Western Cape Government

BETTER TOGETHER.

Sandveld Environmental Management Framework

Western Cape Government:
Department of Environmental Affairs and Development Planning
and Department of Agriculture

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Glossary

Biodiversity Targets	The minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long-term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystems
Critical Biodiversity Area	An area required to meet biodiversity targets for ecosystems, species and ecological processes that is identified in a systematic biodiversity plan undertaken by the provincial conservation authority, of which geographical representations can be found on the South African National Biodiversity Institute's BGIS website http://bgis.sanbi.org/;
Critically Endangered	An ecosystem or species listed as critically endangered in terms of NEM:BA
Ecological driver	The biophysical processes that maintain biodiversity pattern and, if modified, can result in degradation of ecosystem functioning, changes to the composition and structure of affected biodiversity, and, potentially, localised loss of species and destabilisation of the affected ecosystems
Ecoregion	An ecoregion is an area of similar climate, geology and vegetation
Endangered	An ecosystem or species listed as endangered in terms of NEM:BA
Environment	Means the surroundings within which humans exist and that are made up of (i) the land, water and atmosphere of the earth; (ii) micro-organisms, plant and animal life; (iii) any part or combination of (i) and (ii) and the interrelationships among and between them; and (iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing
Environmental Authorisation	The authorisation by a competent authority of a listed activity or specified activity in terms of NEMA, and includes similar authorisations contemplated in a specific environmental management Act
Environmental Impact Assessment	A systematic process of identifying, assessing and reporting environmental impacts associated with an activity, and includes basic assessments and Scoping & Environmental Impacts Reports
Environmental Management Framework	A study of the biophysical and socio-cultural systems of a geographically defined area to reveal where specific land uses may best be practiced and to offer performance standards for maintaining appropriate use of such land

Extensive Agriculture	Livestock farming
Farm / farm unit	In the context of farm-level planning (see 4.2.1 below) means one or more cadastral units that are registered separately in a deeds office, are used for growing crops as a single unit, and fall entirely within the geographical area of this Environmental Management Framework.
Farm-Level Management Plan	A recommended planning document, derived by undertaking a farm-level planning approach for the implementation of the Sandveld Environmental Management Framework, that investigates the agricultural, ecological, and hydrological properties of a farm unit in order to support environmentally responsible farm management
Farm Use Map	A recommended map that delineates the land use categories of a farm unit as captured in the Farm-Level Management Plan
Implementing Authority	The government institutions that are responsible for implementing the Sandveld Environmental Management Framework
Intensive Agriculture	Cultivation of crops, either through tillage or horticulture
Least Threatened	A species or ecosystem not identified as being critically endangered, endangered or vulnerable in terms of NEM:BA
Producers	A person or company that makes, grows, or supplies goods or commodities for sale
Protected Areas	Any of the protected areas referred to in section 9 of the National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003);
Systematic Biodiversity Planning	The process of prioritising areas for conservation; a scientific method for calculating how much habitat is required, relative to quantitative targets and thresholds, for conserving a representative sample of a region's biodiversity and the ecological and evolutionary process that ensure its persistence, in the most spatially efficient manner.
Threatened Ecosystem	Ecosystems that are listed as Critically Endangered, Endangered or Vulnerable in terms of NEM:BA
Virgin Soil	Land that has not been cultivated for 10 years or longer.
Vulnerable	An ecosystem or species listed as vulnerable in terms of NEM:BA
Watercourse	A river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake or dam into which, or from which, water flows; and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a

	reference to a water-course includes, where relevant, its bed and banks
Wetland	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

Acronyms

°C	Degrees Celsius
CBA	Critical Biodiversity Area
C-CAM	Conformal-cubic atmospheric model
CFR	Cape Floristic Region
CO_2	Carbon Dioxide
CPI	Consumer Price Index
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
DAFF	Department of Agriculture, Fisheries and Forestry
DEA	Department of Environmental Affairs
DEA&DP	Department of Environmental Affairs & Development Planning
DEAT	Department of Environmental Affairs and Tourism
DMP	Disaster Management Plan
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMF	Environmental Management Framework
EN	Endangered
ESA	Ecological Support Areas
FEPA	Freshwater Ecosystem Priority Areas
FLMP	Farm-Level Management Plan
GCBC	Greater Cederberg Biodiversity Corridor
GIS	Geographical Information Systems
GNR	Government notice number

ha	Hectare
IDP	Integrated Development Plan
I&AP	Interested and Affected Party
km	Kilometre
l/s	Litres per second
LT	Least Threatened
m	metres
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MCA	Mountain Catchment Area
mm	Millimetres
MTSF	Medium Term Strategic Framework
NBA	National Biodiversity Assessment
NDP	National Development Plan
NEMA	National Environmental Management Act
NEMBA	National Environmental Management: Biodiversity Act
NEMPAA	National Environmental Management: Protected Areas Act
NFEPA	National Freshwater Ecosystem Priority Areas
NGI	National Geospatial Information
NPAES	National Protected Area Expansion Strategy
ONA	Other Natural Areas
p.a.	per annum
SANBI	South African National Biodiversity Institute
SPC	Spatial Planning Categories
SG	Surveyor General
t	Tonnes
TMG	Table Mountain Group

TOPS	Threatened or Protected Species
VEGMAP	Vegetation Map of South Africa, Lesotho & Swaziland
Vu	Vulnerable
WARMS	Water Authorisation Management System
WC: DoA	Western Cape Department of Agriculture
WCCCARF	Western Cape Climate Change Agricultural Response Framework
WCG	Western Cape Government
WCNCB	Western Cape Nature Conservation Board
WMA	Water Management Area

Executive Summary

The Sandveld Environmental Management Framework (EMF) provides a strategic guide to sustainable agricultural development in the Sandveld and Agter-Cederberg regions, one of the most spectacular, culturally rich and environmentally-challenged parts of the Western Cape.

The EMF was initiated by the Western Cape Department of Environmental Affairs and Development Planning and Western Cape Department of Agriculture, and drafted with contributions from a range of government departments and, crucially, the farming sectors and communities who represent the backbone of economic life and social wellbeing in the Sandveld and Agter-Cederberg.

The EMF recognises that farming lies at the heart of sustainable social and economic development for this region and its people. This means that agricultural resources and the ecosystems in which they are embedded must be used and tended wisely for the sake of the wellbeing and livelihood security of those who live and farm in the region, as well as their descendants.

The Sandveld EMF provides a novel and ground-breaking approach to relieving the regulatory burden on farmers in one of the most rapidly-expanding agricultural areas in the Western Cape which also coincides with highly-threatened ecosystems and plant species. The EMF effectively serves as a 'super Environmental Impact Assessment' that identifies which environmental features need to be protected against further cultivation, which of these could be used subject to specific conditions, and where cultivation can be expedited so long as the proponent abides by the regulatory mechanism adopted for the implementation of the Sandveld EMF.

Farmers wanting to responsibly expand existing or establish new cultivated lands will be required to take the findings of this framework into consideration when applying for environmental authorisation, as required by the National Environmental Management Act (NEMA), act 107 of 1998. Farmers who successfully accommodate the findings of this framework will not have to subscribe to onerous and expensive environmental assessment procedures in order to do what they can do best: farm productively and profitably. This is achieved as a result of the Sandveld EMF evaluating the concerns of significance at a strategic level, thereby facilitating the subsequent project-level implementation of this framework. The activities that would be expedited if a farmer complies with the regulatory mechanism for implementation of the Sandveld EMF are outlined in Table 1.1 on page 7 herein. Further mechanisms for the implementation of this framework, over and above the procedures laid out in the Environmental Impact Assessment Regulations, 2014, will be evaluated in future.

This assessment is different to a 'conventional' environmental assessment in several important ways, however – not least in that overall responsibility for agri-environmental planning and assessment has been shouldered by the state, instead of expecting individual landowners to apply for environmental authorisation on a project-by-project

basis, as is generally the case. Landowners, agricultural associations and other key stakeholders have, however, been closely involved in the development of the EMF, which comprised the following main elements:

- A vision that shapes the type of development path that the inhabitants of the Sandveld and Agter-Cederberg aspire to, namely,

  > *"The people of the Sandveld and Agter-Cederberg are committed to sustainable agricultural and social development within the opportunities and limitations defined by the Sandveld EMF and as offered by nature, its resources and climate change"*

- Objectives to guide the drafting and implementation of the EMF, which has the over-arching aims of making it easier for farmers to cultivate land while protecting critical natural resources and their supporting ecosystems;

- A situation analysis that:
  - Describes the natural and socio-economic facets of the Sandveld and Agter-Cederberg and how they interact through farming which, in turn, has led to the largescale loss of vegetation in sand fynbos and strandveld ecosystems in the lower-lying areas, and excessive pressures on some aquifers;
  - Identifies economic trends in particularly the potato and rooibos farming sectors, and analyzes their implications for the protection of critical biodiversity areas, and sustainable use of natural resources in other, less strategically-significant parts of the Sandveld and Agter-Cederberg;
  - Outlined natural features (e.g. steep slopes) or conservation-worthy areas that should be avoided by future agricultural expansion and development while, at the same time, pinpointing where farming could take place without compromising biodiversity targets and ecological corridors; and
  - Identified distinct land-use categories, each with their own, specific qualities and environmental management objectives, that would guide future agricultural development in the region.

- The land-use categories and management objectives are apportioned between strict biodiversity conservation (including the conservation of critical biodiversity areas on farms), other natural areas that may be suitable for some forms of development, and areas that could be actively farmed; and

- Recommends guidelines for sustainable agro-environmental land-use management, depending on the relevant land-use categories and management objectives.

The EMF is a living document that will be periodically reviewed and updated with input from the key stakeholders who contributed to its development. As such, it belongs as much to the relevant state departments as it does to those individuals and communities who live in the Sandveld and Agter-Cederberg, and draw their resources and livelihoods from this jewel in the crown of the Cape West Coast.

1 Introduction and Background

The environmental management framework (EMF) for the Sandveld area is an initiative of the environmental and agricultural functions in the Western Cape Government (WCG), implemented in terms of NEMA[1].

An EMF entails analysing a distinct geographical area for the purpose of guiding sustainable land use, and to provide standards for maintaining a desired level of environmental quality and functionality. As explained by the national guideline on EMFs (EMF guideline).[2]

> "The purpose of an EMF is to function as a support mechanism in the environmental impact assessment process in the evaluation and review of development applications (by environmental authorities), as well as informing decision making regarding land-use planning applications..." (DEA, 2012, p 2)

EMFs do not place restrictions on existing land use rights; they are an aid to informed planning and decision making. However, if informed by strategic assessments undertaken at the appropriate social and ecological scales, EMFs can serve as a crucial guide to proactive planning that is based on achieving balance between justifiable social and economic development, on the one hand, and ecological protection on the other.[3]

The geographical area incorporated in the Sandveld EMF is one of the Western Cape's core agricultural production areas, especially for potatoes and rooibos, and makes a significant contribution to employment in the West Coast region. It also spans the western and most threatened section of the Greater Cederberg Biodiversity Corridor (GCBC). As such, it represents a focal area for integrated biodiversity conservation action and initiatives in support of sustainable agriculture.

