = Vulnerable; EN = Endangered and CR = Critically Endangered

[3] The national target for securing representative vegetation for its conservation

Reference [1]	VEGETATION TYPES & UNITS	Status [2]	Target [3]
	Inland Saline Vegetation		
AZi 1	Namaqualand Riviere	LT	24%
AZi 2	Namaqualand Salt Pans	LT	24%
AZi 6	Southern Karoo Riviere	LT	24%
AZi 7	Tanqua Wash Riviere	LT	19%
AZi 8	Muscadel Riviere	EN	16%
AZi 9	Cape Inland Salt Pans	VU	24%
	Estuarine Vegetation		
AZe 1	Arid Estuarine Salt Marshes	LT	24%
AZe 2	Cape Estuarine Salt Marshes	LT	24%

Rivers and streams can be classified according to their flow pattern, which in effect dictates their morphology and therefore recognisable characteristics. Estuaries unfortunately are often misunderstood – they are commonly viewed as marine systems and the fact that they are part of a river's journey to the sea is forgotten or not taken cognisance of. In terms of the vegetation they are best discussed as wetlands.

Wetlands are somewhat more technical in their morphology than rivers and the generally accepted surrogate for recognising and classifying them is vegetation.
In order to maintain a systematic approach, aquatic systems of the Fynbos Biome will be discussed separately from those of the Succulent- & Nama Karoo Biomes.

fynbos biome

rivers and streams (lotic systems)

These systems have their source in mountains as a result of accumulated precipitation flowing down slope. The headwaters often originate from sponge areas that are actually a form of wetland.

perennial

A perennial river can conveniently be partitioned into three main stretches – the upper, middle and lower reaches. The estuarine stretch of the lower reach is discussed under **Wetlands**.

Fynbos streams and rivers, where they flow through a kloof or ravine, will have a variant of Southern Afrotemperate Forest known as Western Cape Talus Forest clothing the riparian zone.

Many watercourses however, occur on wide, open slopes and the channel is not flanked by cliff faces. Under these conditions a unique and easily discernible vegetation unit occurs - **Fynbos Riparian Vegetation**. Where the water is relatively fast flowing, the vegetation consists of beds of palmiet *Prionum serratum* or sedge *Tetraria cuspidata* and reeds such as *Juncus capensis.* Tall grasses such as *Merxmuellera cincta* flank the water, with emergent restios *Elegia capensis*, *Ischyrolepis subverticillata* and *Rhodocoma virgata.* Tall hydrophilic shrubs such as waterwitels *Brachylaena neriifolia*, smalblad *Metrosideros angustifolia*, bloukeur *Psoralea aphylla* and waterheide *Erica caffra* occur on the terrace. Also on the terrace are golden sceptre *Wachendorfia thyrsiflora*, sundew *Drosera capensis* and ferns, especially *Osmunda regalis*, *Pteridium aquilinum* and *Todea barbara*.

The riparian zone of the middle reaches of most fynbos streams and small rivers comprise a series of riverine and palustrine wetlands. The middle and lower reaches of the larger rivers however, tend to have broad alluvial banks and braiding. The vegetation of these features is **Cape Lowland Alluvial Vegetation**. Here the river is, under normal circumstances, slow flowing and has to an extent panned out. The vegetation is similar to Fynbos Riparian Vegetation, except that it is an admixture of tree species such as Cape willow *Salix mucronata* and Breede River yellowwood *Podocarpus elongatus* with tall shrubs including wilgekoerentebos *Rhus angustifolia* and vleibos *Cliffortia strobilifera,* as well as lower growing shrubs e.g. tabakbos *Senecio halimifolius* and wildewingerd *Cliffortia odorata* forming a thicket. The marginal and flooded areas support a mixture of graminoids and herbs. Most noteworthy of the graminoids are palmiet *Prionum serratum*, matjiesriet *Cyperus textilis*, *Juncus lomatophylla* and *Pennisetum macrourum*. Amongst the herbs are *Laurembergia repens*, vleikruid *Nidorella foetida* and snake knotweed *Persicaria decipiens*.

