

PARADYSKLOOF NATURE AREA

ENVIRONMENTAL MANAGEMENT PLAN

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1 INTRODUCTION

1.1 PURPOSE

The purpose of this Environmental Management Plan (EMP) is to establish a distinct vision and overarching goal for the management of the Paradyskloof Natura Area (from hereon referred to as the Paradyskloof NA or simply the NA) in context of the relevant legislation and associated regulations. Accordingly, the primary aims of this EMP include the following:

- a) Facilitating the rehabilitation and long-term conservation of the Paradyskloof NA.
- b) Promotion of a conservation ethos in the minds of the people of the area and the general public with the objective to create a shared responsibility to maintain the health, diversity and productivity of the area in a spirit of stewardship and caring.
- c) Implementation of management practices that will benefit current and future generations.
- d) Provision of sustainable outdoor recreational opportunities in the area.
- e) Ensuring that future growth and development proposals for Stellenbosch are compatible with the vision, goals and objectives for the area and associated ecological systems.

1.2 VISION

In order to balance the conservation requirements of the Paradyskloof NA with the aspirations of all stakeholders and the place-specific environmental, social and economic constraints, the following vision is set for the area:

To manage and protect the Paradyskloof Nature Area as a sustainable and safe area which is recognised and valued for its environmental integrity and community-supporting functions.

1.3 OVERARCHING GOAL

The over-arching goal of the Paradyskloof NA is to contribute towards environmental sustainability and the conservation of biodiversity as a prerequisite for the latter. This EMP builds on the recognition that for biodiversity conservation to succeed, the maintenance of environmental integrity (as defined by ecological, economic and social criteria) must be one of the primary determinants of land-use planning and management.

Sustainability, under present circumstances, cannot be achieved without any form of management intervention and such intervention has to be financed to a significant extent. Accordingly, sustainable development projects or use within the area should ideally contribute towards the required financing of management activities in a spirit of partnership.

The CSIR (2002) states that sustainable development should *improve the state of any given situation*. Sustainable development requires a long-term, integrated, systems approach pertaining to economic, environmental and social issues. Fostering a strong sense of community and building partnerships and consensus among key stakeholders are important elements of sustainable development (CSIR, 2002). The International Union for the Conservation of Nature (IUCN) defined sustainable development as *'development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs'*.

The International Institute for Sustainable Development (IISD) (1995) states that sustainable development occurs at the intersection of three global imperatives, namely *human well-being*, *environmental integrity* and *economic efficiency*. The interactive model of sustainability illustrates that sustainable development occurs where the three imperatives interact within an 'interactive zone' (Figure 1). Development outside this 'interactive zone' will not be sustainable. Mebratu (1998).¹ The EMP builds on the following understanding of the three global imperatives:



Figure 1: The interactive model of sustainability (Adapted from Mebratu, 1998).

1.3.1 Human Well-Being

Human well-being refers to both *material* and *spiritual* well-being. Material well-being refers to the absence of poverty. Spiritual well-being *inter alia* refers to the absence of inequality and being in a position to obtain new powers, emotionally, intellectually and physically and to be able to play a meaningful role in promoting and achieving sustainable development. It is recognised that the Paradyskloof NA has a significant impact on the well-being of the people of Stellenbosch and surroundings in terms of a number of important aspects.

1.3.2 Environmental Integrity

Environmental integrity refers to the relative '*wholeness*' of the environment. 'Environment' is defined as the aggregate of all external conditions and influences affecting the life of an organism. Environmental integrity is determined by the *value* of the environment or place (natural or human-made), with specific reference to its intrinsic, systemic, and/or instrumental value. The EMP builds on the recognition that the human-made environment is located within and 'contained' by the natural environment. The manner in which human settlements are developed, therefore, has an immense impact on the quality and integrity of the environment as a totality. It is therefore imperative that the human-made environment be planned, designed and developed in a manner that will ensure the maintenance of the values referred to above (i.e. intrinsic, systemic, and/or instrumental value). From a natural environmental perspective, ecological integrity is a key factor in the sustainable development equation. Ecological integrity *inter alia* requires that biodiversity is protected and essential ecological processes and services (e.g. water yield and quality, soil conservation, decomposition, etc.) are maintained. *Environmental health* is the key to sustainable development. The primary threat to environmental health is fragmentation of community-supporting ecosystems. Fragmentation generally leads to a cycle of environmental degradation, which subsequently influences the well-being of the dependent communities.

1.3.3 Economic Efficiency

Economic efficiency is understood as *the optimisation of benefit at the lowest cost*. It includes the innovative and efficient use of available resources. The Paradyskloof NA is an important public

¹ Mebratu, D. 1998: Sustainability and sustainable development: Historical and conceptual overview. *Environmental Impact Assessment and Review*, 18:493-520.

resource that has to be managed for the benefit of all concerned and in terms of best-practice management strategies in order to ensure efficiency.

1.4 GUIDING PRINCIPLES

It is important that the following principles guide future management of the Paradyskloof NA:

- i. Precautionary principle: The precautionary principle refers to actions on issues considered to be uncertain. The principle is used by policy makers to justify discretionary decisions in situations where there is the possibility of harm from making a certain decision when extensive scientific knowledge on the matter is lacking. Precaution may be defined as *caution in advance* or *caution practised in the context of uncertainty*. The precautionary principle is an expression of a need by decision-makers to anticipate harm before it occurs.
- ii. Causal principle: This principle indicates means that default responsibility for rectification or mitigation of any particular impact rests with the entity which directly caused such impact. While the more well-known polluter pays principle is a subcategory of this, the causal principle applies not just to pollution but more generally to all impacts.
- iii. Integration principle: The Integration principle refers not only to the cooperation between different social bodies, but also to the integration of different physical, biological and social realities and issues pertaining to a particular geographic area.
- iv. Cooperation principle: Government as well as the private sector, non-governmental organisations and science all need to be involved to ensure sustainability. Successful long-term environmental management requires that all role players to act cooperatively to achieve a common goal.

2 PLANNING CONTEXT

Stellenbosch Municipality (hereafter also referred to as the Municipality) has directed that the bioregional planning approach advocated by the Provincial Government of the Western Cape through its Bioregional Planning Policy and comprehensively described in the *Manual for application of Bioregional Planning in the Western Cape* (PGWC, 2003) be adopted in municipal planning projects.

The Municipality recognises that one of the critical determinants of the success of an EMP planned in term of the bioregional planning approach is the extent to which all spheres of government co-operate and co-ordinate their activities as it relates to the subject area. This EMP therefore gives effect to the requirement that the planning and management of land units should be undertaken within the context of distinct levels, namely the *national level*, *provincial level* and the *local level* (see Figure 2). Effective integrated planning at these levels requires innovative forms of institutional integration and co-operation. Dialogue amongst all stakeholders, participatory planning and institutional flexibility are, therefore, essential to plan and manage effectively.

The Paradyskloof NA EMP responds to the relevant legislation, policy and regulations, the most important of which are summarised below.

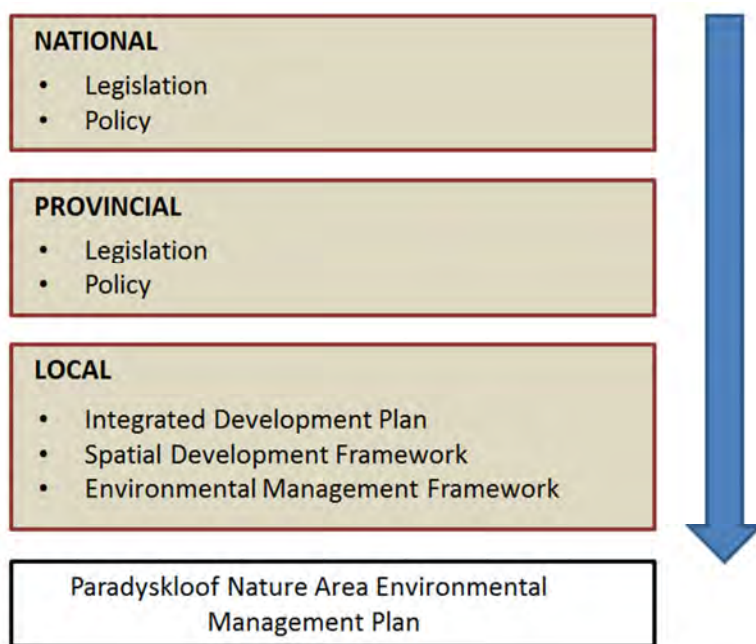


Figure 2: Planning levels applicable to the Paradyskloof NA EMP.

2.1 NATIONAL

2.1.1 South African Constitution

The South African Constitution, Act 108 of 1996, places an obligation on all to ensure that sustainable development is promoted and that the integrity of the environment is respected. In Section 24(b)(iii) of the Bill of Rights chapter of the Constitution, it is stated that ‘everyone has the right to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that secure ecologically sustainable development and use of natural resources, whilst promoting justifiable economic and social development’.

2.1.2 National Environmental Management Act

Section 28 of the National Environmental Management Act, 107 of 1998 (NEMA), creates a general duty of care on every person to *take reasonable measures to prevent significant pollution or degradation of the environment from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment*. The Act provides for the preparation of environmental management plans by the relevant departments involved in the management of the environment.

2.1.3 National Environmental Management: Biodiversity Act

The National Environmental Management: Biodiversity Act, 10 of 2004 (NEMBA), has the following objectives:

- a) To provide for the management and conservation of South Africa's biodiversity within the framework of NEMA.
- b) To provide for the protection of species and ecosystems that warrant national protection.
- c) To provide for the sustainable use of indigenous biological resources.
- d) To provide for the fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources.

2.1.4 National Environmental Management: Protected Areas Act

The National Environmental Management: Protected Areas Act, 57 of 2003, provides for the protection and conservation of ecologically viable areas, for the management of those area, for intergovernmental co-operation and public consultation in matters concerning protected areas, and for matters in connection therewith.

2.1.5 National Water Act

The purpose of the National Water Act, 36 of 1998, is to ensure that South Africa's water resources are protected, used, developed, conserved and controlled in a manner that takes into account, amongst others, basic human needs, equitable access thereto, the promotion of efficient, sustainable and beneficial use of water, facilitation of social and economic development, and protection of aquatic and associated ecosystems.

2.1.6 National Veld and Forest Fire Act

Veld fires in South Africa are dealt with under the National Veld and Forest Fire Act, 101 of 1998. The purpose of the National Veld and Forest Fire Act is *to prevent and combat veld, forest and mountain fires throughout the Republic*. The Act places the duty on land owners to make provision for the management of veld fires on their own land. Failure to do so may result in penalties being enforced and claims lodged against a landowner if the above Act's requirements were not met. In terms of the National Veld and Forest Fire Act the following responsibilities apply to landowners:

- a) *The landowner on whose land a fire may start, or from whose land it may spread across boundaries, must have in place:*
 - *Such equipment, protective clothing and trained personnel required to extinguishing such fire as may occur as prescribed in the FPA (Fire Protection Association) regulations.*
 - *If there are no regulations applicable, then as reasonably required in the circumstances.*
 - *Take all reasonable steps to notify the Fire Protection Officer (FPO) of the local FPA should a fire break out.*
 - *Do everything in their reasonable power to stop the spread of the fire.*
- b) *The Act also requires that should the owner be absent, a known and identified other person responsible needs to be present on or near this land to:*
 - *Extinguish a fire if one breaks out, or assist or instruct others to do so.*
 - *Take all reasonable steps to alert the neighbours and the FPO.*
 - *The owner may appoint an agent to act on his or her behalf to perform these duties.*

2.1.7 National Heritage Resources Act

South Africa' heritage are dealt with under the National Heritage Resources Act, 25 of 1999, which aims to *promote good management of the national estate, and to enable and encourage communities to nurture and conserve their legacy so that it may be bequeathed to future generations.*

2.1.8 Conservation of Agricultural Resources Act

The purpose of the Conservation of Agricultural Resources Act, 43 of 1980 (CARA), is to provide control over the utilization of the natural agricultural resources in order to promote the conservation of soil, water sources and the vegetation and the combating of weeds and invader plants.

2.1.9 Spatial Planning and Land Use Management Act

The Spatial Planning and Land Use Management Act, 16 of 2013 (SPLUMA), includes the following stipulations:

Land use planning principles and objectives

Section 59 (4): To promote environmental integration in land use planning, a competent authority must—

- a) *strive towards ecologically, socially and economically sustainable development, taking into account —*
 - (i) *the economic potential of the relevant area or region;*
 - (ii) *biodiversity;*
 - (iii) *social needs;*
 - (iv) *cultural heritage resources;*
 - (v) *agricultural resources*
- b) *ensure that development heeds the natural processes that control the relevant area;*
- c) *strive to achieve development that is harmonised with the ecological characteristics of the environment;*
- d) *promote the conservation and management of biodiversity;*
- e) *discourage development in unsuitable environments such as —*
 - (i) *areas with a high water table;*
 - (ii) *swamps;*
 - (iii) *flood plains;*
 - (iv) *steep slopes;*
 - (v) *areas sensitive to drift-sands and sea-level rise;*
 - (vi) *areas with high biodiversity importance;*
 - (vii) *areas with important cultural and scenic landscapes —*
- f) *minimise the fragmentation of natural habitat in ecological corridors and areas with high biodiversity importance;*
- g) *facilitate soil conservation and the control of pollution;*
- h) *address the land use implications of —*
 - (i) *the provision and conservation of energy;*
 - (ii) *the management of the demand for energy;*
 - (iii) *climate change mitigation and climate change adaptation strategies;*
- i) *protect the cultural heritage and tourism resources of the Municipality.*

2.2 PROVINCIAL

2.2.1 Constitution of the Western Cape Province

The EMP supports and gives effect to the Constitution of the Western Cape, Act 1 of 1998. In terms of Chapter 10 of the Constitution this province has to adopt and implement strategies to actively promote and maintain the welfare of the people and the environment of the Western Cape, including policies aimed at achieving inter alia the following:

- a) Safety and security.
- b) The protection or advancement of persons, or categories of persons, disadvantaged.
- c) The promotion of a market-orientated economy.
- d) The development of rural communities and the promotion of the welfare of rural workers.
- e) The protection of the environment of the Western Cape, including its unique fauna and flora, for the benefit of present and future generations.
- f) The protection and conservation of the natural historical, cultural historical, archaeological and architectural heritage of the Western Cape for the benefit of present and future generations.