It is in this context that the Sandveld EMF must be understood, namely as representing a proactive approach to reducing the costs (in money and time) of compliance with environmental legislation by reducing the scope of assessment for applicable proposals, whilst protecting the natural resource base and the ecosystems in which it is embedded.

1.1 Location

The Sandveld EMF study area spans approximately 9 350 km^2 on either side of the Olifants River valley, the latter splitting the study domain into the Sandveld component to the south-west and the Agter-Cederberg component to the north-east (please see Map 1.1 below). The Berg River, as far as the Piketberg, forms the southern boundary of the Sandveld component of the EMF, which extends to just north of Lambert's Bay. The

[1] NEMA, Act 107 of 1998
[2] *Integrated Environmental Management Guideline Series (Guideline 6): Environmental management framework regulations, 2010*, GN 806 of 10 October 2010.
[3] De Villiers & Hill (2008)

Sandveld is bounded by the Olifantsrivier Mountains in the east. The Agter-Cederberg component of the EMF lies between the Olifants River and the Northern Cape boundary. The northern part of the Agter-Cederberg includes the Urionskraal valley. The Moravian Mission lands at Wupperthal represent the southernmost area of the Agter-Cederberg.

Map 1.1: The Sandveld EMF study domain

Source: Agri Informatics, 2016

1.2 Relationship between farming and biodiversity conservation

Large parts of the area incorporated in the Sandveld EMF study area fall within the Greater Cederberg Biodiversity Corridor (GCBC), a major regional conservation initiative that incorporates diverse landscapes and ecosystems between the West Coast and the Roggeveld Escarpment in the Northern Cape. However, farming represents the most

important land use and economic activity in the region covered by the Sandveld EMF. Farms therefore represent crucial elements in the conservation network that must be stitched together in order to maintain the ecological integrity and globally unique biodiversity of this part of the Western Cape.

This high degree of convergence between biodiversity conservation priorities and agricultural land use is certainly not unique to the Sandveld and Agter-Cederberg. However, what sets this region apart from others is the rate and magnitude of habitat loss in particularly sand fynbos ecosystems as a result of the rapid expansion of potato and rooibos farming which reached their respective production peaks between 2003 and 2008. Whereas cereal, wine and fruit farming in the Western Cape are also associated with large-scale conversion of ecosystems and biodiversity loss, these changes could be measured in decades or even centuries, depending on the crops involved and where it occurred. In the Sandveld, it has taken little more than 20 years for Leipoldtville Sand Fynbos to be reduced to half of its original, pre-disturbance extent and for this vegetation type to be thrust, by early 2014, into the 'Endangered' category.[4]

One of the major implications of farming in the Sandveld has been a significant reduction in the extent of natural – especially lowland – vegetation in this region, which

Critical Biodiversity Areas (CBAs)

CBA maps identify the most efficient network of sites that are required to ensure the continued persistence of:

- Biodiversity pattern (e.g. species, habitats, vegetation types and ecosystems);
- 'Ecological infrastructure' and the services and goods that it provides to society and human settlement (such as provision of water, grazing for livestock, protection against floods, or pollination); and
- The ecological processes and disturbance regimes by which this biodiversity pattern is maintained.

CBA maps depict categories that are linked to desired management objectives. The categories indicate the importance that is attached to a site owing to its contribution to meeting biodiversity objectives, and therefore serves as an explicit indication of a site's contextual significance. The desired management objectives, in turn, provide the test for determining the appropriateness of a proposed development – development that is consistent with a site's desired management objectives would be appropriate, whereas development that is not consistent with these objectives would probably not be appropriate, and an alternative should be explored.

One of the main achievements of fine-scale biodiversity planning is the extent to which it has reduced the amount of land needed for conservation purposes. With relatively less land needed for conservation, there is also less risk of friction between development objectives and biodiversity priorities. However, due to the threatened nature of many of our landscapes outside protected areas, sites and corridors identified as Critical Biodiversity Areas leave little room for negotiated trade-offs between biodiversity and development. Planning and impact assessment therefore should aim to avoid any further loss of biodiversity in such areas, and a strictly risk-averse approach is called for in these circumstances

Source: SANBI, 2013 (grassland ecosystem guidelines)

[4] Pence (2014)

contains a large proportion of 'Red Data List' plants. Critical Biodiversity Areas (CBAs), comprising high priority habitats and connecting corridors, span about 30% of the Sandveld's landscape, much of which is occupied by active, working farms. In many places, farmland, in the form of irrigated potato circles or dryland (i.e. non-irrigated) rooibos fields, coincides with remnants of threatened indigenous vegetation or wetlands that, in the absence of formal protection, may be vulnerable to future agricultural expansion. In isolated cases, groundwater abstraction for irrigation has also impacted negatively on aquifer yields and water quality.

Due largely to historic land-uses, about 30% of the provincial landscape outside of protected areas in the Western Cape must be specially managed to achieve biodiversity targets and ecosystem thresholds. These conditions create particularly difficult circumstances for potato and rooibos production. In the case of the Sandveld potato sector, soil pathogens and escalating input costs oblige farmers to break new lands so as to protect crops, increase yields and maintain the economic viability of their farms. The rooibos industry, in turn, is driven strongly by tea prices which, when high, offer strong incentive for farmers to increase their plantings in order to capitalise on favourable market conditions.

The close relationship between farming and off-reserve biodiversity conservation poses great challenges to planning, impact assessment and decision-making in support of sustainable development in the Sandveld and Agter-Cederberg. The projected impacts of climate change – fewer winter rainfall events, stronger downpours, higher temperatures, more droughts – introduce another layer of complexity to this state of affairs.

Finding a sustainable balance that will support the co-existence of a thriving agricultural sector with the preservation of a threatened biodiversity poses major challenges for farmers, the state and society at large.

1.3 Purpose and objectives

The Sandveld EMF emerged as a response to these challenges. It is spearheaded by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) and the Western Cape Department of Agriculture (WC:DoA), with wide stakeholder engagement in the affected farming sectors and other government departments and agencies that have functional and/or regulatory responsibilities relating to development, sustainable resource use and biodiversity conservation in the planning domain.

The national EMF guidelines define the objectives of EMFs as including:

- Supporting informed and integrated decision-making by making significant and detailed information about an area available before development proposals are generated;
- Contributing to environmentally sustainable development by anticipating potential impacts and by providing early warnings in respect of thresholds, limits and cumulative impacts, and by identifying already existing impacts to be addressed;

- Supporting the undertaking of environmental impact assessments in the area by indicating the scope of potential impacts and information needs that may be necessary for environmental impact assessments; and
- Supporting the process of delineating geographical areas within which activities listed in terms of NEMA may be excluded by identifying areas that are not sensitive to the potential impacts of such activities.

The objectives of the EMF for the Sandveld are to:

- Promote sustainable development by strategic planning that supports efficient application and decision-making procedures in terms of environmental legislation, thereby minimising potential obstacles to legal compliance;
- Proactively steer new development away from areas of high biodiversity significance;
- Use a holistic approach to land use planning on farms so as to assist producers in making informed decisions about new expansion and sustainable use of agricultural resources;
- Encourage a participatory planning process that will allow local stakeholders, particularly the Sandveld farming community, to take informed co-ownership of the Sandveld EMF and the subsequent Farm-Level Management Plans that are to be developed; and
- Develop the Sandveld EMF as a best practice initiative within a market environment that is increasingly demanding the production of environmentally friendly produce.

Ecosystem Services

Nature provides benefits to society in the form of ecosystem services. Some of these services are familiar to us: they include products such as fresh water, fish, grazing or timber. Others are less tangible, but no less important, and are termed regulatory ecosystem services. Examples of such regulatory services include hydrological processes that replenish aquifers, pollination of crops by insects, or vegetation that stabilises soil and maintains soil moisture.

Ecosystems can be equated with ecological infrastructure: If this infrastructure is degraded, it may no longer be able to provide critical ecosystems services which may ultimately translate into negative impacts on human wellbeing.

Examples of ecological infrastructure that has become degraded, with negative repercussions for people and the economy, include:

- Contamination of groundwater by sea water (over-abstraction) or leached chemicals (poor management of irrigation run-off or agri-chemicals)
- Aggravated floods and erosion due to the in-filling and cultivation of wetlands and channelization of floodplains
- Soil erosion due to the loss of vegetation cover resulting from, for example, inadequate cover crops in areas with dry, hot and windy conditions, over-grazing or poor run-off control in cultivated areas against slopes
- Direct loss of resources (grazing, soil and/or property) owing to uncontrolled wildfires in veld that has become invaded by highly-combustible alien plants
- Loss of pollination services due to the extermination of indigenous bees by invasive bumblebees

As indicated above, the Sandveld EMF has been conceptualised with more in mind than its prescribed role of being an officially-sanctioned informant to environmental and

agricultural decision-making. In addition, it also has two other functions that are of direct relevance to WC:DoA, namely that it must be:

- Sufficiently detailed to inform farm-level planning (see Chapter 4.2.1 below); and
- In the longer term, serve as a basis for developing Farm-Level Management Plans, which does not fall within the scope of work for this, the first phase, of the proposed Sandveld EMF project.

A finalised or adopted Sandveld EMF will become a compulsory reference for the DEA&DP when the department reviews applications for environmental authorisation within the boundaries of the study domain. The information of the EMF can also be used with respect to applications for approvals that are required in terms of legislation pertaining to water, mining and spatial planning and land use legislation.

Overall, the purpose of the Sandveld EMF is to provide a fine-scale, spatially explicit inventory of key agri-environmental informants and preferred development options against which to assess the merits of applications requiring environmental and agricultural authorisation (i.e. its function as a decision support tool for both farmers as well as government departments that regulate agricultural development). It is not the intention of the Sandveld EMF to require environmental authorisation for like-for-like land-use practices. For example, there may be existing settlements that are reflected as Critical Biodiversity Areas or Ecological Support Areas. These may include but are not limited to small towns, villages or farm houses (including farmworker houses). These settlements have not been specifically delineated in this EMF, however, the EMF acknowledges that these settlements are existing and that these do not constitute "*land designated for protection or conservation purposes*" in terms of Listing Notice 3 of the EIA Regulations.