Occasionally, within the estuary Cape Lowland Alluvial Vegetation is present as reedbeds, consisting of either fluitjiesriet *Phragmites australis* or papgras *Schoenoplectus scirpoideus*.

periodic/intermittent

In the Fynbos Biome, periodic rivers of the Cape Fold Mountains have the same vegetation units as the perennial rivers. Periodic rivers on shale have a different vegetation unit – **Cape Inland Salt Pans**. These rivers often drain from large saline slope scars. The dominant plant is the low-growing succulent shrub *Sarcocornia mossiana* and is often accompanied by sparse salt-tolerant shrubs and grasses.

wetlands (lentic systems)

Wetlands are classified according to their spatial orientation and also their function. Riverine wetlands are found on the floodplains of rivers, lacustrine wetlands are "lake"-like in that they are waterbodies fringed with vegetation, palustrine wetlands are "marsh"-like being soft underfoot with emergent vegetation throughout, and finally estuarine wetlands, which are salt marshes.

The vegetation unit commonly occurring in these habitats, except for estuarine wetlands, is **Cape Lowland Freshwater Wetlands**. This unit can either be flooded restiolands, sedgelands, rushbeds, reedbeds, an admixture of hydrophytes or even aquatic plants in permanent waterbodies. In its most basic form, it is dense *Typha capensis* or *Phragmites australis* beds with an assemblage of grasses such as buffalo grass *Stenotaphrum secundatum* and vlei grass *Paspalum vaginatum*. There are many variations to this theme and the species composition varies throughout the Western Cape.

A unique wetland that occurs at higher altitudes in the Cape Fold Mountains deserves mention. They are commonly referred to as sponges. These are peaty marshlands, occasionally dominated by *Sphagnum* moss that can hold moisture throughout the year. They are the source of many of our rivers. They are easily damaged by trampling and fire – leading to increased runoff and erosion.

Estuarine wetlands comprise a separate vegetation unit – **Cape Estuarine Salt Marshes**. This unit is found on estuarine flats and low riverine terraces that are subject to the effects of saline water. They occur as shrublands or low herblands dominated by Amaranthaceae, as meadows dominated by rushes and sedges, or even eelgrasss (*Zostera capensis*) meadows at the lower boundary of the tidal zone.

Commonly occurring plants include *Chenolea diffusa*, seekoraal *Sarcocornia perennis* (and other species), glasswort *Salicornia meyeriana*, gansekos *Cotula coronopifolia*, fleshy plantain *Plantago crassifolia*, sea lavender *Limonium scabrum* and graminoids e.g. sea rush grass *Sporobolus virginicus*, steekbiesie *Juncus kraussii* and *Schoenoplectus triqueter*.

Cape Inland Salt Pans vegetation also occurs around seasonal pools that are found in depressions on young sandstone and limestone of the Bredasdorp Group close to the coast. Here the vegetation is similar to that of the periodic rivers, except when the substrate is sandstone-derived sand and the surrounding vegetation is fynbos. In these cases the Amaranthaceae are not dominant but rather the Gentianaceae (sea rose *Orphium frutescens* and centaury *Chironia decumbens*). Gansekos *Cotula coronopifolia*, carpet gazania *Dymondia margeretae* and grasses such as kweek *Cynodon dactylon* are also conspicuous.

succulent karoo & nama karoo biome

rivers and streams (lotic systems)

perennial

The alluvia of the lower Breede River between Worcester and Bonnievale, as well as those in the western and eastern Little Karoo (Succulent Karoo Biome) host a unique vegetation unit – **Muscadel Riviere**. This vegetation consists of complex riverine thickets dominated by soetdoring *Acacia karroo* with accompanying succulent and low vygie shrublands. Other dominant trees include Cape willow *Salix mucronata* and karee *Rhus lancea*. The shrub- and herblands host amongst others vleibos *Cliffortia strobilifera*, kruidjie-roer-my-nie *Melianthus comosus*, kraalbos *Galenia africana*, gannabos *Salsola aphylla*, muishond malva *Pelargonium glutinosum*, witspekbos *Roepera sessilifolium*, *Phragmites australis* and *Typha capensis.*

The narrow riverine flats of the Koedoesberg-Moordenaars Karoo, Prince Albert Succulent Karoo and Gamka Karoo harbour **Southern Karoo Riviere** vegetation. This vegetation unit is mostly found on valley alluvia as well as drainage lines. It is a thicket consisting of *A. karroo* and *R. lancea* fringed by tall shrubland. The drainage lines are dominated by bushman grass *Stipagrostis namaquensis*. Prominent tall shrubs include star-apple *Diospyros lycioides*, bobbejaanarm *Cadaba aphylla*, gwarrie *Euclea undulata* and pendoring *Gymnosporia buxifolia*.