2.2.2 Land Use Planning Act

The SPLUMA and the Western Cape Land Use Planning Act, 3 of 2014 (LUPA), require that spatial planning and development be guided by normative principles and that policy and plans should explicitly indicate how they would meet the requirements of such principles. These principles are:

- a) Justice: Fair allocation of public resources to ensure that the needs of the poor are addressed.
- b) Sustainability: Sustainable patterns of consumption and production should be supported, and ways of living promoted that do not damage the natural environment.
- c) Resilience: Vulnerability to environmental degradation, resource scarcity and climatic shocks must be reduced. Ecological systems should be protected and replenished. The resilience of all other forms of capital, including social, monetary and infrastructural capital should be enhanced to the extent possible.
- d) Efficiency
- e) Good governance: Good governance is the key to long-term sustainability.

2.2.3 Western Cape Provincial Spatial Development Framework

The Western Cape Provincial Spatial Development Framework (generally referred to as the PSDF) is aligned with the National Spatial Development Perspective (NSDP) and other national policy frameworks, and endorses the vision of the Western Cape Provincial Government to create 'A Home for All'. The PSDF is purported to support the development growth path paved by the iKapa Elihlumayo Strategy and the other lead strategies.

2.2.4 Provincial Bioregional Planning Policy

As stated above, the PGWC is advocating a bioregional planning approach as described in the *Manual for application of Bioregional Planning in the Western Cape* (PGWC, 2003). The Stellenbosch Municipality has adopted the said approach for the planning, development and management of its area of jurisdiction.

2.3 LOCAL

2.3.1 Stellenbosch Integrated Development Plan

The Stellenbosch Integrated Development Plan (IDP) includes a needs-analysis, which puts forward a number of needs for each particular area within the municipality.

2.3.2 Stellenbosch Spatial Development Framework

The primary goal of the Stellenbosch Spatial Development Framework (SDF) is to give practical effect to the mission statement of the people of the local municipal area, as expressed in the SDF of the Stellenbosch Municipality, namely: *'The spatial development framework of the Stellenbosch Municipality should be measured by the 'triple bottom line' of economic efficiency, environmental sustainability and social justice with an emphasis on the issues facing the rural and urban poor.'*

2.3.3 Stellenbosch Environmental Management Framework

The Stellenbosch Environmental Management Framework (SEMF) is Stellenbosch Municipality's strategic environmental management policy that responds to and complies with the relevant statutes and directives. As such, the SEMF serves as a:

- a) Spatial and strategic supplement to the SSDF.
- b) Policy for ensuring environmental sustainability and for the aligning/integrating land-use activities in accordance with defined sustainability objectives.
- c) Strategy towards enhancing the well-being of the people and the environment of the Municipality by providing for:
 - (i) A uniform, effective and comprehensive system of environmental planning and management throughout the Municipality.
 - (ii) Environmental and sustainability principles, norms and standards.
 - (iii) Sustainable and efficient use of land and other forms of environmental capital.
 - (iv) Providing for cooperative governance and intergovernmental relations within the sphere of the Municipality and between the latter and all other institutional spheres and the private sector.
- d) A compilation of and alignment directive for the strategies and plans of the various sectoral departments and directorates of the Municipality.

2.3.4 Stellenbosch Municipality: By-Law Relating To Plantations, Parks, Gardens, Recreational Facilities And Nature Reserves (P.N. 373/1988)

According to the above by-law *no person shall in or on premises, buildings, land, plantations, a commonage, enclosures, nature reserves, parks, gardens, open erven and spaces, picnic areas, nurseries, trees, sport and recreation facilities which are vested in or under control of the Council –*

- (a) *disfigure or deface any post, railing, fence, seat, barrier, gate, notice board, plate, house, building, shed, urinal, closet, flag, mark or other article or thing by pasting thereon or affixing thereto in any way any bills, papers, placards or notices or by cutting, writing, stamping, painting, drawing or marking thereon in any way whatsoever,*
- (b) *remove, destroy, damage or deface any notice or sign,*

- (c) *make a fire or commit any acts whereby a fire may be caused, except in places where fireplaces are provided;*
- (d) *saw, cut, gather, remove dig up, burn, pick or break any timber, tree, shrub, brushwood, fencing, pole, lawn, plants, fruits, flower or equipment, or climb therein or thereon or damage it in any way;*
- (e) *remove or disturb any soil or water at a place other than that specially provided by Council;*
- (f) *erect or cause to be erected any post, rail, fencing, tent, screen, stand, swing, building or construction of whatever nature without the written permission of the Council;*
- (g) *park, drive, ride pull or propel any type of vehicle except a manually operated wheelchair or perambulator when used for the conveyance of an invalid or a child;*
- (h) *leave any refuse, building waste, rubbish, paper, materials or any object except in containers provided for that purpose;*
- (i) *injure, kill, hunt, capture, or disturb any animal or bird, or damage or destroy the nest or eggs of any bird or interfere with the animal life in any other way;*
- (j) *break, damage, hurt, destroy, disfigure or remove any flora, fauna or nest of fauna or objects of historical or scientific interest or any property in the nature reserve;*
- (k) *introduce any flora, fauna, weapon, trap, net, explosive or poison into the nature reserve, or be in possession thereof in the nature reserve;*
- (l) *fire a fire-arm or an air-gun, discharge any firework, catapult or sling or throw a stone or other missile;*
- (m) *in any other way cause a nuisance, obstruction, disturbance or annoyance to the public, to brawl, fight, swear or use obscene, indecent or improper language, gamble, beg, behave in an indecent or offensive manner or drink intoxicating liquor;*
- (n) *sell or offer for sale or hire, or hawk or exhibit any article or distribute any pamphlet, book, handbill, or other matter;*
- (o) *present any public entertainment;*
- (p) *play a musical instrument, and*
- (q) *deliver or say any speech, public address or prayer of whatever nature or sing any song or hold or participate in any public meeting or function unless he has previously obtained the written permission of the Council to do so;*
- (r) *enter upon any ablution or sanitary conveniences indicated as having been provided for persons of the opposite sex;*
- (s) *enter or leave other than by an entrance or exist provided for that purpose, or*
- (t) *refuse to leave when requested to do so by an authorised officer of the Council or a member of the South African Police;*
- (u) *wash any article or animal under a tap, in a pond, fountain or in an ornamental pond or otherwise pollute water, or*
- (v) *swim in a dam or wash any clothes or other things or pollute the water therein in any other manner, and*
- (r) *perform any act whatsoever which may injure persons, damage or destroy any property.*

3 PROPERTY DESCRIPTION

3.1 LOCATION

The Paradyskloof NA is located within Stellenbosch Municipality (refer to Figure 3) on the south-eastern edge of the town of Stellenbosch. It is bordered by University of Stellenbosch owned farm land and nature areas to the north, Stellenbosch Mountain to the east and privately owned farm land to the south.

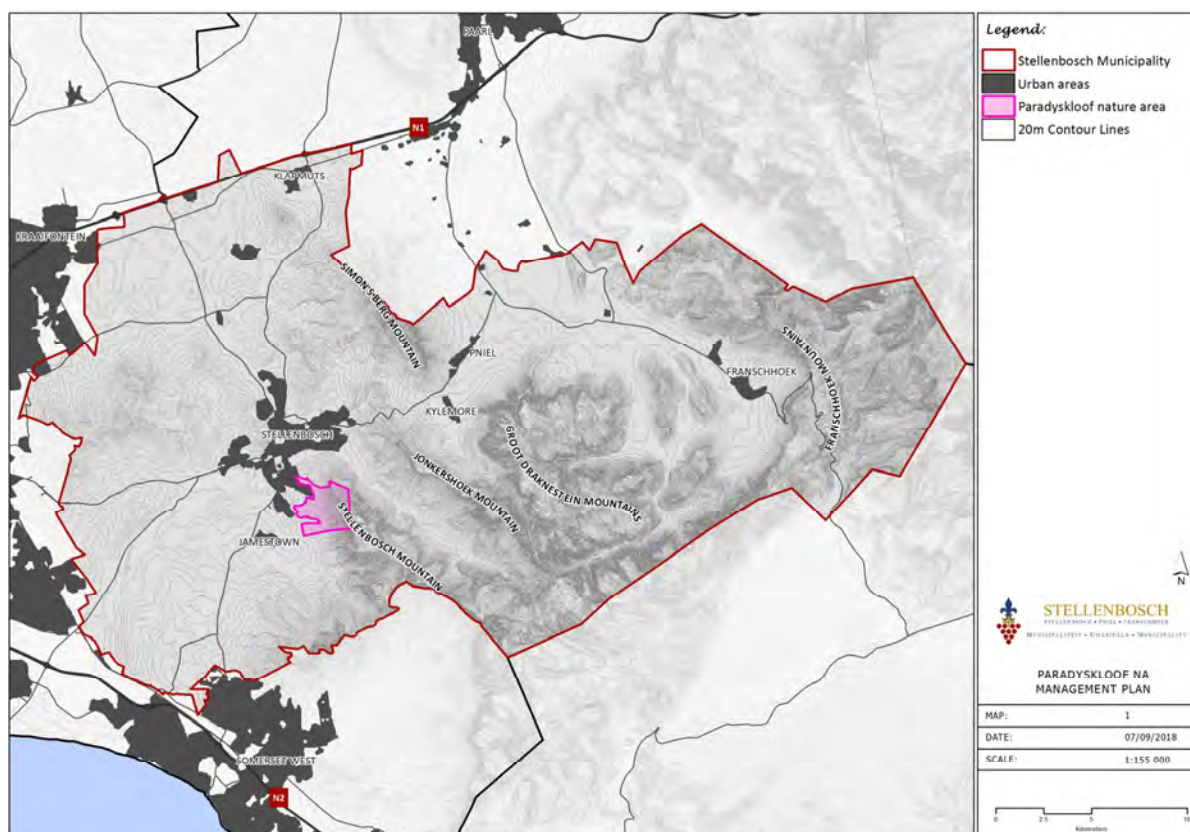


Figure 3: Paradyskloof nature area in context of Stellenbosch Municipality

To the west the area is bordered by the Paradyskloof- and Brandwacht neighbourhoods of Stellenbosch town and land used for farming purposes (Figure 4). The area consist of Portion 2 of Farm 368 and portions of Farms 369 and 366 with a total area of approximately 550 ha. The relevant property is municipal owned land and zoned for agricultural purposes.

The eastern, mountainous, half of the area has always been kept in a natural state with the western half largely used for forestry. Most of the timber have, however, been harvest with an approximately 40 ha portion still planted with pine trees.

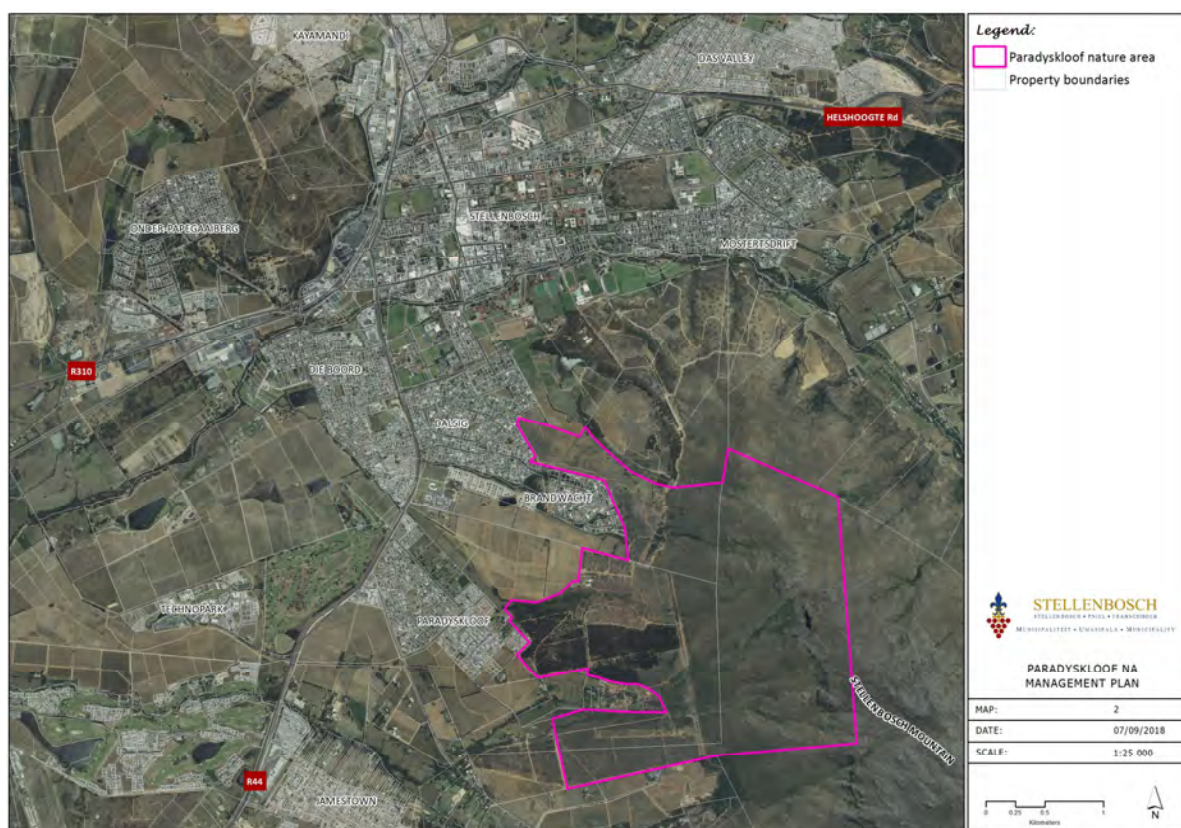


Figure 4: Paradyskloof NA in context of Stellenbosch town

3.2 LANDSCAPE PERSPECTIVE

The Municipality forms part of the Cape Winelands Biosphere Reserve (CWBR) which was approved by United Nations Educational, Scientific and Cultural Organization (UNESCO) and included in the World Network of Biosphere Reserve during 2007. The Paradyskloof NA forms part of a system of nature-and/or protected areas that collectively form the core and buffer areas of the CWBR. This system is based upon the principle that a system of protected areas is a key element of any strategy to maintain biodiversity and ecosystem functions on a larger regional scale. It is imperative that such a system be designed and managed to represent and protect the diversity of ecological processes, communities, species and gene pools (Global Biodiversity Strategy, 1992).