1.4 Regulatory and planning framework

Conventionally, an EMF evaluates land use and environmental trends and characteristics of an area, and strategically forecasts the most appropriate locations for these land use trends over a five-year period. This EMF focuses on ecological and agricultural trends and characteristics of the study area, resulting in a strategy for accommodating these trends while attempting to reduce conflict. In both instances, an EMF is a process and tool rooted in the National Environmental Management Act No. 107 of 1998 and governed by the Environmental Management Framework Regulations of 2010 (GNR. 547 of 18 June 2010). Although rooted in the NEMA, the EMF evaluates the regulatory framework of the study area as one of its characteristics. A detailed analysis of the study area's regulatory and planning framework, as well as the legislative foundation of this EMF, can be found as Appendix A. Below, an overview of the regulatory foundation of the EMF, the regulatory requirements for commonplace agricultural activities within the study area, and the regulatory relief pursued by the implementation of this EMF will be elucidated.

1.4.1 The National Environmental Management Act 107 of 1998 (NEMA)

The NEMA is framework legislation that embraces all three fields of environmental concern, namely the conservation and exploitation of resources, pollution control and waste management, and land-use planning and development[5] and *inter alia*:

- Fleshes out the right to "reasonable legislative measures" for environmental protection;
- Lays down "bed-rock" national environmental management principles that apply to all administrative actions by organs of state that may significantly affect the environment, thereby providing a justifiable basis for 'ecologically sustainable development';
- Prescribes a 'Duty of Care' towards the environment; and
- Establishes general objectives for integrated environmental management (which, in turn, provides the basis of the environmental assessment and management regime in South Africa).

<u>The National Environmental Management Principles</u>

The national environmental management principles are particularly relevant to decisions concerning agricultural development in the Sandveld. These 'sustainability' principles among others require that:

- Environmental management must place people and their needs at the forefront its concern;
- The disturbance of ecosystems and loss of biodiversity must be avoided, minimised and remedied;
- Ecosystem integrity must not be jeopardised;
- The best practicable environmental option must be pursued by means of integrated environmental management;
- The participation of all interested and affected parties (I&APs) in environmental governance must be promoted, including participation by vulnerable and disadvantaged persons;
- Intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment must be promoted;
- The environment must be protected as the people's common heritage; and
- Specific attention must be paid to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

<u>The Duty of Care</u>

Section 28(1) of NEMA reads:

"Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation 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 to the environment".

[5] Glazewski (2000), p 166

The environmental authorities may issue a directive to enforce the 'Duty of Care' provisions and the state can recover the costs of rehabilitation or other remedial measures from the polluter.

The NEMA environmental impact assessment (EIA) regulations

EIA is mandatory for a wide range of prescribed ('listed') activities and circumstances. EIA or 'environmental assessment' refers to the regulatory or administrative process by which the environmental impact of a project and reasonable alternatives is determined.

In terms of general EIA practice and South African legislation, the actual EIA represents the second of two major phases that comprise the EIA process, the first being 'scoping' or the identification of feasible alternatives and issues that would need further investigation to ensure an informed decision. The process of investigation and impact assessment, and which often relies on specialist studies, is the 'environmental impact assessment'.

Besides analysing the environmental impacts of the proposed development and alternatives, EIA also evaluates the significance of these impacts – a process of judgement by which societal values are used to determine if an impact is 'positive' or 'negative', acceptable or not.

The EIA Regulations provide for two 'routes' by which environmental authorisation must be applied for. The first is the Basic Assessment process, currently a more streamlined version of the scoping and Environmental Impact Report (EIR) procedure than before. The EIA Regulations specify which activities require a Basic Assessment. The second 'route' is that of the fully-fledged scoping and EIR option, which applies to a somewhat shorter list of gazetted activities.

Basic Assessment, Scoping and EIR all require public participation. The EIA culminates in an EIR. An EIR is meant to be an objective tool for assisting the state in making an informed decision on the basis of the relative environmental merits or demerits of a development proposal and its alternatives. NEMA provides for a right to appeal against an environmental decision.

The NEMA EIA Regulations constitute a package of prescribed measures to achieve the objectives of integrated environmental management. The main components are:

- The actual regulations, which lay down the rules of conducting either a basic assessment or scoping and EIA (GNR. 982);
- Listing Notice 1: Lists activities that may not commence without environmental authorisation, and which require a basic assessment (GNR. 983);
- Listing Notice 2: Lists activities that may not commence without environmental authorisation, and which require scoping and EIA (GNR. 984); and
- Listing Notice 3: Lists activities in specified geographical areas that may not commence without environmental authorisation, and which require a basic assessment (GNR. 985).

NEMA provides for the exclusion of listed activities from the requirement for environmental authorisation, provided that such excluded activities have been specified in environmental management instruments adopted by the competent (environmental) authority.

It is an offence to commence with a listed activity without environmental authorisation, which can carry a maximum sentence of 10 years' imprisonment, and or a fine of R10 million. An entity that has commenced with a listed activity without the requisite environmental authorisation can apply to rectify the unlawful activity in terms of section 24G of the NEMA. Such an application can, however, be refused, and does not preclude further prosecution.

1.4.2 Regulatory requirements of agricultural activities in the Sandveld study domain

Agricultural activity within the study domain has the potential to trigger a number of activities listed in terms of section 24(2) of the NEMA. Certain activities, however, are more commonly triggered than others, and are described below.

1.4.2.1 Clearing indigenous vegetation

Perhaps the most commonplace listed activities encountered by farmers pertain to the clearing of indigenous vegetation. A total of six listed activities speak to the clearing of indigenous vegetation, which are summarised in Table 1.1 below.

Table 1.1: Activities listed in terms of section 24(2) of the NEMA that are commonly triggered in the study area

Listing Notice:	1 (GNR. 983 of 2014) Suggested process: Basic Assessment process
Activity number:	27
Description:	The clearance of an area of 1 hectare or more, but less than 20 hectares of indigenous vegetation, except where such clearance of indigenous vegetation is required for:
	(i) the undertaking of a linear activity; or
	(ii) maintenance purposes undertaken in accordance with a maintenance management plan.
Activity number:	67
Description:	Phased activities for all activities:
	(i) listed in this Notice, which commenced on or after the effective date of this Notice or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;
	excluding the following activities listed in this Notice- 17(i)(a-d); 17(ii)(a-d); 17(iii)(a-d); 17(iv)(a-d); 17(v)(a-d); 20; 21; 22; 24(i); 29; 30; 31; 32; 34; 54(i)(a-d); 54(ii)(a-d); 54(iii)(a-d); 54(iv)(a-d); 54(v)(a-d); 55; 61; 64; and 65; or
	(ii) Listed as activities 5, 7, 8(ii), 11, 13, 16, 27(i) or 27(ii) in Listing Notice 2 of 2014 or similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices;
	where any phase of the activity was below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.

Listing Notice:	2 (GNR. 984 of 2014)	Suggested process:	Scoping and Environmental Impact Reporting process
Activity number:	13		
Description:	The physical alteration of virgin soil to agriculture, or afforestation for the purposes of commercial tree, timber or wood production of 100 hectares or more.		
Activity number:	15		
Description:	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for:		
	(i) the undertaking of a linear activity; or		
	(ii) maintenance purposes undertaken in accordance with a maintenance management plan.		

Listing Notice:	3 (GNR. 985 of 2014)	Suggested process:	Basic Assessment process
Activity number:	12		
Description:	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.		
	In the Western Cape Province		
	(i) within any critically endangered or endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act10 of 2004 (NEMBA) or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004.		
	(ii) within critical biodiversity areas identified in bioregional plans;		
	(iii) within the littoral active zone or 100 metres inland from the high water mark of the sea or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line or erven in urban areas;		
	(iv) on land, where, at the time of coming into effect of this Notice or thereafter, such land was zoned open space, conservation or had an equivalent zoning; or.		
	(v) On land designated for protection or conservation purposes in an Environmental Management Framework adopted in the prescribed manner or a Spatial Development Framework adopted by the MEC or Minister.		
Activity number	26		
Description	Phased activities for all activities -		
	(i) listed in this Notice and as it applies to a specific geographical area, which commenced on or after the effective date of this Notice;		
	(ii) similarly listed in any of the previous NEMA notices, and as it applies to a specific geographical area, which commenced on or after the effective date of such previous NEMA Notices -		
	where any phase of the activity was below a threshold but where a combination of phases, including expansions or extensions, will exceed a specified threshold; - excluding the following activities listed in this Notice - 7; 8; 11; 13; 20; 21; and 24. All the areas as identified for the specific activities listed in this Notice.		

1.5 Sustainability Principles and Objectives

The Sandveld EMF is based on a set of tailored land-use principles and objectives to guide planning, decision making and resource management in the area to which it applies.

The principles are derived from legislation, namely the:

- The National Environmental Management Act 107 of 1998;
- The Spatial Planning and Land-use Management Act 16 of 2013; and
- The Conservation of Agricultural Resources Act 43 of 1983

The land use objectives have been distilled from the *Rural Land Use Planning and Management Guidelines* published in terms of the Western Cape Provincial Spatial Development Framework and which are based on the biodiversity categories and objectives reflected in biodiversity sector plans.[6]

1.5.1 National and Provincial policy relating to sustainable agricultural development

National and provincial policies are closely aligned when it comes to promoting sustainable agriculture, livelihood and food security, and adaptation to climate change.

1.5.1.1 The National Development Plan (NDP)7

The NDP aims to eliminate poverty and reduce inequality by 2030. It calls for concrete steps to address environmental sustainability and resilience to the anticipated effects of climate change (which, in fact, are two sides of the same coin). This means, among others, making "significant investment" in conserving, rehabilitating and restoring natural ecosystems to improve ecological and economic resilience.

The NDP also focuses on the agricultural sector by promoting job creation through agricultural development, especially irrigated agriculture and land production, developing agricultural diversification through agri-processing, tourism, fisheries and small enterprises and increasing investment in new agricultural technologies, research and the development of strategies for the expansion of commercial agriculture.

1.5.1.2 Medium Term Strategic Framework (MTSF)

The national government's MTSF gives further strategic direction towards implementation of the NDP in the period 2014-2019. Outcome 10 of the MTSF specifically relates to protecting and enhancing environmental assets and natural resources.[8]

The MTSF warns that competing land uses contribute to the overexploitation of natural resources and the subsequent degradation of these natural resources. Unsustainable production processes result in land and ecosystem degradation and soil erosion which continue to undermine the productive potential of land and compromise water and food security. This loss of natural resources and ecological infrastructure is further compromised by the inadequate size, representativeness and quality of the current conservation estate.