The alluvial shrublands contain katkruie *Ballota africana*, skaapkaroo *Pentzia incana*, vingerkanna *Malephora uitenhagensis*, and the graminoid *Cenchrus ciliatus* with *Phragmites australis* forming extensive reedbeds.

periodic & ephemeral

The periodic and ephemeral rivers support the same vegetation units as that of the perennial rivers in the karoo biomes.

key issues

water quality

Nutrient input is an important driver in aquatic ecosystems. The river systems of the Cape Fold Mountains (CFM) are acidic to almost neutral (pH 5.0-6.9) and generally have a low nutrient load.

One of the reasons for the high plant species diversity in Fynbos and particularly on the highly leached sandstone substrates is in fact the overall low nutrient status of these soils. Even slightly differing ratios of limiting nutrients creates a new niche and a differing set of species to evolve. This is referred to as the diversity through adversity principle. Conversely in fertile soil systems minor changes in nutrient ratios are not reflected as changes in species diversity. An example is the *Typha capensis* reed beds found on nutrient-rich organic sludge. They have a low diversity compared to highly leached alluvia in a similar stretch of nutrient-poor river.

Having evolved in low nutrient states, the vegetation of the CFM systems are therefore sensitive and intolerant to an increase in nutrients. Effluent from agriculture and sewage works and stormwater from residential settings all contain excess nutrients and the effect on vegetation structure is marked. What was a species diverse system often becomes a mono-specific stand of bulrush *T. capensis* or fluitjiesriet *Phragmites australis*. It is interesting to note that bulrush thrives on organic pollution whereas a sudden proliferation of fluitjiesriet is indicative of inorganic (mineral salts) pollution.

Wetlands are particularly susceptible to eutrophication, as nutrients remain at the point of pollution. Once again a change in vegetation structure and composition is evident. In extreme cases the water will be turbid due to the proliferation of photosynthesising cyanobacteria. Once they have reached threshold proportions mass die-off occurs. During decomposition all available oxygen in the water is utilised leading to destruction of remaining aquatic life.

River systems of the Succulent Karoo and Nama Karoo Biomes are generally more nutrient rich and their vegetation units reflect this. The species composition reflects a flora adapted to high mineral inputs e.g. fluitjiesriet and the soutbos family Amaranthaceae. A rapid change in vegetation structure and species composition over a period is indicative of a change in water quality. Indicators are an increase in fluitjiesriet, annual grasses and forbs.

flow regime

Lotic systems originating in the CFM have very marked seasonal differences in flow regime. During winter they are in spate and the system flushes all accumulated material. In the middle and lower reaches, the water spills out over the floodplains and sediments and organic material are deposited. During summer, organic material once again accumulates in the river.

In the arid systems, the rivers are also scoured during the rainy season and the river deposits sediment and alluvium along its middle and lower course.

Large volumes of freshwater pour into the estuary, flooding the plains and depositing silt and mud in bays or inlets off the main channel. This flooding is usually sufficient to breach the sandbar that closes it during the dry season. The volume of water, as well as its season of flow, are important in maintaining the functioning of a river and its associated wetlands.

Abstraction from rivers, especially during the dry season, has a major impact on functioning. Many of the feeder streams are reduced to a series of pools with trickle flow between them during summer. These are the refugia for various invertebrate fauna – many of which are endemic to the Fynbos Biome. When too much water is abstracted these pools are no longer connected because of reduced flow and eventually stagnate. Wetlands connected to the river may also dry up and become invaded by grasses and other terrestrial vegetation.

Further to this is a lowering of the groundwater. All rivers have a subterranean river that is connected to them and when there is over-abstraction this subterranean river is simultaneously depleted. This has cumulative effects in that groundwater dependent systems are then negatively impacted and may also cease to function. In the arid regions, this is commonly seen as mass mortalities of soetdoring *Acacia karroo*.

The natural vegetation of the middle to lower reaches of perennial rivers in the Fynbos Biome affects the deposition and scouring of coarse grained sediments such as sand. The vegetation of these alluvia and braidings are adapted to flooding and survive by merely bending and flattening with the flow and offering no resistance. Invasive alien species do not behave in this fashion. Black wattle *Acacia mearnsii*, have thick rigid trunks and pose an obstacle to water passage. They deflect the water towards the riparian terrace and so cause the banks to erode – this accounts for the straight-edged banks that have become all too familiar. Furthermore, they are easily uprooted by scouring and then form log jams. Log jams form a barrage across the floodwaters and hold them back until they eventually burst. The damage caused by this type of flooding is disastrous.

estuaries

The cumulative impacts of decreased water quality and adjusted flow affect the estuary. Decreased flow leads to sedimentation and closing of the mouth for extended periods. Seasonal flooding scours the channel and removes or reshapes the sand banks in and around the mouth. In estuaries, where the seasonal flow is retarded the estuary becomes clogged with marine sands.