Various protected areas in the proximity of the Paradyskloof NA include the Papegaaiberg Nature Reserve, Jan Marais Nature Reserve, Jonkershoek Conservancy, Bottelary Hills Renosterveld Conservancy, Hottentots-Holland Nature Reserve, Koopmanskloof Private Nature Reserve and Simonsberg Nature Reserve (Figure 5).

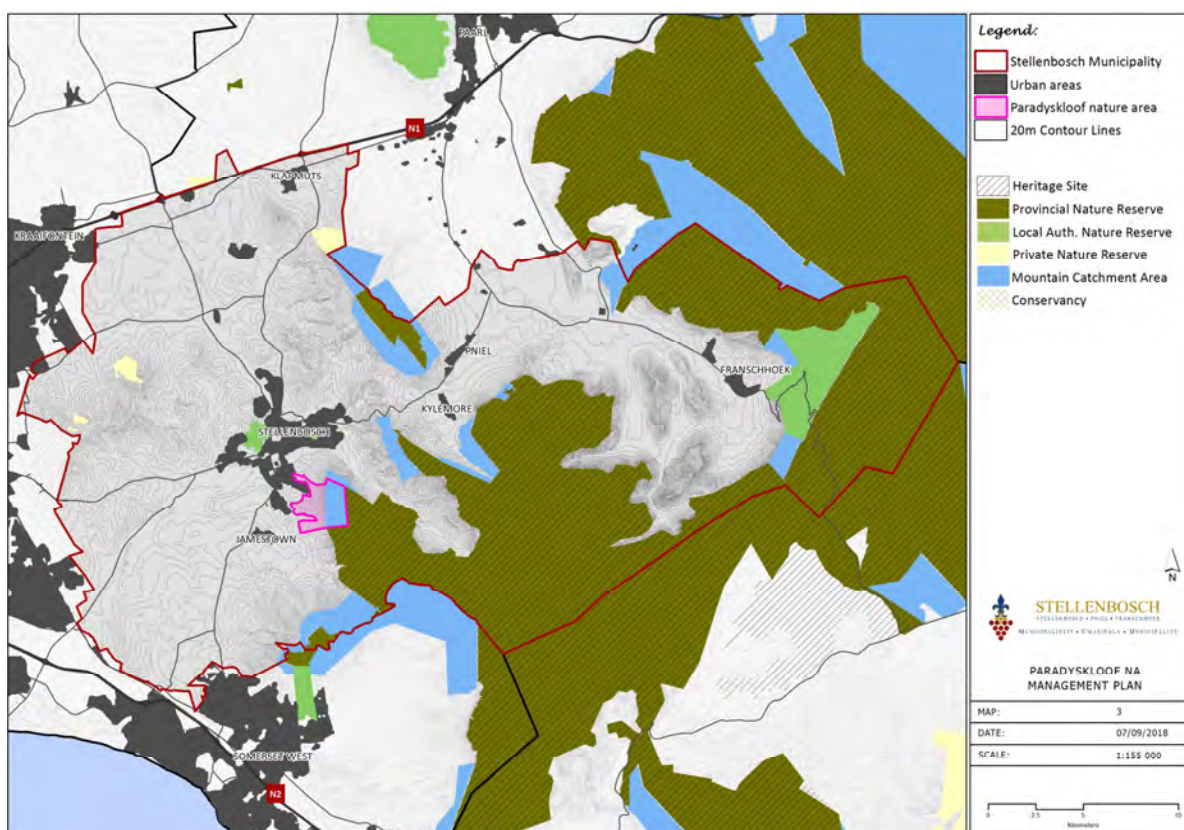


Figure 5: Paradyskloof NA in context of surrounding protected areas

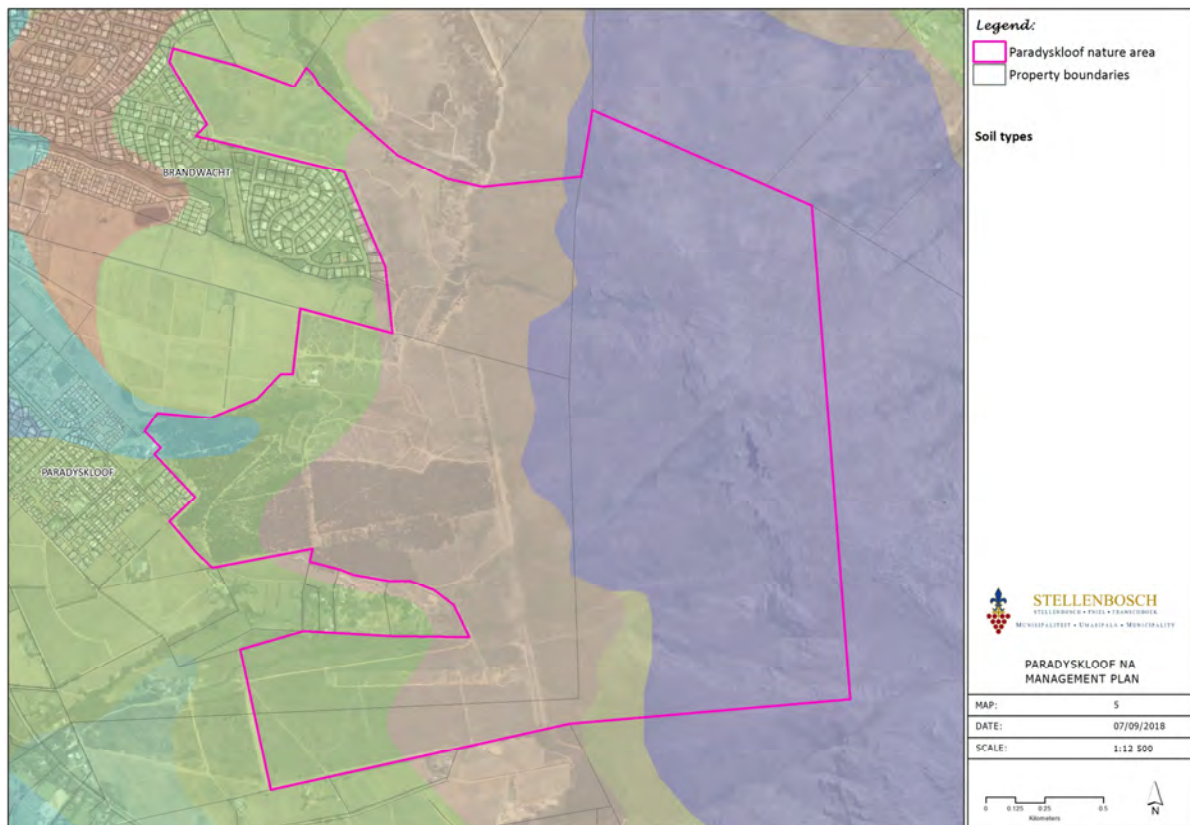
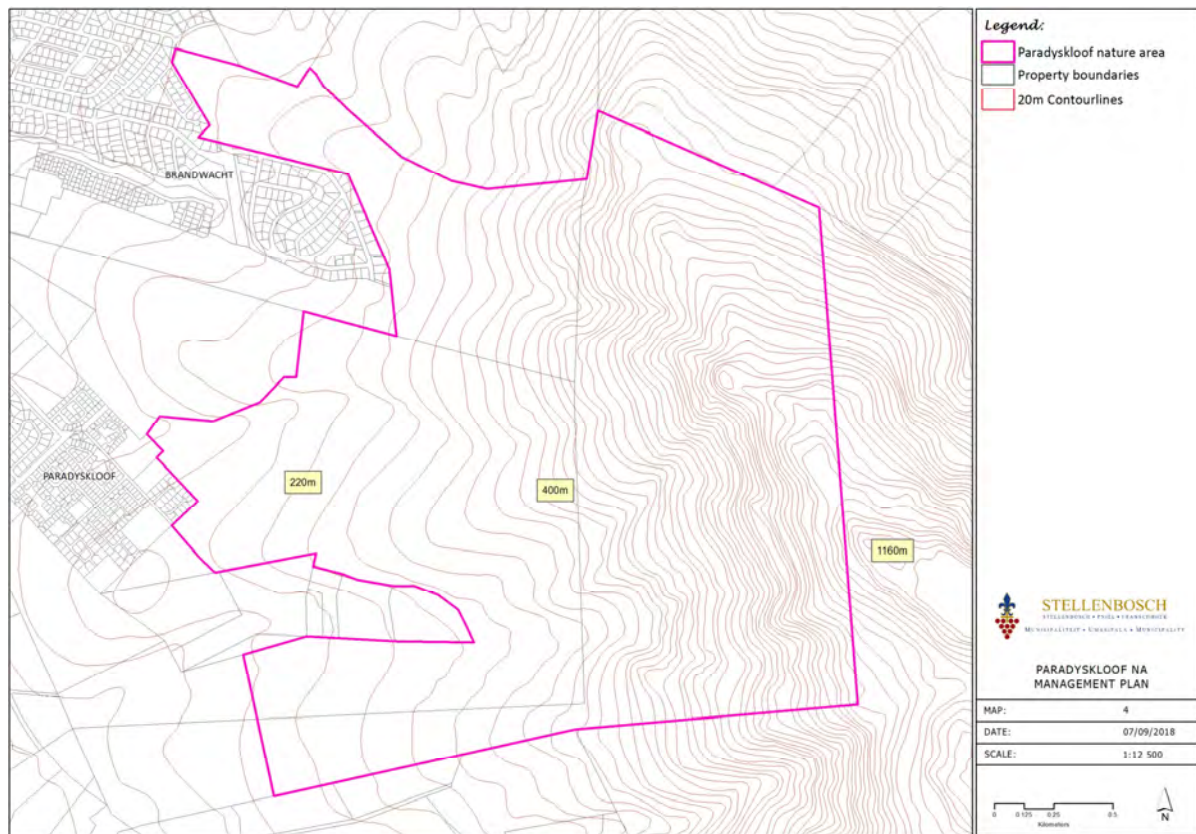
3.3 BIOPHYSICAL CHARACTERISTICS

3.3.1 Climate

Stellenbosch has a typically Mediterranean climate. Summers are dry and warm to hot. Daytime temperatures range from 24°C to 35°C, with some February and March days rising to over 40°C. A south easterly wind often blows in summer bringing cooler air from the nearby coast. Winter is typically wet, windy and cold with daytime temperatures range from 10°C to 20°C. Rains are brought with north westerly winds. Stellenbosch normally receives about 673mm of rain per year. Snow is usually seen a couple of times in winter on the surrounding mountains. Spring and autumn daytime temperatures hover in the 20°C's.

3.3.2 Topography

The Paradyskloof NA slopes upward from its lowest point closest to Brandwacht, at 160 meters above seal level, to the east rising to approximately 1050 m at its highest point. The north-south firebreak, dividing the property in half, is located at 350 m above sea level. Apart from the steep slope the area is characterised by three valleys draining from Stellenbosch Mountain towards the Eerste- and Blaauwklippen Rivers respectively.



3.3.3 Soil

The higher lying areas of Paradyskloof NA is dominated with rock with little to no soil. The lower lying, or western portion of the Paradyskloof NA consist of red and yellow freely drained mesotrophic to eutrophic soils.

3.3.4 Hydrology

The Paradyskloof NA borders the Hottentots-Holland mountain catchment area and forms part of quarternary catchment² No. G22H (refer to Figure 8). The catchment functions of the NA may seem insignificant, however, it performs an important function as part of an integrated group of ecosystems that collectively determine the health of the entire catchment. A primary threat to environmental health is fragmentation of the community-supporting ecosystems. Fragmentation generally leads to a cycle of environmental degradation which consequently influences the well-being of the dependent communities.