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[6] Maree KS and Vromans DC (2010)

[7] https://nationalplanningcommission.wordpress.com/the-national-development-plan/ (accessed 11-02-2016)
[8] http://www.poa.gov.za/MTSF%20Documents/Outcome%2010%20Environment%20MTSF%20Chapter.pdf (accessed 10-02-2016)

As noted by the MTSF,

> All these necessitate integrated and innovative approaches to natural resource management which entail a careful balance between development imperatives and sustainable utilization. An environmental management framework is required to ensure that developments that have serious environmental or social effects are offset by support improvements in related areas...

The MTSF identifies several steps to this end, which hold direct relevance to achieving a 'win-win' balance between farming and biodiversity conservation in the Sandveld:

- Implementing strategies for water conservation and demand management;
- Water resources protection;
- Using biodiversity stewardship to expand the conservation estate;
- Integrating ecological infrastructure considerations into land-use planning and decision-making about new developments;
- Providing incentives for green economic activities; and
- Combating land degradation.

1.5.1.3 Western Cape Strategic Plan 2014-2019[9]

These goals and objectives of the NDP and MTSF have also been integrated into the Western Cape's *Strategic Plan* for the Western Cape, and particularly in terms of Strategic Goal 4, i.e. enabling both environmental and social resilience.

The strategic objectives of this goal include enhanced management and maintenance of the ecological and agricultural resource-base, and improving the provincial response to climate change.

The five-year strategic plan proposes:

- Specific responses with respect to maintaining ecosystem health and optimising resource-use efficiencies;
- Integrated management relating to climate change and regional planning; and
- Developing and implementing a provincial Agricultural Climate Change Response Plan.[10]

1.5.1.4 Western Cape Department of Agriculture Strategic Plan: 2015/16-2020/21[11]

In turn, the Western Cape Department of Agriculture's Strategic Plan states that sustainable resource management lies at the core of a productive agricultural sector and provincial food security.

[9] https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/strategic_plan_2015_with_erratum.pdf (accessed 10-02-2016)
[10] The draft plan is available at: http://www.acdi.uct.ac.za/research/smartagri (accessed 10-02-2016)
[11] http://www.elsenburg.com/sites/default/files/publications/2015-04-29/strategic-plan-draft3%28h%29-2015-2021.pdf (accessed 10-02-2016)

To this end, Departmental Strategic Goal 4 calls for the optimisation of efficient and sustainable utilisation of water and land resources to increase 'climate-smart' agricultural production. This includes increasing options for farmers to adapt to climate change.

The department's area-wide planning initiatives will enable farmers to increase the area under production on their farms whilst conserving the areas that require critical biodiversity management and conservation initiatives (this needs to be supplemented by improving agricultural yields within the existing, farmed footprint of the Sandveld planning domain so as to reduce pressure on natural habitats and ecosystem services).[12]

This corresponds closely with one of the key off-shoots of the Sandveld EMF, namely developing farm- and area-wide plans that will supplement the EMF at the local level.

Biodiversity mainstreaming

Mainstreaming biodiversity involves incorporating biodiversity considerations directly into the policies and planning of business or industry and organs of state.

Mainstreaming biodiversity ensures that addressing development needs and protecting the environment is not an either-or situation, but rather that development is supported by the sustainable use of natural resources.

http://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity

1.5.1.5 Draft Climate Change Response Framework for the Agriculture Sector of the Western Cape Province[13]

As with biodiversity 'mainstreaming' in the Western Cape,[14] the draft *Climate Change Response Framework for the Agriculture Sector of the Western Cape Province* recommends that climate change adaptation should be embedded in local and district-level line functions and master planning, such as the Integrated Development Plans (IDPs), Spatial Development Frameworks (SDFs) and Disaster Management Plans (DMPs).

The Sandveld EMF provides an important opportunity to give devolved, practical effect to the objectives and adaptive strategies recommended by the draft *Climate Change Response Framework for the Agriculture Sector of the Western Cape Province*, in that the EMF:

- Sets out to achieve a spatially-defined balance between agricultural production and maintaining ecosystem resilience in a region with high biodiversity importance and vulnerability to climate change;

[12] Phalan *et al.* (2016)
[13] WCG:Agriculture and WCG:EADP (2015)

[14] http://www.sanbi.org/biodiversity-science/science-policyaction/mainstreaming-biodiversity/cape-programme/our-strategy/bio (accessed 10-02-2016).

- Gives farmers, environmental assessment practitioners and officials a reliable basis for informed agricultural planning, environmental assessment and decision-making; and
- Is designed to expedite application procedures and decisions while safeguarding the natural environment and ecosystem services that underpin human wellbeing and sustainable agriculture in the Sandveld and Agter-Cederberg.

The Sandveld EMF is closely guided by these policies relating to sustainable agriculture and its broader role in facilitating improvement in the quality and livelihoods of rural communities, and maintaining its vital contribution to domestic food security and economic competitiveness.

1.5.2 Principles

The principles that underpin the Sandveld EMF recognise that the Constitutional right to ecologically sustainable development exists in tandem with the right to have justifiable social and economic development promoted – and that sustainable development depends on our ability to balance these rights in practice.[15]

They also promote positive planning, or planning whereby impact avoidance has priority and compensation is used as a last resort for mitigating or off-setting residual environmental impacts.[16]

The Sandveld EMF is embedded in the principles that planning, decision making and land-use management relating to agricultural and other development within the geographical boundaries of the EMF must:

- Actively pursue the best practicable environmental option[17] for reconciling justifiable agricultural development with biodiversity-related opportunities and constraints as defined and mapped by the Sandveld EMF,
- Optimise agricultural utilisation of natural resources in support of sustainable economic growth and land reform in a manner that does not compromise the long-term integrity, productivity or resilience of affected ecosystems,[18,19,20]
- Take special care to protect prime and unique agricultural land against non-agricultural development[21] and prevent habitat loss and ecological degradation in ecosystems that are subject to significant human resource usage and development pressure,[22] and

[15] Fuel Retailers Association of Southern Africa v Director-General: Environmental Management, Department of Agriculture, Conservation and Environment, Mpumalanga Province and Others (CCT67/06) [2007] at 93
[16] Brownlie *et al.* (2005)
[17] NEMA 107/1998, section 1
[18] CARA 43/1983, section 3
[19] SPLUMA16/2013, section 7(b)(iii)
[20] NEMA 107/1998, section 2(4)(a)(iv)
[21] SPLUMA 16/2013, section 7(b)(ii)
[22] NEMA 107/1998, section 2(4)(r)

- Aim for the most efficient means for expediting official decisions about future agricultural development that is consistent with the relevant land-use management of objectives specified by the Sandveld EMF and informed by proactive environmental screening and practical verification of mapped features.

1.5.3 Land Use Objectives

The management objectives for farming and safeguarding ecological resources are based on the Western Cape Rural Land-use Planning and Management Guidelines (2009) and Western Cape Biodiversity Framework (2014).

In order to promote a consistent approach to land-use in the Western Cape, it is important to maximise the alignment of the Sandveld EMF with current spatial policy in the Western Cape. For this reason, the land-use objectives that apply to each land-use category in the Sandveld area are based closely on the land management objectives reflected in the *Western Cape Rural Land-use Planning and Management Guidelines*, published in 2009.

The rural land-use planning guidelines recommend land use objectives for *inter alia* biodiversity conservation at a landscape and farm scale, and agriculture (see Box). The guidelines recognise that agriculture provides the base for rural economies. The approach to planning therefore is to:

Objectives of the Western Cape rural land-use planning guidelines:

- Promote sustainable development in appropriate rural locations throughout the Western Cape, and to ensure that the poor share in the growth of the rural economy;
- Safeguard the functionality of the province's life supporting ecosystem services (i.e. environmental goods and services);
- Maintain the integrity, authenticity and accessibility of the Western Cape's significant farming, ecological, cultural and scenic rural landscapes, and natural resources;
- Assist Western Cape municipalities to plan and manage their rural areas more effectively; and
- Provide clarity to the provincial government's social partners on what kind of development is appropriate beyond the urban edge, suitable locations where it could take place, and the desirable form and scale of such development.

- Promote consolidation of farming landscapes and prevent their fragmentation;
- Provide for land and agrarian reform;
- Improve the viability of farming by facilitating diversification of the agricultural economy; and
- Promoting sustainable farming practices.

The Western Cape rural land-use planning guidelines provide for five spatial planning categories (SPCs) that correspond with mapped biodiversity priority areas. These are outlined in the table below.

Table 1.2: Spatial categories and corresponding mapped biodiversity priority areas

Biodiversity conservation category	Spatial planning category (SPC)
Protected areas CBAs	Core 1
Ecological Support Areas (ESAs)	Core 2
Other natural areas (large, intact remnants, especially adjacent to CBAs or ESAs	Buffer 1
Other natural areas in a transformed/agricultural matrix	Buffer 2
Intensive agriculture and settlements (no remaining natural habitat)	Intensive agriculture

Table 1.3 reflects the management objectives for the respective biodiversity conservation categories set out above.[23]

Table 1.3: Management objectives for the different biodiversity categories

Biodiversity category	SPC	Biodiversity Management objectives
Statutory protected areas Critical Biodiversity Areas	Core 1	Maintain as natural land. Rehabilitate degraded areas to a natural or near-natural state. Manage against further degradation and for no further habitat loss.
Ecological Support Areas	Core 2	Maintain at least in a near-natural state to ensure that these components of ecosystems remain functional (some loss of habitat can be tolerated). See management objectives for Buffer 1.
Other Natural Vegetation (intact, adjacent to CBAs)	Buffer 1	Must serve as undeveloped buffers between CBAs and cultivated areas. These areas may be developed provided that: They are depicted on Farm-Level Management Plans; Optimal buffer widths have been determined by a biodiversity specialist; Fragmentation is discouraged; Veld is burnt in blocks larger than 300 ha; Managed burns on smaller farms are not less than 100 ha, and blocks of less than 50 ha are burnt in one go; and Alien plants are removed.
Other Natural Vegetation (in transformed, agricultural matrix)	Buffer 2	Areas favoured for land-uses other than biodiversity conservation. This land may be developed, provided that: It is depicted on farm plans; Development is consistent with sustainable agricultural practices as defined by the best practice guidelines for the potato and rooibos sectors; and Prior to any transformation, patches less than 50 ha should be burnt in one go and kept free of alien invasive species.

[23] Maree & Vromans (2010)

The objectives that apply to the conservation of biodiversity in the Sandveld and Agter-Cederberg therefore need to be reconciled with, and honour, specific agricultural objectives, that are obliged to promote:

- The protection of prime and unique agricultural land and resources in accordance with the principles of sustainable production and land use;
- Securing unique and high potential agricultural land against alienation; and
- Justifiable agricultural development as intimated by section 24 of the Bill of Rights.