Occasionally the opposite also occurs. Excess water may also enter the system through stormwater and sewage return flow. This increased non-seasonal flow severely alters the functioning of an estuary. In many small estuaries the freshwater input in summer is insufficient to breach the mouth. The estuary would then be a safe haven for juvenile fish. Unfortunately, estuaries are artificially breached to release the excess water so as to protect homes that have been built within the flood line.

Recreational activities also impact on estuaries and the over-utilisation of resources is a major cause for concern. The plight of fish such as white steenbras *Lithognathus lithognathus* and dusky cob *Argyrosomus japonicus* needs no introduction. However, the destruction of habitat, in particular eelgrass *Zostera capensis* beds through collecting of bait organisms has somehow gone unnoticed. In large estuaries such as the Breede River, the mudflats are bare. Eelgrass is important for releasing nutrients such as phosphorous into the water, where it is utilised by plankton and is important as a refuge for fish as well as invertebrates, especially cracker shrimp.

Construction of additional jetties needs careful attention. Jetties cause erosion of banks and obstruct flow into and out of an estuary.

management objectives

"Sensitive, vulnerable, highly dynamic or stressed ecosystems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure" (National Environmental Management Act, 1998).

site environmental management plan

objective: *To have a site specific Environmental/Conservation Management Plan in place, to guide management actions required on a site scale.*

management actions:

- Commission a site specific EMP to be compiled;
- Use monitoring, observations and site specific requirements to inform further management actions required;
- Make recommendations for revision and highlight areas of under performance;
- Review site EMP as/when required, as defined in the EMP.

funding

objective: *To have an environmental management budget in place that allows for the implementation of this EMP and a site-specific EMP, through the development of a site Annual Plan of Operation (**APO**).*

management actions:

The landowner/manager is to prepare an APO. The APO will consist of the required operating and capital expenditure as well as planned funding sources through external agencies and programmes. The APO will consist of:

- A sustainable budget that is costed annually to allow for the implementation of the EMP.
- Complete an APO, using the template provided in the EMP Guide Tool, by year end of each year.

Opportunities for external funding and assistance do exist; see EMP Guide Tool for funding opportunities.

vegetation management

alien vegetation

objective: *To remove all invasive alien vegetation from the natural areas by the most cost-effective methods and the least amount of damage to the natural environment. Invasive alien vegetation transforms and replaces indigenous vegetation, adds to the fuel load, increasing the fire frequency and intensity, transforms the riparian zones, affects the functioning of aquatic ecosystems by altering water quality and flow.*

The **Best Practice Guideline: Alien Vegetation Management** provides the information required for control of the invasive alien flora.

Before any clearing of alien vegetation is initiated, it must be understood that when the programme starts, it must be implemented until completion. There is no value in *ad hoc* clearing, with no follow-up program.

management actions:

- Obtain an aerial photograph of the area whenever an official survey is undertaken, to assess plant growth and extent of alien infestation.
- Identify areas for clearing to ensure compliance with the Conservation of Agricultural Resources Act (CARA) regulations.
- Demarcate areas that will not be cleared of alien plant species initially (ensuring that the CARA regulations are complied with at all times).
- Removal of all invasive alien plant species from the natural areas, excluding those identified above.
- Regular assessment of invasive species control and intensity of invasion.