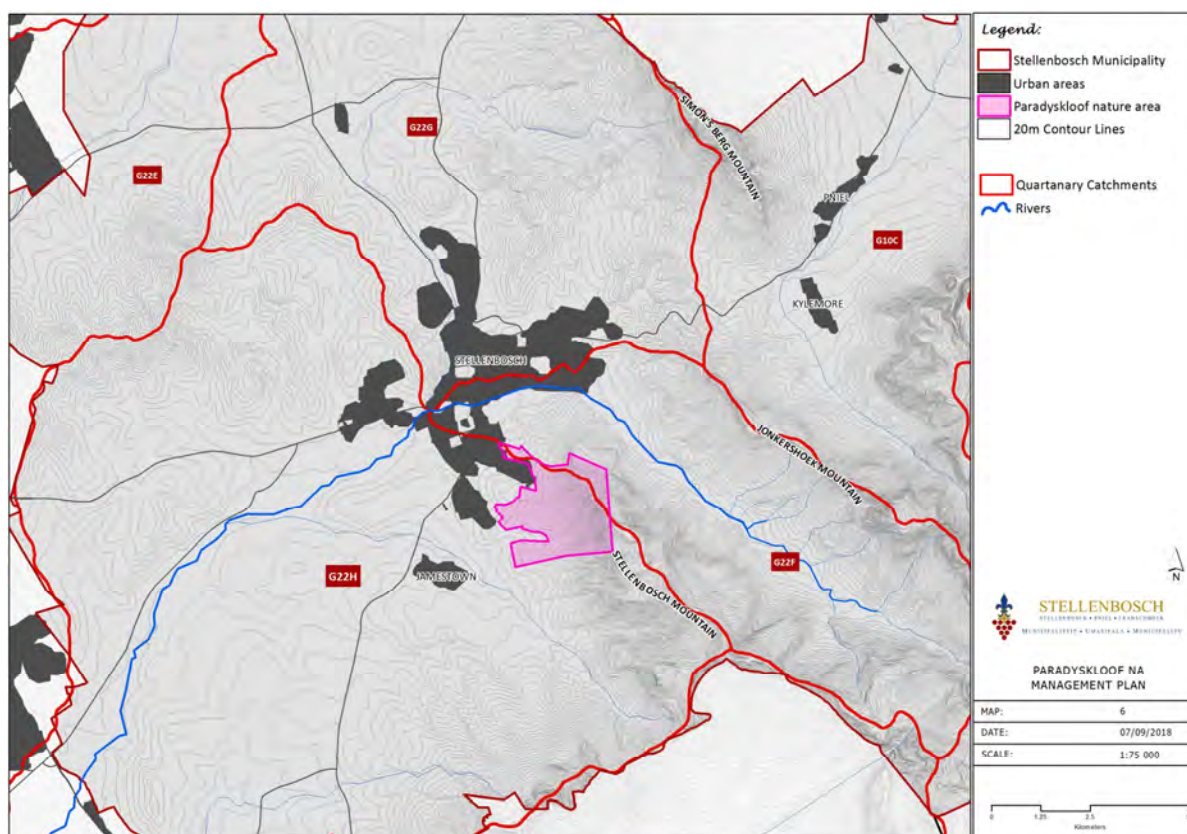


Figure 8: Paradyskloof NA in catchment area context.

Ecosystems and/or catchments are mutually dependent on every natural component for their existence. The loss, or degradation, of one component thus affects all others, potentially leading to the collapse of the total system on which communities may depend for their livelihood. Hence the

² Catchment (or catchment area) is defined as the entire land area from which water flows into a river; catchments can be divided into smaller 'sub-catchments' which are usually the area which drains a tributary to the main river or a part of the main river.

importance of conserving every natural part, or life form, of a system that forms part of the natural water cycle³. Government policy, which forms the basis of the National Water Act, 1998 (Act 36 of 1998), states that *'since many land-uses have a significant effect on the water cycle, the regulation of land-use should, where appropriate, be used as an instrument to manage water resources'*.

3.3.5 Fauna

The Paradyskloof NA, especially the higher lying area, is home to leopards, caracals, klipspringers, baboons, honey badgers, mongoos and numerous smaller animals like micem shrews and rats. Birdlife includes kingfishers, black eagles, spotted eagle owls, sugarbirds, orange-breasted sunbird and protea seedeaters⁴. On warm days rock agama lizards can be seen basking in the sun. Berg adder, puff adder, boomslang and Cape cobra are fairly common.

3.3.6 Flora

The area forms part of the world-renowned Cape Floral Kingdom internationally recognised as one of the six Floral Kingdoms of the world. The Cape Floral Kingdom is the smallest, covering a mere 0,06% of the earth's surface, and is the only Floral Kingdom contained in its entirety within a single country. The Cape Floral Kingdom is characterised by its exceptional richness in plant species and its high endemism. More than 8 700 species are known to occur, with more than 68% being endemic⁵. The Cape Floral Kingdom is of immense scientific importance, both nationally and internationally. It covers only 4% of South Africa, but contains 45% of all plant species of Southern Africa. Approximately 75% of all plants in the South African Red Data Book are found in the Cape Floral Kingdom. Many Fynbos species are extremely localised in their distribution, with sets of such localised species organised into 'centres of endemism' (Low and Rebelo, 1996).

The vegetation type of Paradyskloof NA is Cape Wineland Shale Fynbos and is a vulnerable terrestrial ecosystem. Cape Wineland Shale Fynbos soil is naturally poor in nutrients, moist and is slightly acidic. The biodiversity of the Cape Wineland Shale Fynbos is incredibly high. The Cape Wineland Shale Fynbos comprises a diversity of protea, erica, geophyte and daisy species as well as some endemic species. The vegetation type is of conservation significance because of its high vulnerability state due to its location on lower slopes, which are mostly used for agricultural and urban development. Of the 54% remaining natural areas only 25% are formally protected.

The information provided by the South African National Biodiversity Institute (SANBI) and the Cape Action for People and the Environment (C.A.P.E.) with regard to the irreplaceability⁶ of habitats indicates that the middle to higher lying area above Paradyskloof and Brandwacht is of immense conservation importance (Figure 9). This is mainly due to the fact that the area is, or used to be, the habitat of the now almost extinct West Coast Renosterveld. The objective is to rehabilitate and

³ The water (hydrological) cycle describes the natural process of moving water out of the oceans, into the atmosphere, and back to the land and oceans.

⁴ <http://www.capenature.co.za/wp-content/uploads/2015/10/Jonkershoek-Map-Brochure1.pdf>

⁵ Confined, or exclusive, to a particular specified area.

⁶ The potential contribution of a site to a preservation or representation goal. It is a fundamental way of measuring the conservation value of any site. An irreplaceable site will appear in every analysis of alternative combinations of sites. In other words, it is one which must be included in a conservation area because significant options for preservation are lost if the site is excluded.

conserve as much as possible of this area. More recent data, however, that was released as part of the Western Cape Biodiversity Spatial Plan (2017), shows that a large portion of the area is regarded a Critical Biodiversity Areas (CBAs) (Figure 10). The various categories indicated on Figure 10 are defined in Table 1 below.

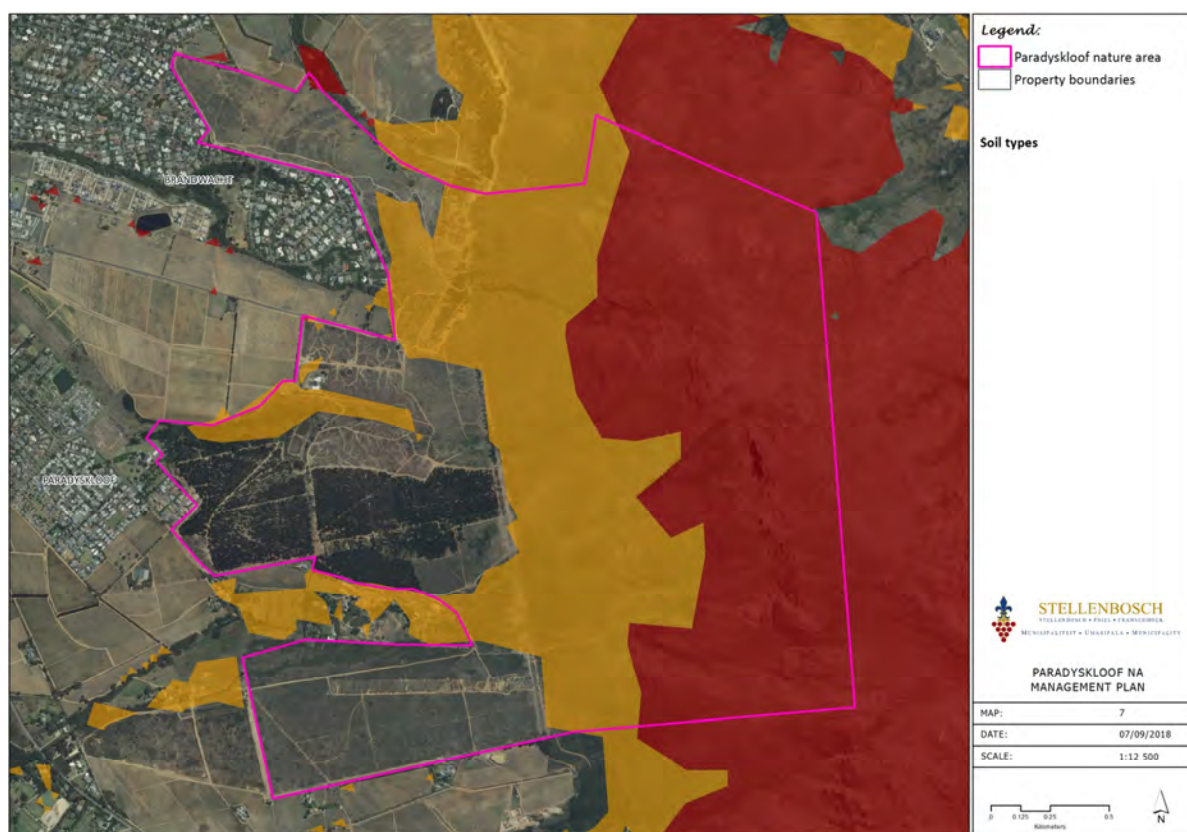


Figure 9: Irreplaceability of habitats in the Paradyskloof NA (Source: CAPE).

Table 1: Western Cape Biodiversity Spatial Plan map categories

MAP CATEGORY	DEFINITION
Protected Area	Areas that are proclaimed as protected areas under national or provincial legislation.
CBA 1	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.
CBA 2	Areas in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure.
ESA 1 ⁷	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.
ESA 2	Areas that are not essential for meeting biodiversity targets, but that play an important role in supporting the functioning of PAs or CBAs, and are often vital for delivering ecosystem services.
Other Natural Area	Areas that have not been identified as a priority in the current systematic biodiversity plan, but retain most of their natural character and perform a range of biodiversity and ecological infrastructure functions. Although they have not been prioritised for biodiversity, they are still an important part of the natural ecosystem.

⁷ Ecological Support Area



Figure 10: Critical Biodiversity Areas (Source: SANBI)

3.4 INFRASTRUCTURE

A number of municipal infrastructure is located within the Paradyskloof NA including water treatment works, reservoir and recently drilled boreholes. Being an old forestry area the western portion of the area has kilometers of existing service roads. The Paradyskloof NA also has a “clubhouse” that was recently refurbished by the Municipality (Figure 11).

3.5 USE

The Paradyskloof NA is utilised in various ways, including:

- a) **Forestry:** Most of the western portion of the Paradyskloof NA was at some point used for forestry. Whilst most of the trees in the area have been harvested over time the area still consist of an approximately 40 ha area of mature pine.
- b) **Outdoor recreation:** As mentioned above, the Paradyskloof NA’s western section has numerous existing service roads. These roads, and a system of tracks and trails, are used for recreational purposes. These uses include
 - Cycling (mountain-biking)
 - Hiking
 - Walking of dogs
 - Running

- Horseriding
- c) Research
- d) Municipal infrastructure and service delivery: As described in Chapter 3.4 above, the Paradyskloof NA includes various area which form part of active municipal infrastructure that are used and maintained on a daily basis.
- e) Events: The Paradyskloof NA is the subject of numerous event applications, mainly associated with mountain-biking or trail-running as well as the use of the clubhouse.
- f) Filming: Stellenbosch Municipality from time-to-time received applications for filming or photoshoots within its nature areas.