The Sandveld EMF cannot adjudicate on disputes that may arise from conflicts between biodiversity and agricultural land use objectives. It can, however, highlight situations where such disputes are likely unless they are pre-empted by positive planning, or identifying the best practicable alternative for balancing the respective objectives of biodiversity conservation and sustainable agricultural development.

1.6 Compilation of the Sandveld Environmental Management Framework

The drafting of the Sandveld EMF was comprised of a number of steps. The section below briefly outlines the process followed:

Situation analysis report using the Driver-Pressure-State-Impact-Response framework[24], which:

1. Provided the *status quo* of the study area;
2. Identified and described the major drivers of change and anticipated trends and pressures, which represents opportunities and constraints;
3. Described how land-use pressures have impacted on the study domain and looked at different impact scenarios;
4. Identified policy and spatial informants and policy responses to planning, development and land-use regulation in the study area;

Draft Environmental Management Framework report, which

5. Synthesised a set of principles that should guide development planning and decision making in the study area;
6. Developed a list of land-use types and desired land-use objectives for each category;
7. Identified land-use categories that would be and would not be compatible with environmental constraints and sustainable land-use objectives; and
8. Developed maps that spatially depict the land-use categories identified in terms of the status quo analysis, the desired land-use objectives for each category and areas where current land-use differs from desired land-use objectives.[25]

24 EEA (1995) Europe's environment: the Dobris Assessment. European Environment Agency, Copenhagen

25 The methodology employed in the compilation of the maps is outlined in more detail in Appendix A

2 Situation analysis

The drafting of the Sandveld EMF was preceded by a situation analysis, undertaken between November 2013 and November 2014. The situation analysis produced a 'status quo' report which had three main functions, namely to:

- Record land use pressures and their effects on the receiving environment;
- Make projections about potential future land use trends; and
- identify areas of heightened risk of conflict between agricultural and biodiversity conservation.

The main findings of the 'status quo' report are summarised here.

2.1 Geographic setting

The study area lies inland of the Atlantic coastline of the Western Cape province and is broadly defined by the Berg River in the south, the Northern Cape boundary to the east, the 32nd parallel (south) and the Koebee Mountains in the north. The total area is approximately 9 350 km^2 in extent. The north-trending Olifants River valley bisects the study area into the western 'Sandveld' (5 553 km^2) component, and the eastern 'Agter-Cederberg' (3 799 km^2) component.

The physical structure of the study domain is defined by the following elements:

- A low-lying coastal plain (the Sandveld), approximately 100 km long and 40 km wide;
- The northern outliers of the Olifantsberge, which separate the Sandveld from the Olifants River valley to the east;
- The Piketberg massif, which dominates the south-eastern corner of the Sandveld;
- The valley of the Olifants River, which forms the interface between the western and eastern components of the study domain;
- The Cederberg, Nardouw, Gif and Matzikama mountains that run northwards, roughly parallel and to the east of the Olifants River (the regionally-important Doring River joins the latter near the Bulshoek Dam, north of Clanwilliam); and
- The Agter-Cederberg, which incorporates the Urionskraal area in the north and the highly broken terrain inland of the escarpment.

2.1.1 Geology and soils

The study domain falls predominantly within the Cape Fold Belt Mountains and related valleys and lowlands. The geological units consist (in order of age) of the Malmesbury Group, the Gariep Supergroup and the Cape Supergroup, which is dominated by hard-wearing sandstones.

The Cape Supergroup comprises a succession of sandstones, shales and minor conglomerates subdivided into the Table Mountain, Bokkeveld and Witteberg Groups. The Cederberg area is comprised mainly of rocks of the Table Mountain Group (TMG), with

the Peninsula, Pakhuis and Cederberg Formations and the Nardouw Subgroup dominating the area.

Soils vary from deep, excessively drained, mostly aeolian sands (which contain the major aquifers of the Sandveld), to duplex soils (sandy topsoil, clayey subsoil) and shallow lithocutanic soils.

Figure 2.1: Bokkeveld shales overlying the TMG

Figure 2.2: Weathered sandstone formations of the TMG

Figure 2.3: The Cederberg is home to numerous San rock art paintings

2.1.2 Climate, weather and climate change

2.1.2.1 Climate and weather

The study area experiences a typical Mediterranean climate with hot, dry summers and moderate to cold winters. The air above the cold Benguela current and upwelling region along the west coast is relatively dry and cold, contributing to the dry climate of the west coast and adjacent interior.[26] Rain is brought to the region by mid-latitude frontal systems in winter (May to August) and, in the east of the study domain, convective thunderstorms in summer.[27]

Average rainfall throughout the Sandveld is generally low to moderate, although slightly higher in the mountainous areas.[28] Leipoldtville in the north, Redelinghuys in the central Sandveld, and Aurora in the south each receive on average of 300 to 400 mm of precipitation per annum (p.a.). Annual rainfall doubles in the central Cederberg: Algeria, about 50 km east of Redelinghuys, has an annual rainfall of 700 to 800 mm p.a. Conditions are considerably drier around Vanrhynsdorp and Urionskraal, which are located in the Succulent Karoo and receive on average 200 to 300 mm of rain p.a.

Summers are hot, with some cooling towards the coast, whereas freezing conditions and snow can be experienced in the Cederberg Mountains in winter. Lowest mean annual temperatures are recorded at the coast (Lambert's Bay, 15-16˚C p.a.), and the highest in the vicinity of Vanryhnsdorp (19-20 ˚C p.a.). Average mean temperatures for the Sandveld range between 16 and 19˚C p.a. Summer maximums (February) range between 34˚C (Vanrhynsdorp, Sandberg, Paleisheuwel and Aurora), 28˚C (Wupperthal) and 24˚C (Lambert's Bay).

Evaporation ranges from 1 200 – 1 600 mm p.a., and is thus always in excess of rainfall. This indicates that the sandy, primary aquifers of the Sandveld from which potato farmers draw water groundwater for irrigation are recharged from rainfall in the high-lying mountainous areas to the east.

The moderate to even relief of the Sandveld, relatively low rainfall and distance from the main regional mountain catchment area in the Cederberg mountains, mean that this area seldom experiences floods. However, settlements and farmland in the Agter-Cederberg are considerably more vulnerable to being cut off by rapidly-rising ephemeral flows in winter.

Dry, hot and windy summers, combined with high-altitude lightning strikes or human negligence, make this a naturally fire-prone region, as evidenced by its fire-adapted fynbos and renosterveld ecosystems.

But, as with many regions elsewhere in the world, the climate of the Sandveld can no longer be accepted as being stable, and land-use planning and agriculture need to be

[26] Archer *et al.* (2010) *South African Risk and Vulnerability Atlas* http://researchspace.csir.co.za/dspace/bitstream/10204/4974/1/Archer2_2010.pdf (accessed 15-02-2016)
[27] PGWC and UCT-ACDI (2015) http://www.acdi.uct.ac.za/research/smartagri (accessed 15-02-2016)
[28] All climate-related data source from Cape Farm Mapper, http://gis.elsenburg.com/apps/cfm/ (accessed 15-02-2016)

forewarned about – and, crucially, adapt to – potential climate shifts that point to less rainfall, more droughts and an increase in extreme weather events.

Draft 'SmartAgri' *Status Quo Review of Climate Change and the Agricultural Sector in the Western Cape*

The Western Cape government, through the Department of Agriculture and Department of Environmental Affairs and Development Planning, commissioned the University of Cape Town's African Climate and Development Initiative to investigate climate change responses in agriculture in the province, as well as to assess climate-related risk and impacts on specific commodities and agri-climatic zones.

The study also entailed the drafting of 'A Climate Change Response Framework for the Agriculture Sector of the Western Cape Province (WCCCARF)' which was published in a draft format in 2015.

Impacts on different production sectors

It was found that the biggest threats of climate change to field crops most likely related to the distribution and intensity of pest species, the spread of diseases and growth of weeds.

'SmartAgri' climate and farming review: Key points

- Agriculture is fundamentally driven and impacted by climate systems and many commodities are highly exposed to climate variability and climate change.
- The complex mountain topography and ocean influence in combination with heterogeneous land use, vegetation and soils, results in a rich mosaic of meso-climate and agricultural production potential.
- Climate change will cause shifts in locally important climate systems or processes, such as the strengthening of conditions which give rise to orographic rainfall in the shoulder seasons (autumn, spring) and poleward (southerly) contraction of rain-bringing storm tracks during winter.
- Recent trends indicate year-round warming and a reduction in rain days during autumn in some areas. This is a trend also perceived by the farming community.
- Downscaled projections of temperature indicate continued warming of 1.5 °C to 3 °C across the whole province with some moderation of increases along coastal areas.
- Global Circulation Models and the C-CAM dynamically downscaled projections of rainfall indicate reductions in winter rainfall over most of the province by mid-century.
- Statistically downscaled projections of rainfall show high uncertainty with growing evidence that increased orographic rainfall in spring is a possibility. Given the current state of the science, both increased and decreased rainfall should be considered by decision-makers. Decreased rainfall generally poses the highest risk.

Horticultural crops (besides apples) were unlikely to become limited by moderate warming. However, seasonal shifts in rainfall could give rise to production and quality problems. Some regions were likely to gain from this, and others to lose. New areas could also become suitable for horticultural production.

Insufficient water for irrigation held the greatest threat for irrigated crops. Pests, diseases and warming of the currently warmest production regions could also become problematic.

Dryland horticultural crops, such as rooibos, would experience shifts in suitable production areas. Production in warmer and drier areas would contract. New areas that are currently too cool or wet could become available for rooibos production in future.

A reduction in rangeland vegetation (grazing) would have the greatest impact on extensive livestock production. There would also be changes in water availability, pests and diseases.

Generic climate-related risks include floods, droughts, hail, frost and damage to agricultural infrastructure; it is likely that these events will become less predictable, and more common. Adverse climate impacts on agricultural activities could compromise food security, contribute to higher levels of poverty due to job losses, and increased urbanisation.

Climate change impacts on agri-climatic zones

The 'SmartAgri' research identified 23 agri-climatic zones in the Western Cape, and analysed how climate change could affect future agricultural potential in each of them. Six of these agri-climatic zones are located within or close to the area covered by the Sandveld EMF. The implications of climate shifts for each of these areas are presented below (Table 2.1).

The negative effects of climate change – chiefly due to temperature increases -- will be felt most acutely in the Knersvlakte, Hardeveld/northern Sandveld, and northern Cederberg agri-climatic zones: high to medium-range warming will cause some areas to become marginal and those that are already marginal will experience worsening conditions. Higher-lying areas are generally more buffered against increasing temperatures than those at lower altitudes. No area in the domain of the Sandveld EMF will be untouched by climate change. There will be winners and losers, with some feeling it earlier, and more acutely.