It may be necessary to contract certain tasks such as extensive alien vegetation clearing to private contractors if there is insufficient capacity within the staff establishment or if it is economically beneficial. All private contractors on site must however be strictly controlled.

natural vegetation

objective: *To ensure that the remaining areas of natural vegetation are best managed so as to contribute towards biodiversity conservation, retaining representative samples of our natural vegetation and habitats to allow for biodiversity and ecological processes to persist.*

management actions:

- Identify the vegetation type/s present on your property;
- Familiarise yourself with best conservation management practices for the particular vegetation type;
- Develop a plant species checklist;
- Contribute records of rare and threatened species and localities to SANBI;
- Map the location of rare and threatened plant species to inform management activities e.g. road/path placement;
- Make provision for seasonal monitoring, during spring and autumn months, of rare and threatened flora on site (where possible comment should be made on numbers of individuals and locality);
- A reintroduction plan must be prepared if areas are to be rehabilitated, stating species to be reintroduced and the source of material.

fauna management

objective: *To promote the conservation of indigenous fauna (the big and hairy and small and slimy alike), as an important component contributing to and maintaining ecosystem functioning.*

management actions:

- Develop faunal species lists including mammals, birds, reptiles, amphibians, arachnids and scorpions, and other invertebrates;
- Conduct at least *ad hoc* monitoring of faunal populations and maintain recordkeeping;
- Contribute significant records and localities of fauna to the Atlas databases at the Animal Demography Unit (**ADU**) at University of Cape Town (**UCT**);
- Ensure that management and recreational activities do not impact on sensitive species i.e. control the collection of bait organisms;
- Implement responsible problem animal management, where necessary, ensuring to be in possession of the relevant permits;
- Eradicate invasive exotic faunal species, where necessary, ensuring to be in possession of the relevant permits;
- Limit the impact (competition and predation) by domestic animals on indigenous species. Where residential estates abut natural areas, it may be necessary to compile a policy on pets. It is preferable to be proactive in this regard.
- Compile a policy on introduction (accidental or deliberate) of potentially invasive species (e.g. wildfowl) or wild animals previously kept as pets e.g. terrapins which could genetically pollute local races or harbour geographically isolated diseases.
- Commission a reintroduction policy and plan for species that previously naturally occurred in the area, for example, whitefish *Barbus andrewi* in the Breede River.

Before **reintroduction** the following points need to be considered:

- Was the desired species naturally resident in the area?
- Why did the animal become extinct in the area?
- Is that causal factor still a threat?
- Is the habitat still suitable for the species?
- What are the potential negative effects of the reintroduction?
- Where is the nearest existing population?

The careful reintroduction of species can enhance the conservation value of the area and increase the marketability of the site. All reintroductions must be based on sound ecological principles. CapeNature must be consulted on the translocation and reintroduction of all fauna.

surface- & groundwater management

objective: *To maintain the quality and quantity of water resources in a near natural state as possible, as per the National Water Act (NWA) 36 of 1998, as potable water resources and to prevent significant lowering of the water table that will adversely affect other ecosystem components and processes, such as wetlands.*

management actions:

- Commission a hydrological survey to establish the following: seasonal flow rates, current water usage and appropriate abstraction rates based on the Ecological Reserve;
- Ensure that the relevant authority (CMA or DWAF) implements a water quality monitoring programme;
- Audit and map potential points of pollution;
- Obtain qualified advice for placement and management of solid waste disposal systems, so as to prevent contamination;
- Implement a pollution monitoring programme;
- Have a remediation procedure, in the event of pollution incidents.

access management

objective: *To inform the best placement and management of access points and pathways, avoiding insensitive sitings of these and allowing livestock unrestricted access to sensitive process areas such as wetlands, drainage lines and seeps.*

management actions:

- Conduct an audit of the siting and condition of existing access points and pathways;
- Identify suitable access points and pathways, and decommission those in sensitive process areas;
- Don't allow livestock to have unrestricted access to riparian zones, only for short periods (seasonal) for grazing;

- Maintain pathways/boardwalks to ensure its use and not the making of alternative routes;
- Implement a rehabilitation programme, where this is required.

use of living resources

objective: *To ensure sustainable use of natural resources and minimise adverse effects on biodiversity and ecosystem processes.*

See the **Best Practice Guideline: Sustainable Utilisation of Natural Resources** for more detail.

recreation & tourism management

objective: *To ensure the appropriate use of natural areas for recreation and tourism and minimise detrimental impact on biodiversity and sensitive processes.*

See the **Best Practice Guideline: Recreation & Tourism Use** for more detail.

road maintenance & erosion control

objective: *To ensure that geomorphological processes and soils are adequately understood and impacts thereon duly minimised, avoiding the consequent loss of natural resources and habitat.*

management actions:

- Identify and understand erosion sources;
- Prioritise erosion problems requiring control efforts;
- Where the terrain has sustained damage due to excessive trampling and/or past access by vehicles, implement a rehabilitation programme. Have measures in place to prevent further erosion damage;
- Road and footpath erosion control must be monitored and managed on an ongoing basis;
- Records should be kept (preferably photographs) of previous erosion management, in order to measure effectivity;