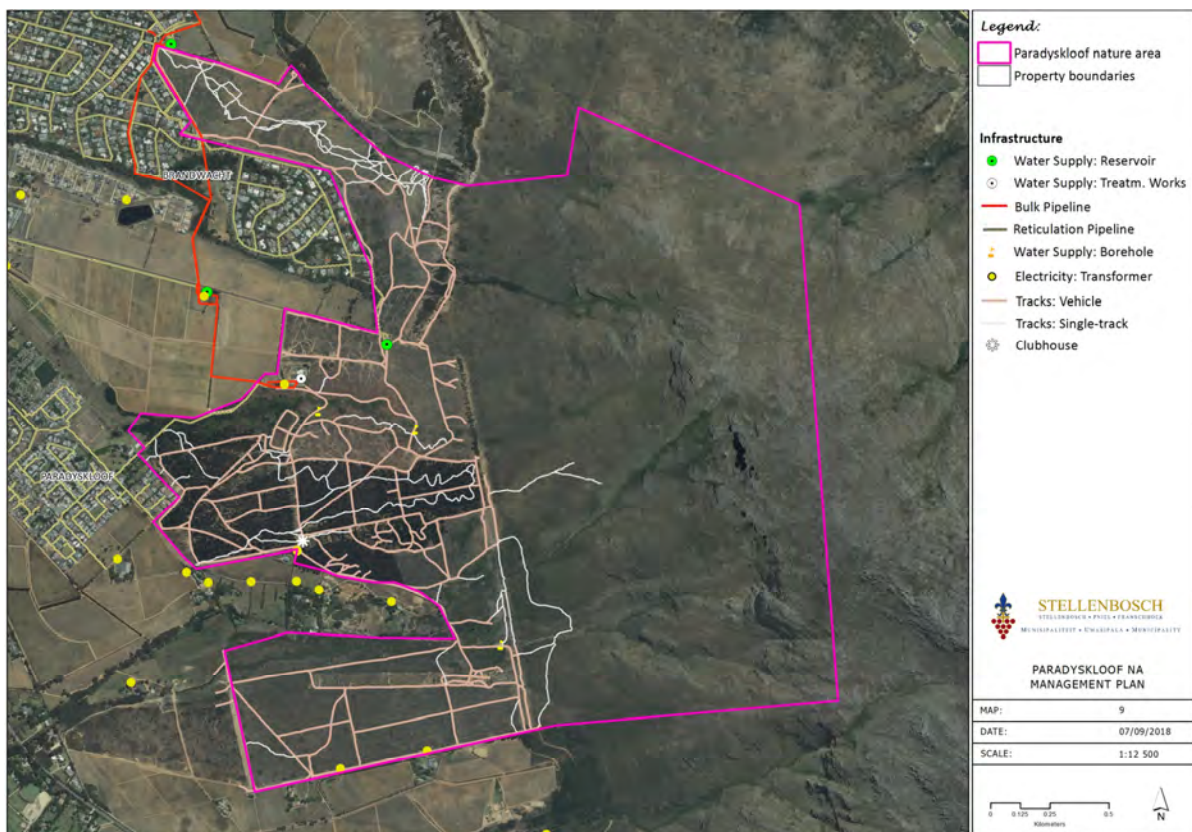


Figure 11: Existing infrastructure within the Paradyskloof NA

3.6 THREATS

The eastern portion of the Paradyskloof NA is in a natural state whilst the western part has been impacted upon by historic land-uses, with particular reference to the forestry activities that have been largely phased out over the recent past. These activities resulted in:

- (i) Habitat fragmentation and degradation.
- (ii) General loss of biodiversity in affected areas.
- (iii) Soil erosion.

Further threats to be addressed or mitigated include the following:

- a) Access control: Uncontrolled access poses various threats to the area, mainly in terms of security (crime prevention), managing the risk of fire and vandalism.
- b) Misuse and misunderstanding: The use of the area was primarily focused around the *instrumental* value of the site, which implies that the site has essentially been considered a mere resource utilised for forestry, infrastructure and recreational activities. These land-uses have caused degradation of the visual integrity and ecology of the site.
- c) Fire: Given the nature of the ecology of the area, the presence of the forest, biomass, limited control of access and various other factors that increase the risk of an ignition the Paradyskloof NA is a risk to fire.
- d) Infestation of alien vegetation: The infestation of alien plant species is a significant threat to the ecology and visual quality of Paradyskloof NA. The alien vegetation (which is a legacy of former forestry-related land uses) has resulted in a modified floral composition which is conducive to high-intensity fires. In turn, these are immensely disruptive to the ecology of fynbos and ecosystem processes.

4 MANAGEMENT DIRECTIVES

This section comprises the management strategies and guidelines in terms of which the Paradyskloof NA is to be managed in order to achieve the objectives documented above. The management strategies and guidelines are addressed under the following themes:

- Administration
- Environmental Protection
- Land Use Management
- Environmental Auditing

4.1 ADMINISTRATION

The long-term sustainability of the area largely depends on its effective administration. Of key importance in this regard is that the principle of economic efficiency be given effect through the general administration of the area and that its positive role and functions in respect of the promotion of environmental integrity and human well-being be understood and supported at all levels. Institutional commitment to achieving effective administration of the NA through, *inter alia*, the allocation of adequate budgets is of paramount importance.

Stellenbosch Municipality, through the Department: Community Services and its Nature Conservation section, is responsible for the management of the Paradyskloof NA. In terms of the principle of *inclusivity* the management of the NA is an ongoing inclusive process that gives meaningful consideration to the changing and dynamic interests, needs and values of the people of Stellenbosch and those that have an interest in ensuring a sustainable future for the area. In this regard, it is important that the following be achieved:

- a) Continued participation, representation and involvement of all stakeholders promoting broad-based policy learning and capacity development.
- c) Developing and utilising the skills and capacities of the people living in the area in the management of the NA.
- d) Encouraging on-going involvement of local people in the programs identified for the management of the NA.

Accordingly, the Municipality is to facilitate the establishment of a Friends of Paradyskloof NA that complies with and has the capacity to give effect to the above requirements. Whilst Stellenbosch Municipality is responsible for the general maintenance of the area and the implementation of this EMP it will rely on the Friends of the Paradyskloof NA for specific management activities as required (Figure 12) or where the Municipal is limited through capacity constraints. The Municipality and representatives of the Friends of the Paradyskloof NA in turn will serve on the Stellenbosch Protected Areas Forum, attended by the Department of Environment and Development Planning, Cape Nature, Stellenbosch University and representatives from other protected areas throughout the municipal area. The Stellenbosch Protected Areas Forum is technical / scientific in nature and meets on matters concerning the management and conservation of protected areas in the Municipality.

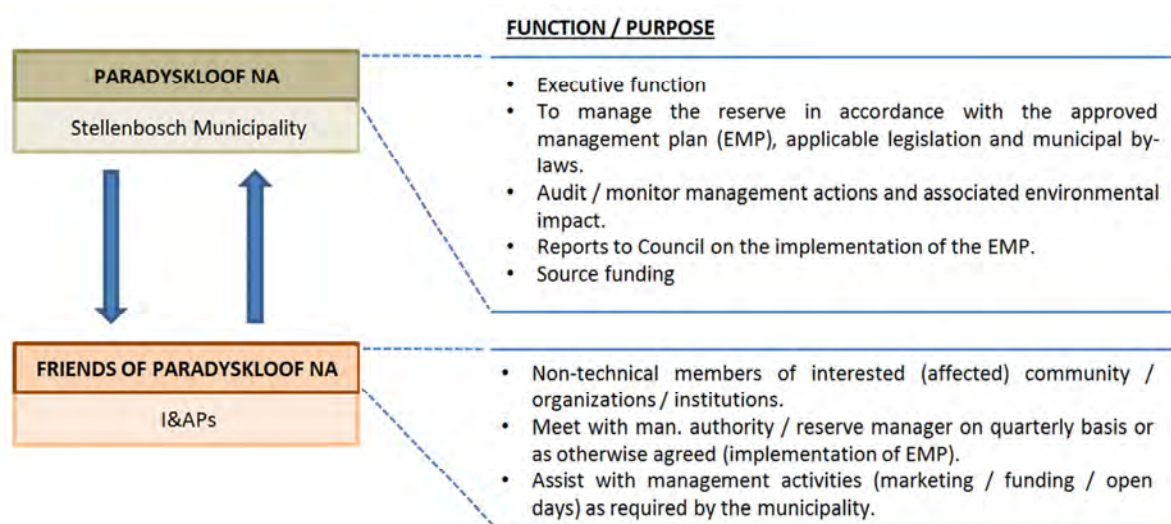


Figure 12: Paradyskloof NA management structure

Table 2: Guidelines for inception phase management

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
1	Compile an annual budget for Paradyskloof NA.	Annual at the beginning of the new financial year
2	Explicitly provide for the required funding for the Paradyskloof NA in the Stellenbosch Integrated Development Plan.	Ongoing
3	Solicit funds from potential donors.	Ongoing
4	Facilitate the establishment of a Friends of Paradyskloof NA group.	On the approval of the EMP and endorsement of the "Friends of..." concept by Council.

4.2 ENVIRONMENTAL PROTECTION

Natural resources are defined as *any materials, services and conditions that are necessary for the survival of living organisms, and have the potential to enhance quality of life. They are, in a sense, inherited by people, and are therefore part of the earth's (the natural) and people's (the cultural) heritage. Living resource conservation is specifically concerned with plants, animals and micro-organisms, and with those non-living elements of the environment on which they depend. Living resources have two important properties, the combination of which distinguishes them from non-living resources - they are renewable if conserved, and they are destructible if not* (Perry, 1954).

The intention and focus of environmental protection on the Paradyskloof NA is to facilitate the removal or mitigation of threats to the ecological of the NA, to restore the biodiversity and ecological integrity of the area to the extent that it can function as a self-sustaining system.

4.2.1 Alien Clearing

Invasive alien plants are plant species that have been introduced, either intentionally or unintentionally, to South Africa. They can reproduce rapidly in their new environments and, as mentioned above, tend to out-compete indigenous plants. The result usually includes a variety of negative ecological, social, and economic impacts. Invasive alien species pose the biggest threat to biodiversity after direct habitat destruction.

Stellenbosch Municipality has prepared and adopted the Stellenbosch Municipality Invasive Alien Management Plan (April, 2017). In terms of this plan the Paradyskloof NA has *high indigenous biodiversity that is under threat by invasive alien plants*. The northern section of the site contains *Acacia saligna*, *Acacia mearnsii* and *Eucalyptus globulus*. In the central area (towards the neighbourhood of Paradyskloof) most of the natural vegetation originally has been transformed into pine plantations. This is attributed to the plantation history of the area, consequently filling the seed bank with pine seeds over the plantation period. New seedlings sprout from the seed bank when vacant space becomes available after harvesting or clearing activities. There is a high occurrence of seedlings within the site, which is contributed to the disturbance caused by clearing efforts that occurred in the area. Within the disturbed area opportunistic recruitment of other invasive species, such as *Acacia saligna* and *Acacia mearnsii* is able to establish. Though their infestation is less severe than that of *Pinus pinea*, it is important to take into account the fast spreading nature of the species (via wind or human dispersal from already established populations) may lead to high infestation in the area if left unmanaged. The area is infested with *Pinus pinea*, *Eucalyptus globulus*, *Acacia implexa*, *Acacia melanoxylon*, *Acacia mearnsii*, *Acacia saligna* and *Acacia pygnantha*, of which *Acacia saligna* and *Acacia mearnsii* infestation is the most severe, collectively covering up to 25% of the central area of Paradyskloof NA (Figure 13).

In terms of the above Invasive Alien Plant Management Plan past clearing efforts have taken place within the Paradyskloof NA though the lack of follow up strategies has enabled the establishment of seedlings within the cleared areas. Initial clearing methods must be followed-up and monitored to ensure successful clearing of invasive alien plants. Accordingly:

- Clearing efforts should initiate at the top of the infested area, in terms of slope, and continue downwards. This will reduce erosion effect as well as minimize the re-establishment process of invasive alien plants within the cleared areas from overhead populations.
- Strategic placement of large tree trunks should reduce soil erosion on slopes after invasive alien clearing.
- Because the northern section of the Paradyskloof NA is less infested clearing strategies should start there, on the upper slopes, and continue downwards.
- Removal strategies for clearing invasive alien species in the area should be a combination of mechanical and chemical methods. All species should be removed mechanically by uprooting young plants and tree felling of larger trees (via axe or chainsaw), followed by the application of chemical herbicides to the cut surface to prevent resprouting. Each species has its own corresponding herbicide requirements to prevent resprouting activities and should be applied soon after tree felling. The use of herbicides may have negative effects on the health of soil composition and the natural ecosystem and should thus be used with caution and in reasonable/prescribed amounts.
- Continuous follow-up and removal of new seedlings after the initial clearing efforts are essential in order to clear the property of invasive alien plants. Follow ups and monitoring should occur annually and remaining or re-established invasive species should be removed when located.

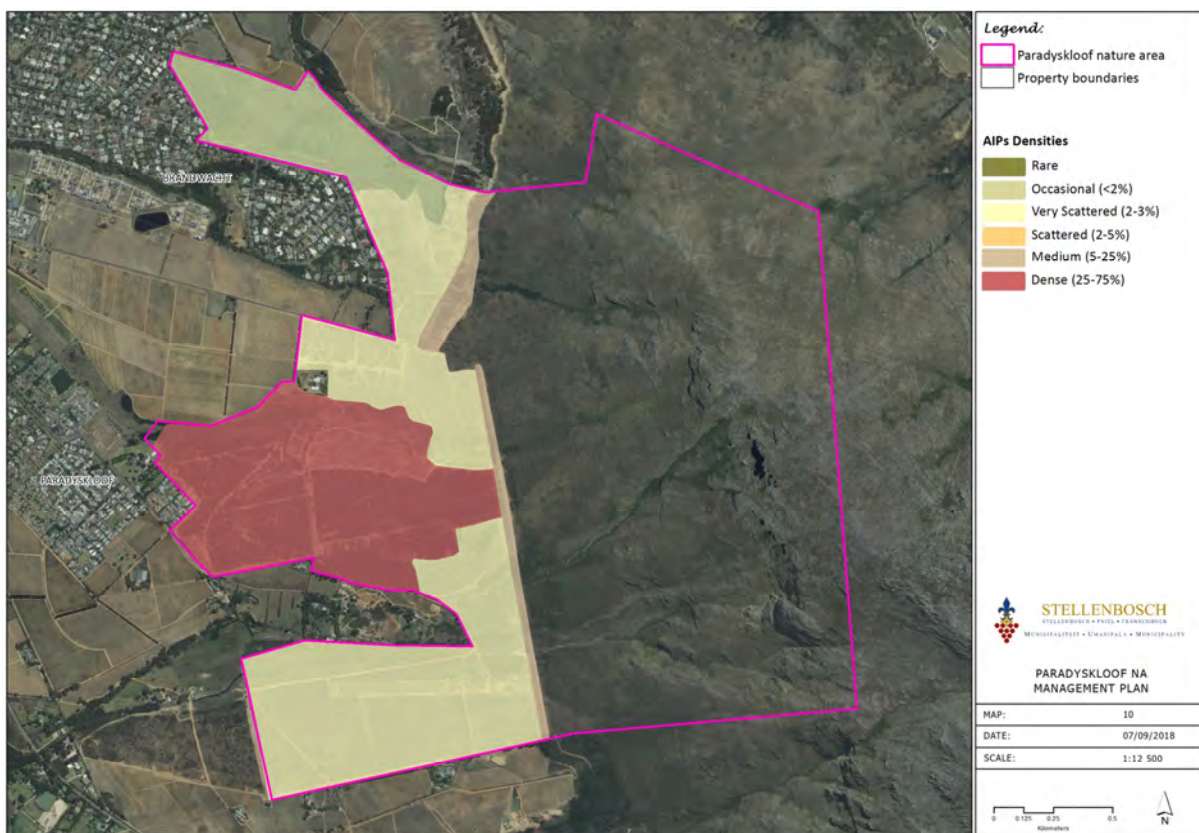


Figure 13: Paradyskloof NA AIPs densities

Table 3: Guidelines for alien clearing

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
5	Implement the Stellenbosch Alien Invasive Plan (IAP) Management Plan (2017).	Annual between the months of September and May
6	Map the areas that have been cleared of alien plants, indicating the date of operations, species removed and the current status of the portion of the site.	Annual as clearing is undertaken
7	Conduct an audit on the implementation of the IAP Management Plan.	Annually, by end of June

4.2.2 Flora

‘Natural vegetation is the visual expression of the environment, it is a product of the action of environmental factors over time and hence can be a valuable indicator of potential productivity of ecosystems’ (Bayer, 1970).