An extreme scenario for the Sandveld could be creeping desertification from the north as temperatures rise, rainfall becomes more erratic, groundwater reserves dry up and previously irrigated potato circles and rooibos tea lands fall fallow, without adequate vegetation cover. Add windier conditions, fynbos that dies back and more wildfires, and the outlook starts looking bleak.

All is not gloom, however. The potato sector may, in fact, benefit from increased concentrations of atmospheric carbon that will, through a fertilisation effect, contribute to increased yields, especially in winter. Evapotranspiration by potato plants is reduced under conditions of higher $C0_2$ concentration, implying that water use will decrease with higher yields and lower water use in the Sandveld. With more atmospheric CO_2, tuber sizes are also expected to increase. [29]

[29] Steyn *et al.* (2014)

2.1.2.2 Adaptation to climate change in an uncertain world

As the threat and impacts of climate change looms larger and larger, it is becoming increasingly important for agriculture to adapt in advance to changing conditions or to run the risk of being overwhelmed when it is too late to do anything. Because climate change entails many unknowns, farming and society at large must learn to plan and contend with this uncertainty. Iterative risk management with multiple feedbacks is a useful approach for adaptation in agriculture.[30]

By assessing the widest range of scenarios and impacts – including the least likely possibility, with the largest consequences (such as the extreme scenario raised above) – it is possible to understand the trade-offs of alternative risk management actions. Monitoring, learning and adjustment are key elements of such an adaptive strategy.

Adaptation needs to go beyond being reactive. Instead, we need to plan for adaptation, in specific locations – such as in the Sandveld and Agter-Cederberg. However, other than anticipated warming and drying, it is difficult to pin down specific impacts on farming in the region.

2.1.2.3 The impacts of climate change on ecosystem services

Ecosystems that provide these essential services to humans and the economy can be viewed as the ecological infrastructure: if kept in good working order, they deliver a stream of benefits to society, largely free of charge. But if degraded or disrupted, the services start drying up and human wellbeing becomes affected.[31] There are many examples in South Africa of how we have suffered the consequences of damaged ecosystems, particularly in terms of adverse changes to water flows, flow regulation and water quality.[32]

These range from water losses attributed to alien invasive plants (which, conservatively estimated, have reduced surface run-off in South Africa by 3 000 million m³ or about 7% of the national total),[33] to impacts of historical over-grazing on the availability of groundwater and soil erosion in the Little Karoo,[34] siltation of dams[35] and widespread erosion and flood damage on farms in degraded catchments in the Western Cape.[36]

[30] PGWC and UCT-ACDI (2015)
[31] Kotzé P (2013)
[32] Le Maitre *et al.* (2007)
[33] CSIR (2008)
[34] Le Maitre *et al.* (2007)
[35] SANBI (2013a)
[36] Holloway A *et al.* (2010)

Table 2.1: The implications of climate shifts for each of the agri-climatic zones identified in the 'SmartAgri' research

Agri-climatic zone	Main water resource features	Main climate features	Climate change temperature projections	Main commodities	Socio-economic features	Future agricultural potential
Cederberg	Rivers, very low storage capacity	Winter rainfall, very cold in winter with occasional heavy rain	Medium range warming	Rooibos, wheat, citrus, wine grapes, potatoes and cattle	Low population density	Increasingly less productive, especially in the north
Hardeveld/ Sandveld (North)	Very low storage capacity, use of groundwater	Low rainfall in winter, warm to hot in summer	Medium to high range warming	Wheat, wine grapes, rooibos, potatoes	Low population density	Increasingly marginal
Knersvlakte	Almost no storage capacity	Very harsh climate, very hot in summer, cold in winter with low winter rainfall	High range warming	Wheat, wine and table grapes, rooibos, sheep, cattle and goats	Very low population density	Already very marginal, becoming worse
Olifants irrigation	Olifants River dam, large storage capacity	Hot and dry summers with occasional winter rainfall	Medium to high range warming	Citrus, wine and table grapes, rooibos, tomatoes	Seasonal labour	Remains viable as long as river flows and dams fill up, but constrained by heat
Piketberg	Farm dams, very low storage capacity	Unique island mountain climate, wetter and cooler than surrounding area	Medium range warming	Pears, fynbos flowers, stone fruit, wheat, citrus, herbs/essential oils, wine grapes, Cape rush, sheep and cattle		Remains viable as long as farm dams fill up, but changing due to warming
Rooikaroo-Aurora	Berg River in south, low storage capacity	Hotter and drier than Swartland to the south, more variable rainfall	Medium range warming	Wheat, canola, rooibos, sheep and cattle	Low population density	Increasingly marginal for wheat

Agri-climatic zone	Main water resource features	Main climate features	Climate change temperature projections	Main commodities	Socio-economic features	Future agricultural potential
Sandveld (South)	Very low storage capacity, extensive use of ground-water, Berg River	Rainfall in winter, warm to hot in summer, windy in summer	Medium range warming	Wheat, potatoes, rooibos, sheep and cattle		Increasingly marginal

2.1.2.4 Closing the gap between climate change, reduced ecosystem services and impacts on agriculture

How could climate change affect the delivery of ecosystem services to agriculture and people in the Sandveld and Agter-Cederberg, what are these impacts, and can we adapt our farming practices in time, so as to prevent them from occurring?

The value of ecosystem services to agriculture in the Western Cape, and their ability to provide resilience to climate change is very poorly studied, so it is almost impossible to provide conclusive answers to these questions.[37] The World Resources Institute recommends a step-by-step process (see Table 2.2 below) for identifying and assessing the impacts of development on ecosystem services, which is also useful for analysing how changes in the provision of ecosystem services may impact on society, including agriculture.[38]

Table 2.2: Step-by-step process for identifying and assessing impacts of development on ecosystem services

Scoping stage	1. Identify relevant ecosystem services
Baseline and impact analysis stage	2. Prioritise relevant ecosystem services
	3. Define the scope and information needs of the ecosystem services assessment
	4. Establish the baseline for priority ecosystem services
	5. Assess project impacts and dependencies on priority ecosystem services
Mitigation stage	6. Mitigate impacts and manage dependencies of project on priority ecosystem services

If this approach is adopted to identify priority ecosystem services in the domain of the Sandveld EMF, and links them to specific ecosystems, it becomes possible to start defining

[37] PGWC and UCT-ACDI (2015, p 10).
[38] Landsberg F *et al.* (2013)

the EMF's role as a safeguard for this ecological infrastructure. Also, the EMF can support the broad farming community and its partners in the state in planning how best to use land and resources to reinforce resilience to climate change – which may, or may not, yield the type of extreme scenario sketched above.

This is all about precautionary, adaptive planning and management, in which agricultural is a foremost stakeholder. Table 2.3 suggest linkages between cultivation and groundwater abstraction that may compromise the delivery of ecosystem services, and outlines the risk of these impacts arising in the face of climate change. It helps us to identify:

- Where planning needs to find a balance between farming, and the maintenance and conservation of ecological infrastructure in farmed landscapes; and
- How climate change may exacerbate these risks, and thereby to start adapting land use practices to reduce the vulnerability of farming and people to the adverse effects of a changing climate in the Sandveld and Agter-Cederberg.

This is a highly tentative analysis of a very complex situation, which is fraught with uncertainty and major difficulties in making accurate forecasts about how climate change may actually 'play out' in the Sandveld, and the implications this holds for food and livelihood security in the region.

It is presented as a departure point for further research, discussion and precautionary planning that enhances human and natural resilience to a warming and unpredictable future.

Table 2.3: Possible linkages between groundwater abstraction and cultivation with resultant impacts on ecosystem goods and services

P = Provisioning services, R = Regulating services.

Provisioning services: Products obtained from ecosystems (e.g., water, wood, fish, grazing)

Regulating services: Benefits obtained from the regulation of ecosystem processes (e.g., flood attenuation, groundwater recharge, pollination)

'Ecological infrastructure' in Sandveld/Agter-Cederberg planning domain		Ecosystem services	Description	Major drivers of environmental change in Sandveld planning domain: Threats to provisioning/ regulating services		Risk to agriculture if service is irreversibly degraded	Likelihood of risk materialising in event of HIGH RISK hot/dry climate projections (years) 1 = none, 2 = unlikely, 3 = moderate, 4 = high, 5 = definite	
Dominant terrestrial ecosystems as per Fynbos Forum ecosystem guidelines				Cultivation	Over-abstraction of groundwater		5-10	20-50
Coastal	Strandveld types	P	Grazing (limited)	NO	NO	LOW	1	1
		R	Control of sediment movement/drift sand/coastal erosion (?)	POTENTIAL	NO	LOW	2	3-4
Lowland Fynbos	Sand fynbos	R	Sand stabilisation Control of infiltration (?)	POTENTIAL UNKNOWN	NO UNKNOWN	MEDIUM-HIGH UNKNOWN	2	4-5
		S	Crop pollination (rooibos)	POTENTIAL	NO	MEDIUM-HIGH	2	3-5
Midland-Mountain Fynbos	Sandstone fynbos	P	Water supply (surface and ground -- drinking, irrigation	NO	NO	HIGH	2	3-4

'Ecological infrastructure' in Sandveld/Agter-Cederberg planning domain		Ecosystem services	Description	Major drivers of environmental change in Sandveld planning domain: Threats to provisioning/ regulating services		Risk to agriculture if service is irreversibly degraded	Likelihood of risk materialising in event of HIGH RISK hot/dry climate projections (years) 1 = none, 2 = unlikely, 3 = moderate, 4 = high, 5 = definite	
Dominant terrestrial ecosystems as per Fynbos Forum ecosystem guidelines				Cultivation	Over-abstraction of groundwater		5-10	20-50
			Habitat for wild and cultivated rooibos)					
		R	Control of infiltration (seeps and mountain streams), base-flow regulation, groundwater recharge, flood attenuation, erosion control	NO	NO	HIGH	2	3-4
		S	Crop pollination (rooibos/citrus)	POTENTIAL	NO	MEDIUM-HIGH	2	3-5
Renosterveld	Shale renosterveld	S	Crop pollination (citrus)	POTENTIAL	NO	MEDIUM-HIGH	2	3-5
Succulent Karoo	Succulent karoo	P	Grazing	POTENTIAL	NO	HIGH	2	4-5
		R	Soil stabilisation	POTENTIAL	NO	MEDIUM-HIGH	2	3
		S	Nutrient cycling	POTENTIAL	NO	MEDIUM-HIGH	2	3
Aquatic ecosystems and vegetation								
Wetlands	Seeps -- as for sandstone fynbos							

'Ecological infrastructure' in Sandveld/Agter-Cederberg planning domain		Ecosystem services	Description	Major drivers of environmental change in Sandveld planning domain: Threats to provisioning/ regulating services		Risk to agriculture if service is irreversibly degraded	Likelihood of risk materialising in event of HIGH RISK hot/dry climate projections (years) 1 = none, 2 = unlikely, 3 = moderate, 4 = high, 5 = definite	
Dominant terrestrial ecosystems as per Fynbos Forum ecosystem guidelines				Cultivation	Over-abstraction of groundwater		5-10	20-50
	Valley bottom	P	Stock watering, irrigation	NO	UNKNOWN	HIGH	2-3	4-5
		R	Groundwater infiltration and recharge (?)	UNKNOWN	UNKNOWN	UNKNOWN	?	?
			Water filtering/dilution of pollutants	POTENTIAL	UNKNOWN	MEDIUM-HIGH	?	?
			Sedimentation/retention capacity	POTENTIAL	UNKNOWN	LOW-MEDIUM	?	?
Rivers	Foothill	P	Stock watering, irrigation	UNKNOWN	POTENTIAL	HIGH	2-3	4-5
		R	Groundwater infiltration and recharge (?)	UNKNOWN	POTENTIAL	UNKNOWN	?	?
	Lowland	P	Stock watering, irrigation	UNKNOWN	POTENTIAL	HIGH	2-3	4-5
		R	Groundwater infiltration and recharge (?)	UNKNOWN	POTENTIAL	UNKNOWN	?	?