See the **Best Practice Guideline: Sensitive Development** for more detail.

signage & awareness

objective: *To inform of the sensitivity and value of biodiversity features and ecosystem processes, and to facilitate the appropriate use thereof.*

management actions:

- In order to achieve the above, three types of signage need to be considered: **directional**, **informational** and **interpretational**. The first guides visitors to and around the area, while the second provides information on some aspects of the area and management (such as erosion control). Interpretation of the environment, the third form of signage, would focus on aspects such as functioning of the ecosystem in the natural areas, emphasising the unique biodiversity and ecological processes.
- Where necessary, a signage policy and manual should be compiled;
- Signs indicating the name of the site should be erected at all vehicular and pedestrian access points;
- Signage must be set up to inform of areas being rehabilitated;
- Awareness programmes must be initiated for the purpose of informing and educating residents and visitors regarding environmental sensitivity and interaction (e.g. snake encounters, the value of biodiversity, biological monitoring and rehabilitation)

fencing

objective: *Where necessary, fence areas for access control and management.*

While a definite demarcation of the boundary of natural areas helps visually establish such areas as being of conservation value, rather than simply vacant open space, fencing also limits the natural transit of wildlife and therefore ecosystem processes. It is apparent that continuity of best practice conservation management is required across cadastral boundaries in order for the broader ecosystem to best benefit from holistic management.

management actions:

- Where possible, internal and common cadastral fencing should be removed to allow for connectivity;
- Appropriate fencing should be used, and where possible jackal-proof and electric fencing should be avoided;
- Public road-side boundaries should be well demarcated for access control and to prevent wildlife road kill;
- All roads not for public vehicular access must have locked gates;
- Stiles may be placed over fences to allow access along approved pedestrian paths;
- Where fencing hinders the natural transit of wildlife, provision must be made for thoroughfare e.g. bottom fence strand raised for tortoises;
- Fence line and access gates should be regularly inspected.

archaeological and heritage features

objective: *To ensure that the archaeological and heritage aspects of the site are protected as defined in the Natural Heritage Resources Act 25 of 1999.*

management actions:

- Inform SAHRA of potential heritage features on site and acquire advice on protection measures. These features may be of significant archaeological importance and damage to these features would lower their archaeological value and possibly their tourism value;
- Keep record of heritage features on site;
- Prevent any damage to these features.

monitoring and recordkeeping

objective: *To evaluate management actions of the site as well as monitor biodiversity components and ecological processes. Data can contribute towards regional conservation plans and initiatives and further highlight conservation priorities.*

management actions:

- It is critical that sites collect baseline information (resource inventory) as a priority;
- Establish a plan of action/objective for monitoring of specific features, components and processes;
- Describe methods used and maintain these;
- Map fixed monitoring sites or features to be monitored, preferably with a GPS;
- Keep data safe and have duplicates;
- All research activities (external studies) are to be controlled i.e. written permission granted with the condition that a copy of the final research report is provided;
- Manager to compile monthly report, incorporating all incidents, significant events and findings and operations that have taken place.

staff training and skills development

objective: *To continually capacitate and train staff in environmental knowledge and a range of skills and enhance their capacity.*

management actions:

- Staff training should include the following:
  - Regular fire training and fire exercises
  - Use of appropriate machinery, tools and technology
  - Public relations and interactions
  - Ecosystem components
  - Management training
  - Waste management & recycling
  - Use of herbicide application
  - Methods for alien vegetation control

ecological connectivity

objective: *Identify suitable corridors or expansions for connecting natural and protected areas to improve the overall resilience of the protected area and allow processes to function at an appropriate scale and so allow for holistic management of the ecosystem.*

management actions:

- Liaise with CapeNature Regional Office regarding expansion and connectivity opportunities;
- Approach and liaise with neighbours in this regard;
- Draw up a Memorandum of Understanding or contractual agreement between neighbours detailing areas of responsibility amongst others.

voluntary conservation

objective: *Consider proclaiming natural areas for conservation in perpetuity, via the CapeNature Stewardship program.*

management actions:

- Familiarise with the three levels of **stewardship options** i.e. Voluntary Conservation Site, Biodiversity Agreement and Contract Nature Reserve;
- Landowner should contact local CapeNature stewardship coordinator to discuss options and benefits.