Table 4: Guidelines for flora conservation

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
8	Institute research to verify existing botany reports and assessments pertaining to the vegetation types that occur in the Paradyskloof NA.	Once the vegetation has recovered to the extent that a reliable information can be gathered and conclusions can be drawn
9	Ground-truth and update the CBA status of all parts of the nature area in cooperation with Cape Nature and SANBI.	On availability of Cape Nature and SANBI.
10	Institute scheduled research and monitoring to determine the recurrence of species.	Annually
11	Prevent the non-sustainable harvesting of plants used as traditional medicines dedicated training and education of local people, law enforcement and monitoring.	Annually. Efficiency of strategies to be audited

The introduction of non-endemic species to the Paradyskloof NA is forbidden. The fringes of the area, especially along the edge of the urban area and household gardens, must be monitored in this regard.

4.2.3 Fauna

Biodiversity conservation essentially means conserving all the elements (‘parts’) of the natural environment. The mix of species in an ecosystem enables that system both to *provide* a flow of ecosystem services under given environmental conditions, and to *maintain* that flow if environmental conditions change.

The loss of biodiversity, therefore, limits the resilience of the affected ecosystem, which in turn, may have direct negative economic implications. Therefore, in order to promote biodiversity conservation in the NA it is imperative that the conservation of the faunal component receives appropriate attention.

Table 5: Guidelines for fauna conservation

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
12	Continually monitor and record occurrence of wildlife.	On-going
13	Prevent all forms of unnatural predation through on-going education and law enforcement.	On-going

4.2.4 Soil

Former and current land-uses resulted in loss of topsoil in places within the NA. Appropriate measures must be taken to protect areas susceptible to erosion by installing all the necessary temporary and permanent drainage works as soon as possible. Steep slopes and other areas prone to erosion must be maintained or restored according to the following guidelines:

- a) Warning signage displaying NO ENTRY, must be installed on all roads, trails or walkways that are permanently or temporarily closed. Physical barriers, using local natural material, may be constructed where NO ENTRY signs are not respected to prevent users from accessing such roads, trails or walkways.
- b) Existing erosion areas must be back-filled (using on-site material), compacted and restored to a proper condition.
- c) Roads, trails or walkways, permanently closed for use, must be:
 - i) ploughed,
 - ii) the top soil scarified (to make sure that no downhill trenches or drainage lines are created),
 - iii) water diversion walls created by hand at a distance of 10 metres apart (depending on the slope) leading 5 metres into the natural vegetation,
 - iv) and revegetated by either soughing or transplanting appropriate material.
- d) Areas, where the above measures are not sufficient, must be logged, parallel to the contour in order to prevent further soil erosion. Logs must be laid in lines 15 metres apart, depending on the slope (the steeper the slope the closer the barriers must be laid to each other). Logs must be secured by means of steel pegs hammered through a drilled hole on each end of the log (logs longer than 2 metre must be secured by an additional steel peg through the middle of the log). Where logs are laid across a road, the log must be laid up to a minimum of 1 meter past the edge of the road.
- e) Roads (to stay in use) must be graded to have a slight gradient to the inside (up-hill) (refer to Figure 14). A drainage ditch must be created on the inside of the road. Gravel humps must be created at an angle across roads to drain water from the road surface into to the drainage ditch. At selected locations (depending on the slope) furrows must be created across the roads surface to discharge the water collected in the drainage ditch. The guiding principle behind the creation of a drainage ditch and discharge furrows is to not allow water to reach a speed at which it will create erosion. After a rain event all roads must be inspected to determine if any maintenance is required.
- f) Erosion sites on bicycle tracks and walking trails must be logged following the contours and spaced vertically 0.8-1.2 m apart, depending on the steepness of the slope.
- g) Logs must be untreated pine (or gum) poles of not less than 150 mm with a taper of not more than 75 mm over its length.

- h) Cut and fill slopes will be shaped and trimmed to approximate the natural condition and contours as closely as possible and be undulating. Levels, incongruous to the surrounding landscape, will be reshaped using a grader and other earthmoving equipment.

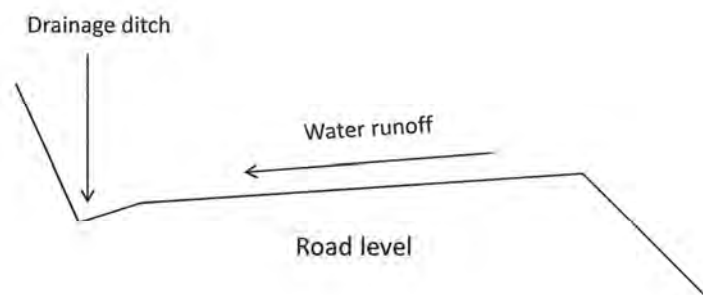


Figure 14: Road surface slope with a drainage ditch

Table 6: Guidelines for the conservation of soils

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
14	Restore erosion sites in accordance with the guidelines above.	On-going Quarterly photographic monitoring at fixed points Annual auditing
15	Inspect drainage ditches on all roads after exceptional rain event to determine whether maintenance is required.	On-going
16	Implement preventative measures on potential erosion sites. All roads and tracks, used or closed, are considered potential erosion sites.	On-going Quarterly photographic monitoring at fixed points Annual auditing
17	Prevent overuse of routes and sites susceptible to erosion through appropriate signage.	Monthly site inspection

4.2.5 Water

The role and potential impact of Paradyskloof NA seems negligible when considered against the scale of the catchment as a whole. The area is, however, vital components of the catchment and should be managed accordingly.

Table 7: Guidelines for managing Paradyskloof NA as part of the Eerste River catchment

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
18	Remove all forms of pollution.	On-going
19	Manage invasive alien plants in terms of the Stellenbosch IAP Management Plan (2017).	On-going

4.2.6 Fire

The Paradyskloof NA is susceptible to fire due to activities on the property as well as land uses on adjoining properties. Any fire management regime must therefore provide innovative measures to combat the occurrence and spread of wild fires. The overarching fire management goals as it pertains to the Paradyskloof NA are to:

- a) Protect people and property.
- b) Protect natural and cultural resources from undesirable effects of fire.
- c) Suppress unwanted fire.
- d) Allow fire to assume its natural role in the ecosystem.
- e) Manage fire cooperatively with neighbouring land owners and other stakeholders.

The fire management regime of the NA is premised upon the following risk management strategies:

Table 8: Fire management strategies

Management Strategies	Guidelines
a) Avoiding the risk	Prohibiting high-risk human activities in close proximity to the NA.
b) Reducing the hazard	Prescribed burning, preparation of firebreaks or manual clearing of fire hazards as well as regular inspections.
c) Reducing ignitions	Education and awareness programs, fire bans, reduction in activities during high-risk season or periods, efficient ignition investigation.
d) Reducing consequences	Contingency plans, community education programs for self-protection (lives and property), and building restrictions and standards for areas prone to veld fires.
e) Implementing an innovative artificial burning regime	Such regime and associated practices are to reduce the risk of wild fires spreading and causing extensive ecological and financial damage. Such artificial regime implies the creation of a mosaic of veld ages that will enhance the capacity of the area to and maintain its ecological functioning.

This EMP builds on the recognition that the threat of fires to the Paradyskloof NA and the relevant reasons for such threat are unique. Due to surrounding land uses and human behaviour wild fires will probably not be prevented through any measures taken. The solution lies in a combination of options (a), (b) and (c) above.

It is important to understand the basics of fire before preparation can be made for efficient control thereof. It is essential to note that three environmental components are required for a fire to occur. These are oxygen, heat and fuel (refer to Figure 15). Whilst the atmosphere contains 21% oxygen, only 16% oxygen needs to be in the air for a fire to start. Fuel is any living or dead material that will burn. If ignition occurs in the situation or environment where all three elements are present combustion will result and a fire will continue to burn until one of the three elements are removed. It is difficult to exclude oxygen from fires. Heat is considered a constant. However, a reduction in fuel will reduce the total energy output (refer to Figure 16). Fuel or more specifically the amount of fuel is the aspect that can be influenced most. It therefore becomes the most critical factor in the prevention and control of fire.

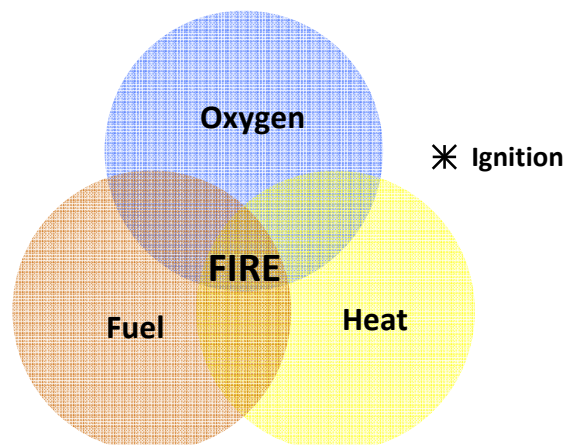


Figure 15: Basic elements of fire

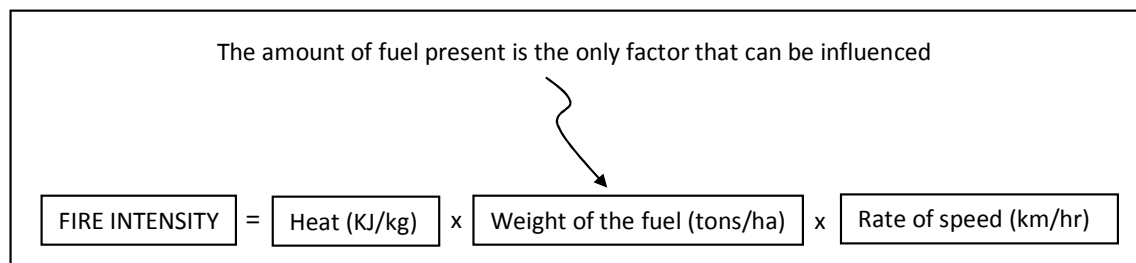


Figure 16: The factors determining the intensity of fire

Two ways of reducing the fuel load are alien vegetation clearing or control and the establishment and maintenance of firebreaks.

4.2.6.1 Alien Clearing

Invasive alien plants are characterised by being able to reproduce rapidly in their new environments, and this is usually due to a combination of factors, including:

- A lack of natural enemies in the new environment
- Resistance to local diseases and other plant pathogens
- Highly competitive growth and colonising strategies that provide them with a competitive edge, and an ability to out-grow local indigenous plants

Invasive alien plants can significantly alter the composition, structure and functionality of ecosystems and increase the fuel load for fires. They degrade the productive potential of the land, intensify the damage caused by veld fires and flooding, increase soil erosion, and impact on the health of rivers and estuaries.

4.2.6.2 Firebreaks

Fire breaks are cleared paths which will prevent the spread of fire by removing the fuel from the fire path. Section 12 of the National Veld and Forest Fire Act *stipulates that every owner on whose land a veldfire may start or burn or from whose land it may spread must prepare and maintain a firebreak on his or her boundary between his or her land and any adjoining land.* In terms of Section 13 of the Act *above a landowner is obliged to prepare and maintain a firebreak, with due regard to the weather, climate, terrain and vegetation.* The firebreak must:

- be wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading to or from the neighbouring land,
- not cause soil erosion, and must
- be reasonably free of inflammable material capable of carrying a veldfire across it.

In terms of Section 16 of the National Veld and Forest Fire Act the right or duty to prepare and maintain a firebreak prevails over any other prohibition in any other law on the cutting, disturbance, damage, destruction or removal of any plant or tree, except the owner must where possible, transplant any plant which is protected in terms of any law or where it is safe and feasible, position the firebreak so as to avoid such plant or tree.