'Ecological infrastructure' in Sandveld/Agter-Cederberg planning domain		Ecosystem services	Description	Major drivers of environmental change in Sandveld planning domain: Threats to provisioning/ regulating services		Risk to agriculture if service is irreversibly degraded	Likelihood of risk materialising in event of HIGH RISK hot/dry climate projections (years) 1 = none, 2 = unlikely, 3 = moderate, 4 = high, 5 = definite	
Dominant terrestrial ecosystems as per Fynbos Forum ecosystem guidelines				Cultivation	Over-abstraction of groundwater		5-10	20-50
Aquifers	Primary	P	Water for drinking and irrigation	INDIRECTLY, YES	YES	HIGH	2-3	4-5
		R	Sub-surface water storage	INDIRECTLY, YES	YES	HIGH	?	?
			Regulation of water balance	INDIRECTLY, YES	YES	HIGH	?	?
			River base-flow regulation (?)	INDIRECTLY, YES	UKNOWN	UNKNOWN	?	?
			Prevention of 'verbrakking'	INDIRECTLY, YES	YES	HIGH	?	?
			Prevention of saline intrusion	INDIRECTLY, YES	YES	HIGH	?	?

2.1.2.5 What can be inferred from this analysis

Currently, the most evident impacts on ecosystem services in the Sandveld component of the EMF domain in particular arise from irrigation and land clearance practices. For example:

- The over-abstraction of groundwater has a negative impact on the quality and/or availability of subterranean water as a provisioning service for agricultural and other uses; and
- The loss of wetland habitat and functioning as a result of agricultural expansion has a negative effect on aquifer recharge (i.e. a regulatory service).

The removal of indigenous vegetation in order to establish fields can also impact on primary aquifers and the delivery of water to agriculture as cleared land has higher soil temperatures, which increases evaporative losses of moisture in the vadose zone. Higher temperatures can be expected to exacerbate such loss of groundwater through evaporation. Whereas catchments and aquifer recharge zones in the mountains are generally secure against human impact, their provisioning and regulatory functions are likely to be compromised if rainfall patterns start changing as a result of climate change.

Less rainfall in the mountains would result in less water being available to recharge the deep-seated secondary aquifers of the Table Mountain Group of sandstones, which represent the main source of groundwater in the Sandveld.

Less rainfall also means less vertical recharge of primary aquifers. If rain falls during hotter periods, recharge will also be reduced as evaporation increases. Short, sharp burst of low volumes of rainfall will also lead to less aquifer recharge which is generally better under conditions of long, soaking rainfall.

The present farming footprint, and its expansion into indigenous vegetation, may also be contributing to conditions conducive to wind erosion and the risk of soil destabilisation. These are liable to worsen under the effect of higher temperatures, less rainfall and windier days and/or increased wind speeds.

It is evident from the foregoing that potentially adverse interactions between farming, the affected ecosystems and the delivery of ecosystem services which currently may not be evidently harmful take on a different hue if the 'high risk' climate scenario (i.e. a high risk of increasingly hot and dry conditions) is factored into the assessment.

Crop pollination does not appear to be at risk from agriculture, but this could change under different climate scenarios (putting, particularly, the rooibos and potentially citrus sectors at risk if this service were to be reduced).

Much work is still needed to confirm connections between farming-related land-use practices and their impacts on the delivery of ecosystem goods and services. This is not to say that these connections do not exist: and, if they do, they could have potentially severe repercussions for the viability of farming in the area covered by the EMF.

The pertinent question would be how seriously to take these new risks to sustainability and resilience of farming, for if they have not been problematic until now, this may well change. Failure to act now may have potentially severe consequences for the long-term

viability of farming in the region, which can have severe effects on the future stability and wellbeing of the region and its people.

In the meantime, mapped Ecological Support Areas (ESAs) represent the ecological infrastructure that must be maintained in good 'working order' so that it can carry on supplying the ecosystem goods and services that underpin agriculture and the livelihoods in the domain of the Sandveld EMF, and lay the basis for agri-ecological resilience against the pressures and shocks of climate change.

2.1.3 Catchments and rivers

The study area spans four ecoregions recognised by the Department of Water and Sanitation. Ecoregions are defined as areas of similar climate, geology and vegetation (see Table 2.4 below). Rivers in the same ecoregion are ecologically more similar to rivers in a different ecoregion. The eastern, Agter-Cederberg, component of the study domain encapsulates 10 quaternary catchments, and the western, Sandveld, component, 12. Four quaternary catchments span the boundary between the two components of the study domain.

The ecoregions in question are:

- The Western Cape Coastal Belt (which extends south from the Olifants River towards Lambert's Bay, Elandsbaai and the Verlorenvlei);
- The South Western Coastal Belt, which roughly corresponds with the Olifantsrivier Mountains and the region south of Verlorenvlei;
- The Western Folded Mountains, largely comprising the Cederberg and Koue-Bokkeveld ranges; and
- The Greater Karoo, inland of Cape Fold Belt and the escarpment.[39]

Table 2.4: The distinctive attributes of the respective aquatic ecoregions (RHP, 2006):

	Ecoregions			
	Western Coastal Belt	South Western Coastal Belt	Western Folded Mountains	Greater Karoo
Landscape	Low relief plains	Moderate relief plains	Moderate/high relief mountains and hills	Low, moderate and high relief
Vegetation	Succulent Karoo	West Coast Renosterveld	Sandstone Fynbos	Central and Great Nama Karoo
Altitude (m)	0 - 700	0-300	300 – 1 700	300 – 1 700
Rainfall pattern	Winter	Winter	Winter	Very late summer to winter
MAP (mm)	0 - 300	100 – 1 000	200 – 1 500	0 – 500
MAR (mm)	<5	20 to 250	5 to >250	5 – 40
Av. daily temp (°C)	16-22	14 - 20	10 - 20	10 - 20

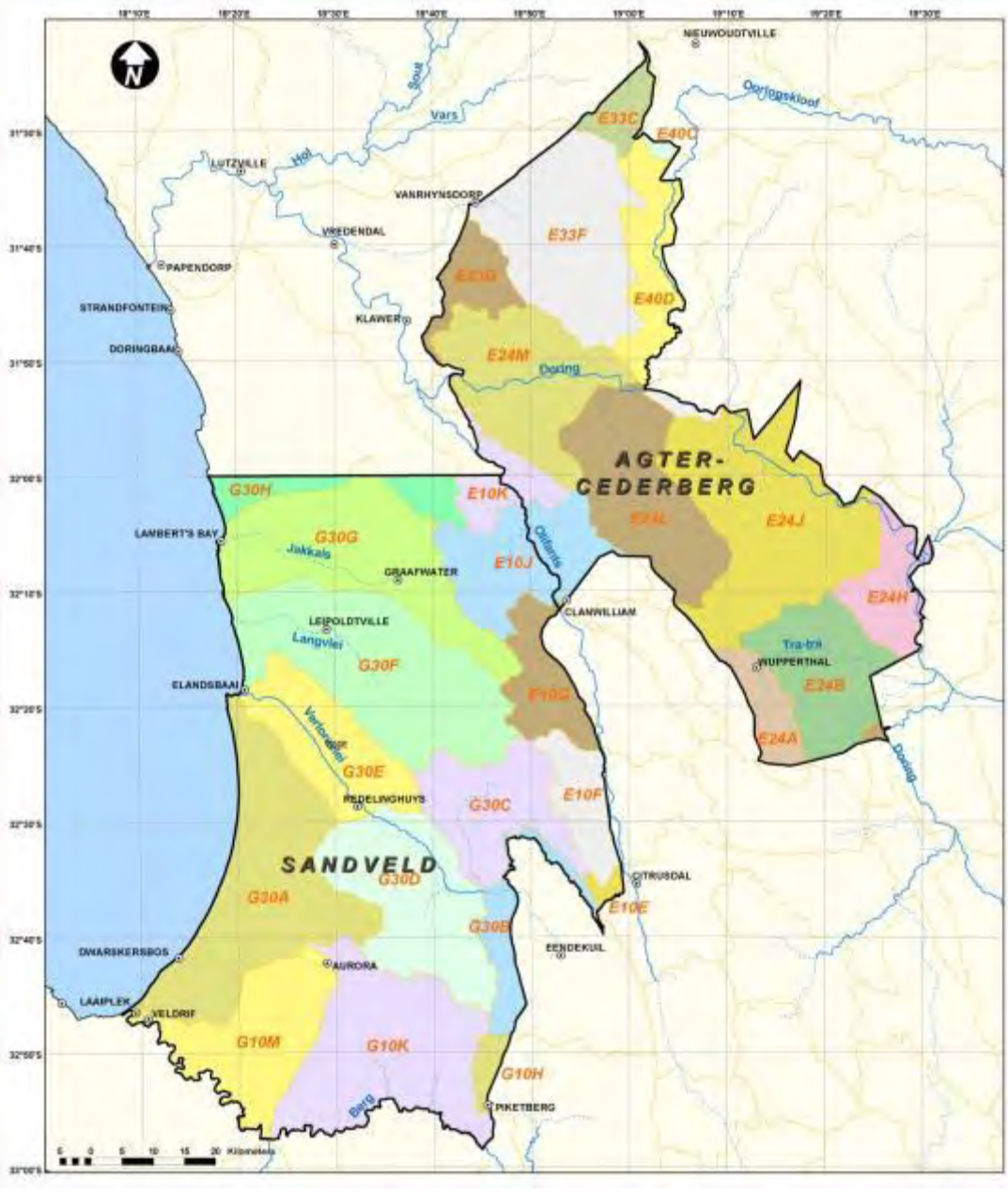
[39] RHP (2006), pp 8 & 9

The bulk of the study area is located within the Olifants-Doorn catchment, with a minor proportion located in the Berg River catchment in the south (roughly between the Piketberg and the mouth of the Berg River at Velddrift).