A fire break is a means of access for personnel and equipment, to serve as a control line and to serve as a line from where a fire can be attacked from, for example by setting a backburn. The firebreaks are to be linked to access roads, thereby reducing the areas requiring preparation and increasing accessibility to the various sites. Locations where firebreaks are required vary. Individual circumstances will determine what type, width and length will be applicable. When constructing firebreaks it is important that all vegetation cover is removed and that only rocks and soil (minerals) are exposed. A fire can travel very slowly through the grass roots or decayed vegetation and great care must be taken to ensure that minimal earth is exposed throughout the length and width of the break. The following factors must be taken into account with the construction of firebreaks.

- Access: The placement of firebreaks on a slope must be determined by access to the break.
- Slope: Slope is the steepness of the land and has the greatest influence on fire behaviour. The steepness of the slope affects both the rate and direction of the fire spread. Fires usually move faster uphill than downhill and the steeper the slope, the faster the fire will move. This is because:
 - on the uphill side, the flames are closer to the fuel;
 - the fuels become drier and ignite more quickly than if on the level ground;
 - wind currents are normally uphill and this tends to push heat flames into new fuels;
 - convected heat rises along the slope causes a draft which further increases the rate of spread; and
 - burning embers and chunks of fuel may roll downhill into unburned fuels, increasing spread and starting new fires.
- Aspect: Aspect is the direction the land faces - north, south, east or west. The aspect of a slope influences a fire's behaviour in several ways:
 - southern aspects receive more direct heat from the sun, drying both the soil and the vegetation;
 - fuels are usually drier and less dense on southern slopes than fuels on northern slopes;
 - heating by the sun also causes earlier and stronger slope winds; and

- on south-facing slopes, there will normally be higher temperatures, stronger winds, lower humidities, and lower fuel moistures.
- Terrain: *Terrain* or special land features may control wind flow in a relatively large area. Wind flows like water in a stream and will try to follow the path of least resistance. Ridges, trees, and rocks may alter wind flow and cause turbulence or eddies to form on the windward side of obstructions. Also, when wind flows through a restriction, such as a narrow canyon, it increases in strength. Wind movement can be critical in chutes or steep v-drainages. These terrain features create a chimney effect, causing a forced draft, as in a stove chimney. Fires in these chutes or drainages spread quickly and are dangerous.
- Elevation
- Vegetation type
- Moisture content
- Size and shape of material.
- Volume and area covered.
- Fuel content (breaks alignment should avoid heavy fuel concentrations and be situated in areas with the lightest fuels possible).
- Wind direction (internal belts should as far as possible run parallel with the prevailing winds).
- Spotting distance.
- Firebreaks should be anchored, iether to a natural barrier, road or another firebreak.
- Natural or existing barriers like roads, paths, streams, lakes, vleis, rivers, rock outcrops, or any other break in fuel should be utilise as far as possible.

There are four methods of preparing a firebreak and proper consideration should be given to each before commencing the preparation of a firebreak.

- Manual: Preparing a firebreak manually involves the utilisation of a team of workers working in a planned manner using manual tools.
- Burning: After deciding where the belt is to go, an adequate tracer is cut around the entire belt, and then the belt itself is burnt. This is the most common form of preparing a firebreak.
- Ploughing/brushcutting: Ploughing/brushcutting with a tractor is a common method of constructing breaks where the vegetation is low or has been previously removed. The positive thing with brushcutting is that the roots are not destroyed and this will assist in reducing erosion on these breaks. Bushcut material should be removed two months after cutting, and mulched at a organic dump.
- Application of herbicide: With this method herbicide is used to kill off all the plant growth in the firebreak.

Firebreaks currently being maintaind in and around Paradyskloof NA exist along the edge of Brandwacht- and Paradyskloof neighbourhoods, towards the north of the area as well as a firebreak between the old forestry section and the eastern mountain slopes (Figure 17).

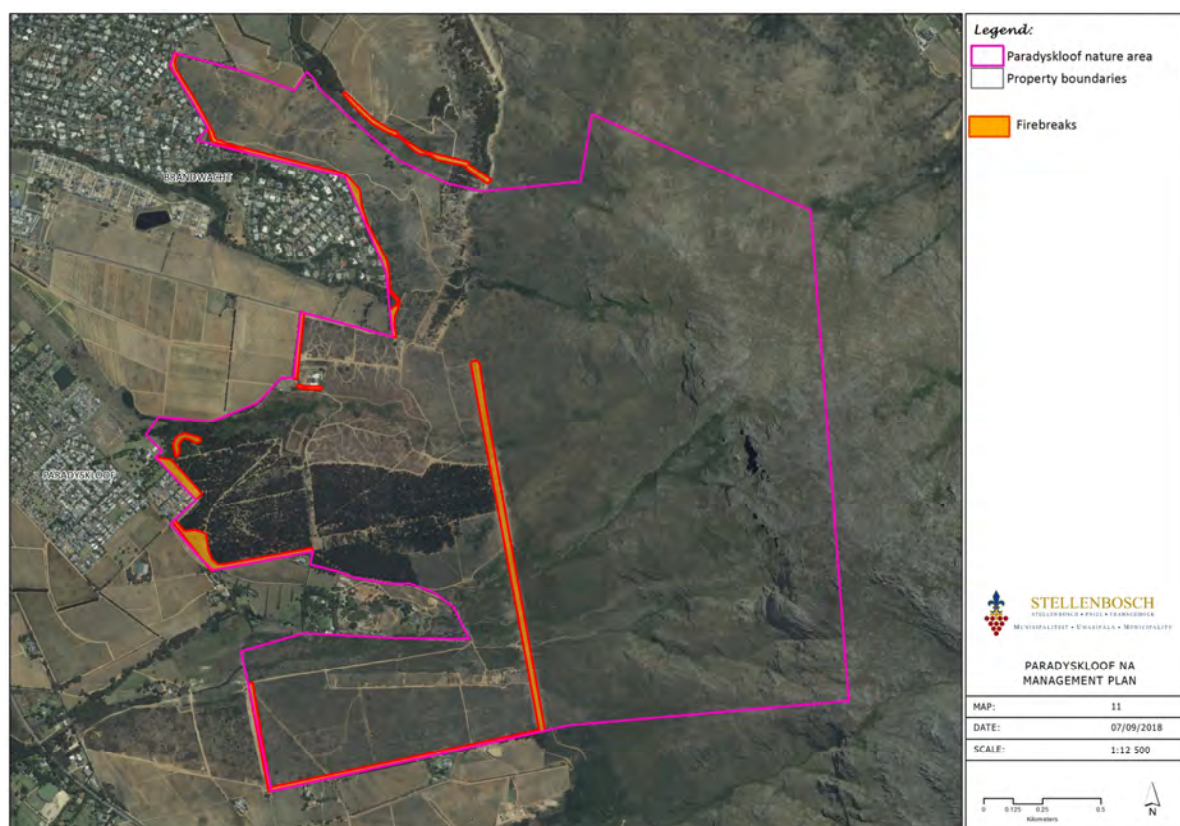


Figure 17: Firebreaks in and around Paradyskloof NA

Table 9: Guidelines for management of fire within the Paradyskloof NA

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
20	Maintain the existing firebreaks.	Annually Completed by end October
21	Conduct inspection of the area along with a representative of the local fire protection association to identify the need for additional firebreaks.	Immediately
22	Prepare firebreaks as required.	Completed by end October
23	Prepare and maintain a register of veld fires including the extent and date.	Compliance audited annually







4.3 LAND USE MANAGEMENT

4.3.1 Management / Use Areas

Chapter 3.5 above lists the main uses of the Paradyskloof NA. Because the area has such a spectrum of uses and comprises an area with variable degrees of degradation, ecological importance and topographical characteristics, a uniform set of management principles and rules for utilisation of the area is not feasible. The area must be retained as a public resource, used for recreational purposes on a daily basis whilst the environmental integrity of the area is protect at the same time.

The management and use of the Paradyskloof NA is therefore predribed by way of defining the areas within which the various activities or use is allowed within. Table 10 below describes the various areas depicted by Figure 18. The various areas and uses are informed by existing infrastructure and use as well as the information contained in the Western Cape Biodiversity Spatial Plan.

Table 10: Paradyskloof NA Management / Use Areas

Area		DEFINITION
	Conservation 1	Areas proclaimed as protected areas under national or provincial legislation. User activities with minimal impact allowed in these areas.
	Use	<ul style="list-style-type: none"> • Research • Hiking • Trail-running
	Conservation 2	Areas in a natural condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. User activities with minimal impact allowed in these areas.
	Use	<ul style="list-style-type: none"> • Research • Hiking • Dog-walking • Trail-running • Mountain-biking on defined routes
	Rehabilitation	Areas in a degraded condition to be rehabilitated.
	Use	<ul style="list-style-type: none"> • Research • Hiking • Dog-walking • Trail-running • Mountain-biking on defined routes • Approved events
	Recreation	Infrastructure for recreational use.
	Use	<ul style="list-style-type: none"> • Hiking • Dog-walking • Trail-running • Mountain-biking • Approved events • Film-shoots
	Utility	Areas that contains municipal infrastructure.
	Forestry	Existing pine forest to be maintained as such and potentially harvested harvested.

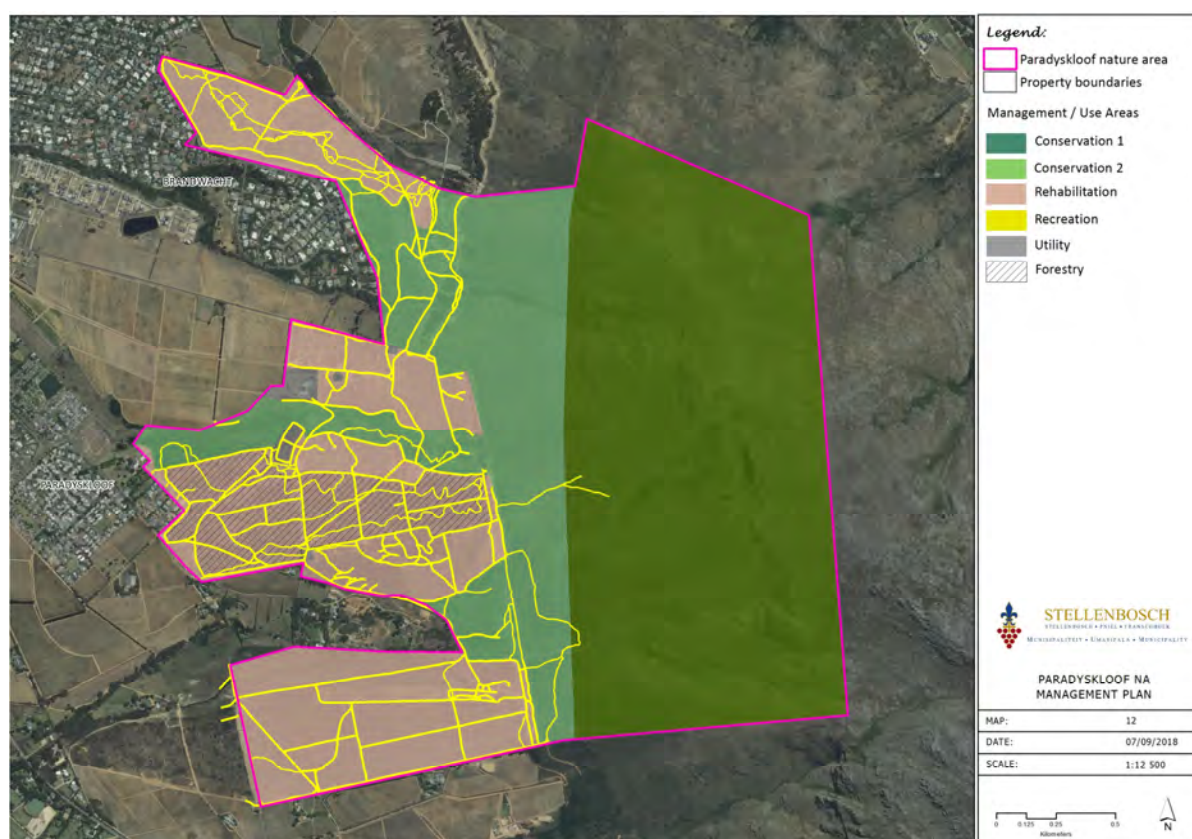


Figure 18: Paradyskloof NA Management / Use Areas

Table 11: Guidelines for management of the Paradyskloof NA Management / Use Areas

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
24	Investigate formally declaring the Paradyskloof NA as a nature reserve.	Immediately after EMP approval
25	Communicate the applicable use areas and associated appropriate activities through signage at the NA entrances and on-site.	Immediately after EMP approval
26	Conserve and protect Conservation 1 and 2 areas.	Audited
27	Inspect Recreation Areas to assess the impact of use and degradation.	Annually
28	Implement necessary rehabilitation works where required.	Ongoing
29	Investigate the possible utilisation / harvesting of the the existing pine plantation or part thereof.	Immediately after EMP approval

4.3.2 Clubhouse

Stellenbosch Municipality has recently refurbished the clubhouse situated within the Paradyskloof NA (shown on Figure 11 above). The facility is intended to be used for municipal meetings and functions and to serve as an educational centre. The facility may be used for alternative uses following an application process. Managed correctly this facility can add immense value to the Paradyskloof NA by way of drawing visitors to the area and providing income that can contribute to the management of the area.

Various risks or challenges associated with the facility include the following:

- i) Use of the facility may become a source of nuisance for users of the area or neighbouring landowners if permitted uses is not defined and managed.
- ii) Use of the facility may become a source of pollution.
- iii) The facility and use thereof presents a fire risk.
- iv) The facility runs the risk of becoming delapidated or a financial burden if not managed correctly or used to its full potential.

The following set of rules must be implemented in order to adress the above risks / challenges:

- a) An official application for use of the clubhouse must be submitted to the Department: Community Services at least ten (10) working days before the proposed event.
- b) Use of the clubhouse must be approved by the Department: Community Services at least five (5) working days before the proposed event.
- c) Conditions set by the Department: Community Services must at all times be complied with.
- d) The applicant, deemed as the private person or the representative of the organisation which is applying to host the event at the clubhouse, is responsible for enforcing all the conditions set for the event and general laws, by-laws and rules applying to the surrounding nature area.
- e) The applicant assumes liability for any loss or damage occasioned during the event, with respect to both the event participants and municipal property.
- f) Fire is only allowed in designated areas and if approved by the Department: Community Services.
- g) Access for public users of the clubhouse may only by gained from the designated access gate.
- h) A maximum of 10 vehicles are allowed to enter the premises to attend a event held at the clubhouse. If the amount of guests attending an event require more than the allowed 10 vehicle access arrangement must be made for the additional guest to be transported from the access gate up to the clubhouse.
- i) Apart from access and unless the required permission is gained an event's activities is restricted to the clubhouse precinct.

Table 12: Guidelines for management and use of the Paradyskloof NA clubhouse

REF –NR	ACTIONS/IMPLEMENTATION	TIME FRAME
30	Maintain the clubhouse in good order.	Immediately
		Ongoing
31	Maintain a 15 meter cleared area around the clubhouse to act as a firebreak. This area is to be kept clear of any form of biomass.	Immediately
		Ongoing
32	Investigate / explore alternative uses for the clubhouse.	Immediately after EMP approval
33	Conduct inspection of the clubhouse following each event / function.	Ongoing
34	Consider each event or function in terms of the applicable event / function criteria.	Ongoing
35	Investigate the feasibility of entering into a lease agreement with a private entity or organisation to occupy a portion of the facility.	Immediately

4.3.3 Recreational Use

A primary function of the Paradyskloof NA is to enhance the well-being of the people of Stellenbosch and those visiting the area. Accordingly, the NA has an important role, namely to provide the foundation for recreational and tourism opportunities which are environmentally compatible. Chapter 3.5 above lists the range of outdoor- or recreational activities Paradyskloof NA is utilised for.

Rules applicable to the recreational use of the area are:

- a) Entry and use is at a person's own risk. Stellenbosch Municipality and/or its employees shall not be liable for any damage, loss, theft, injury, accident or death suffered by any person, howsoever caused.
- b) No lighting of fires (except in the event that approval has been granted by the Department: Community Services as part of an event).
- c) No smoking.
- d) Only approved / designated roads, trails or tracks may be used. The construction or clearing of new roads, trails or tracks are prohibited.
- e) Public vehicle / motorised access to the area is prohibited unless authorised.
- f) Visitors to comply to all signage including access signage and route markers.
- g) Any user of the area utilising the area for cycling, hiking or any other permitted activity must be equipped with the necessary safety gear and equipment.
- h) All users must utilize the area in a manner that considers the enjoyment and safety of other users.
- i) Various routes (roads, tracks or trails) may exclude particular activities such as cycling. In such cases where a route is temporarily closed for rehabilitation or maintenance, or permanently excludes a particular use, appropriate signage will be installed to communicate such information which must be adhered to as in (f) above.

Table 13: Guidelines for management of recreational use of the Paradyskloof NA

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
36	Audit all roads, trails and tracks and update maps accordingly. Decide on the appropriate use (or decommissioning / rehabilitation) thereof and install appropriate signage.	Immediately after EMP approval
37	Maintain existing roads, trails and tracks to be fit for recreational use.	Ongoing
38	Inspect roads, trails and tracks to be fit for recreational use.	Monthly during summer or after heavy rain events. Weekly during summer.
39	Repair damaged roads, trails and tracks.	Ongoing
40	Close routes that require maintenance or rehabilitation and are not deemed to be safe for recreational use by installing appropriate signage and access barriers.	Ongoing
41	Inspect and maintain signage and route markers throughout the area.	Monthly

4.3.4 Access Control

Chapter 3.6 above lists access control, or the lack thereof, as one of the main threats to the management of the area influencing secondary threats such as the security of the area, vandalism and fire. Existing access control is inadequate and must be addressed. Access control requires that the perimeter of the area is secure and access regulated.

Table 14: Guidelines for management access control

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
42	Audit existing accesspoints to the NA.	Immediately and ongoing
43	Audit existing access control infrastructure.	Immediately
44	Audit existing locks and ownership of keys.	Ongoing
45	Keep a register of key-holders.	Ongoing
46	Investigate the financial aspects of manned access control at the Paradyskloof main gate.	Immediately
47	Investigate the financial aspects fencing the area.	Immediately
48	Deploy additional staff with direct communication with law enforcement to monitor the area.	Immediately and ongoing
49	Liaise with municipal law enforcement, private security, local Whatsapp or email groups and the municipal courts to improve reporting and conviction of offences.	Immediately and ongoing

4.3.5 Municipal Infrastructure

As described in Chapter 3.4 above the Paradyskloof NA houses various municipal infrastructure. It is important that the Municipality are able to access, maintain and effect required improvements to these infrastructure. Although the importance of these works can not be underestimated it must be planned and executed in a manner that has the least possible impact on the area.

Table 15: Guidelines for management of municipal infrastructure

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
50	Maintain all infrastructure in good working order.	Ongoing
51	Development proposals or plans for maintenance work within the Paradyskloof NA to be circulated to the Department: Community Services for input.	Ongoing

4.3.6 Events

As mentioned in Chapter 4.3.3 (Recreation) above the Paradyskloof NA is an important resource used for spiritual, scientific, educational, recreational and tourism opportunities. Stellenbosch Municipality receives various applications for events in Paradyskloof NA for consideration. It is the Municipality's responsibility to ensure that such events are compatible with the area of Paradyskloof NA, that such an event does not present a threat or impact to the area that can not be avoided or mitigated and that the area can ultimately benefit from such an event.

In order to give effect to the potential of the Paradyskloof NA in this regard events must be used as a way to create a strong element of ecological and cultural awareness with event organisers and participants in order to ensure environmental sustainability. The following applies to events in Paradyskloof NA:

- (i) Events are to be held in a manner that has the least possible negative environmental impact.
- (ii) Event applications must be submitted timeously for consideration, preferably 90 day prior to such an event.
- (iii) Potential effects of an event must be considered by the municipality and an approval granted only if the potential impact of such an event is considered to be acceptable or is of such a nature that the likely impacts can be avoided and/or mitigated.
- (iv) The applicant applying for an event license is to provide a scope of the proposed event activities, an assessment of the likely environmental impacts of such activities, recommended mitigation measures to be implemented and the degree to which the proposed mitigation measures are expected to address the identified environmental impacts.
- (v) An application for an event in a nature area is to be circulated to the relevant municipal department tasked with the management of such an area for consideration, comment and the provision of conditions before a decision for the granting/refusal of an event license is made.
- (vi) An applicant may be liable for an application fee, the criteria of which have been approved by the Council of Stellenbosch Municipality.
- (vii) An event license granted is only valid upon acceptance of the set conditions for the hosting of the particular event and payment made of the application fee by the event organizer.
- (viii) Unless specified otherwise, the event organizer assumes responsibility for the event's compliance to conditions imposed during the granting of an event permit.
- (ix) The event organizer is responsible for any rehabilitation to a nature area damaged or degraded during an event. The scope of such rehabilitation work will be the restoration of an area to the state prior the hosting of the relevant event.
- (x) In the event that rehabilitation work is required the municipality may direct an event organizer to investigate, evaluate and assess the impact of specific activities and report thereon and to complete rehabilitation measures before a specified reasonable date.

Table 16: Guidelines for events in the Paradyskloof NA

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
52	Consider all events in the area in terms of the above criteria.	Ongoing
53	Development a set of application fees for submission to Council.	Immediately after EMP approval

4.3.7 Development

It is imperative that the integrity of the Paradyskloof NA be protected through appropriate planning and management intervention. Accordingly any physical development in the Paradyskloof NA is to be planned and implemented to have the least possible impact and to have any such impact mitigated.

Table 17: Guidelines for development

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
54	Development proposals within the Paradyskloof NA to be circulated to the	Ongoing

	Department: Community Services for comment.	
55	Investigate the inclusion of other (adjoining) land into the Paradyskloof NA.	Ongoing

4.4 ENVIRONMENTAL AUDITING

This EMP builds upon the notion that uncertainty (or lack of knowledge) about the status and function of ecosystems can be addressed in an *adaptive management strategy* - an approach that relies on continual assessment and adjustment. Although repeated revision of management decisions is at the core of adaptive management, this does not threaten resource security, rather it provides for sustainability of resource use. Threats to resource security can be minimised if management objectives are set clearly. In addition, adaptive management will reduce the sort of pressure that stymies action because initial choices are not viewed as final. The dimension of continual improvement is embodied in adaptive management. Continual improvement is defined as the process of enhancing management actions to achieve improvements in overall performance (i.e. remaining dynamic). It is achieved by continually evaluating environmental performance against set environmental policies, objectives and targets with the purpose of identifying opportunities for improvement. Accordingly, the Paradyskloof NA EMP is a dynamic document which is subject to updating and amendment in accordance with the results of monitoring and auditing and the outcomes of on-going scientific research.

4.4.1 Auditing Strategies

Table 18: Auditing actions

REF -NR	ACTIONS/IMPLEMENTATION	TIME FRAME
56	Audit all documented impacts of management actions on the environment.	Annually in October
57	Implement procedures for handling incidents of non-conformance with the EMP.	Annually in October
58	Manage environmental records, including the results of audits and reviews.	Immediately after EMP approval
59	Submit audit report to the Municipality.	Annually in October

4.4.2 Auditing Procedures

The environment audit to be undertaken is a methodical examination of the site's environmental information to verify whether, and to what extent, the management actions have complied with set performance criteria. The review of the EMP on a five-year basis is based upon the results of the environmental audits the objective being to ensure its continuing appropriateness and effectiveness.

The environmental audit consists of three stages, namely *pre-audit*, *on-site audit* and *post-audit*. Pre-audit includes the administrative issues associated with planning the audit, selecting the institution to conduct the audit, and preparing the audit protocol. The main purpose of the pre-audit stage will be to develop an audit plan, based on the most recent information and the results of the previous year's audit. The audit plan must also address where the audit is to be conducted, what the scope and objectives of the audit are, how the audit will be conducted (keeping in mind that the results of the audit must be comparable to previous year's audit results), and when the audit is to be conducted.

The on-site audit involves the recording of required information. The audit team gathers information by observation, conducting photographic studies, taking measurements, and conducting tests as was determined during the pre-audit stage. During the on-site audit stage the strength and weaknesses of the methods of information gathering must be evaluated in order to determine whether the process of auditing is effective in achieving its goal. In keeping with the adaptive management approach, the auditing process must also be looking for continual improvement. All the information obtained is recorded and a comprehensive record of the audit and the state of affairs produced.

The audit report is completed during the post-audit stage. Such report will reflect previous results, current results, and recommended improvement goals. The audit report will also indicate failures or deficiencies and recommendations for corrective actions.

4.4.3 Environmental Indicators

Table 19: Environmental Indicators for the auditing process (*Environmental Indicators for National State of the Environment Reporting* [DEAT, 2002]).

ENVIRONMENTAL MANAGEMENT	
Environmental Management	EM01 – Multilateral environmental agreements EM02 – Budgetary allocation to natural resource management EM03 – Budgetary allocation to environmental education EM04 – Budgetary allocation to environmental research EM08 – Voluntary use of environmental accounting and reporting EM10 – Environmental reporting by the Municipality
BIODIVERSITY & NATURAL HERITAGE	
Species Diversity	BD01 – Threatened and extinct species per taxonomic group BD02 – Endemic species per taxonomic group BD03 – Alien (non-indigenous) species per taxonomic group BD04 – Population trends of selected species BD05 – Distribution and abundance of selected alien species
Habitat Change	BD06 – Extent of conserved area BD08 – Disturbance regimes: fire frequency
Resource Value	BD11 – Contribution to job creation: eradication of alien species
LAND USE	
Land Use	LU01 – Land cover LU02 – Land productivity vs potential
Land Condition	LU03 – Soil loss LU04 – Land degradation

5 VALIDITY

The Paradyskloof NA EMP is based upon and aims to give effect to a long-term vision for the area which is not subject to *ad hoc* or short-term amendment. However, in terms of the principle of continual improvement the EMP is subject to revision in accordance with the results of on-going monitoring and auditing to be undertaken as described in Chapter 4.4. It will be valid, in its current form, for a period of 5 years from the date approved by Council of Stellenbosch Municipality after which comprehensive revision has to be considered.

Within this period addition or amendments to the EMP can be considered as approved by the established Friends of the Paradyskloof NA. These additions or amendments will be added to the document as addendums before being included in the document on revision. Examples of such addendums may included documents such as:

- a) Updated maps,
- b) Founding documentation on the proposed “Friends of the Paradyskloof NA”,
- c) Updated rules on access, use of the NA or Clubhouse, etc.

6 CONCLUSION

The Paradyskloof NA EMP is a mechanism intended to facilitate the achievement of the vision set for the area. The EMP and its associated processes of community participation, education and performance auditing presents an opportunity for all concerned to participate in the long-term management of the area for the benefit of the current and future generations. The implementation of the EMP presents the first step in such process. This document should therefore not be seen as a final product, but rather as a step towards the implementation of integrated bioregional planning as *‘an organised process that enables people to work together, think carefully about the potential and problems of their region, set goals and objectives, define activities, implement projects, take actions agreed upon by the communities, evaluate progress and refine their approach’*.