Three of the rivers within the EMF are designated as 'flagship, free-flowing rivers' that must be maintained in a natural or at least near-natural condition, and not be impounded. They are the:

- Doring River;
- Tra-tra River; and
- Matjies River.

Map 2.1: The catchments within the study area



Source: Agri Informatics, 2014

The highly-modified Olifants River (250 km) is the main watercourse within the Olifants-Doorn water management area (WMA 17). It is a perennial system, impounded by the Clanwilliam and Bulshoek dams. The Clanwilliam Dam currently captures about 35% of the Mean Annual Runoff (MAR) of the Olifants River at the dam site. By raising the dam by 13 m, an additional 70 million m^3 of water will become available annually for local water users. This represents approximately 50 000 ha of new production opportunity.

The Olifants estuary is one of only three permanently open estuaries on the west coast of South Africa.[40]

The flow requirements for the lower Olifants River and the estuary are supported by the contributions from the Doring River, which rises in the Hex River mountains and joins the Olifants River about 310 km from its source[41]. The seasonal Doring River is the largest tributary that joins the Olifants River at Trawal, some 18 km downstream of the Bulshoek Barrage. It has a bimodal flow pattern, fed by winter runoff from the mountains of the Cape Fold Belt and, in summer, sediment-rich, saline, flows from the Roggeveld and Karoo.[42]

The Tra-tra River drains eastwards from the Cederberg to the Tankwa River, which flows northwards into the Doring River. The Berg River rises in the Franschhoek mountains. Its lower reaches skirt the study domain for about 90 km in the south before entering the Atlantic Ocean via an extensive estuarine and salt marsh system at Velddrift.

Other major rivers that support irrigation in the Sandveld include the Palmietfontein, Verlorenvlei, Langvlei, Jakkals, Doring, Brandewyn, Biedouw, Tra-tra and Troe Troe rivers.

There are altogether 22 wetland groups in the area covered by the biodiversity sector plan for the Saldanha Bay, Bergrivier, Cederberg and Matzikama municipalities.[43] Many of these have been designated as CBAs or Freshwater Ecosystem Priority Areas (FEPAs) owing to their contribution to the achievement of biodiversity targets and ecosystem thresholds in the region. They also provide important services to agriculture in the form of groundwater regulation, maintenance of water quality and water security against the effects of climate change.

Table 2.5: Estuarine wetlands in the study area (adapted Maree and Vromans, 2010)

Estuary	Municipality	Estuary type	Approx size (ha)
Jakkalsvlei estuary	Cederberg	Estuarine channel and estuarine depression	78
Langvlei	Cederberg	Estuarine depression	287
Verlorenvlei	Cederberg	Estuarine channel	1 667
Berg River	Berg River	Estuarine channel and estuarine depression	7 770

[40] DWAF (2005)
[41] RHP (2006)
[42] RHP (2006)
[43] Maree & Vromans (2010)

Table 2.6: The status of wetlands in the three municipalities (adapted from Maree and Vromans, 2010):

Municipality	Total area of wetlands (ha)	% of wetlands >75% intact	% of wetlands classified as aquatic CBAs	% of aquatic CBAs that are protected
Cederberg	18 868	57.00	66.32	40.67
Bergrivier	19 453	58.49	84.54	17.25
Matzikama	8 429	50.70	53.42	0.19

2.1.4 Groundwater

Groundwater characteristics vary significantly throughout the study area and both primary and secondary aquifers are present. Primary aquifers typically occur in the shallower sedimentary deposits whereas secondary aquifers are mostly found within the harder geological rocks, with groundwater flows occurring in fissures and fractures (see Table 2.7 below for aquifer types). There is seasonal interaction between surface water and groundwater in the region, and groundwater levels can vary from surface level to depths of 40 m below ground level. Groundwater recharge is thought to occur mainly in the higher-lying mountains to the east (e.g. the Olifantsberge and the Cederberg). The estimated groundwater potential (i.e. water available for centre pivot irrigation using yield and quality datasets) for the central section of the Sandveld and southern half of the Agter-Cederberg is generally good (see Map 2.2 below).

Table 2.7: Aquifer types found within the study area.

Aquifer type and yield	*Sum of Area (km²)*	*Percentage*
FRACTURED		
Fractured 0.1 - 0.5 l/s	1 641.52	18.02
Fractured 0.5 - 2.0 l/s	4 412.46	48.44
Fractured 2.0 - 5.0 l/s	1 322.17	14.51
Fractured > 5.0 l/s	59.63	0.65
TOTAL FRACTURED	7 435.78	81.62
INTERGRANULAR		
Intergranular 0.0 - 0.1 l/s	213.54	2.34
Intergranular 0.1 - 0.5 l/s	759.69	8.34
Intergranular 2.0 - 5.0 l/s	188.82	2.07
Intergranular > 5.0 l/s	157.68	1.73
TOTAL INTERGRANULAR	1 319.74	14.49
KARST		
Karst 0.5 - 2.0 l/s	94.41	1.04
Karst > 5.0 l/s	259.90	2.85
TOTAL KARST	354.31	3.89

It must be noted that not every borehole has been visited in the Sandveld and there are also areas where boreholes are very sparse. The implication of this is that there may be

areas classified as having "low" groundwater potential and in reality this is not the case. When assessing groundwater potential and the distribution of centre pivots, it is assumed the centre pivots will be located in areas where the groundwater potential is medium or high. This assumption is largely correct, although some anomalies do occur. These can be attributed to four main reasons:

1. There is an error in the groundwater potential data set due to data scarcity;

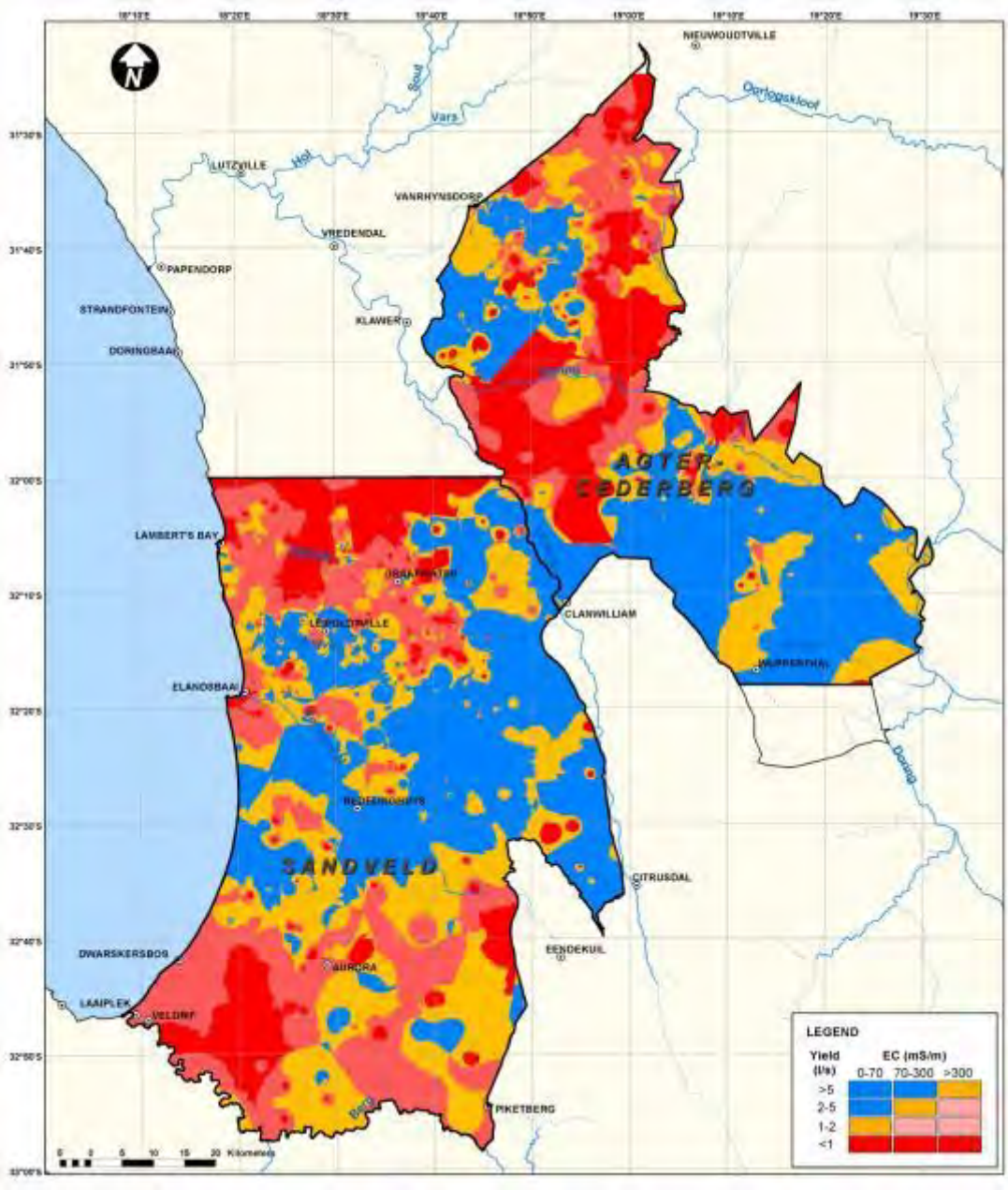
2. Centre pivots can be located in areas of poor groundwater quality (e.g. saline groundwater with a high electrical conductivity – EC), as desalination plants are being installed in the Sandveld. These desalination plants are usually at the larger scale farming operations. The desalination is cost effective in these instances as it is not sea water that is being treated but groundwater that is above the acceptable limit of use for agriculture (which is probably a tenth the salinity of sea water). This means the operational pressures at the desalination plants are much lower than for sea water desalination (and relatively cheaper to run) and the treated water recovery is much higher, with lower volumes of brine being produced. In addition, the desalinated water is often blended with groundwater so that the irrigation water is within acceptable limits;

3. The boreholes are a significant distance from the centre pivots. Thus in some situations the boreholes are many kilometres away from the centre pivots and thus the centre pivots themselves can be located on low groundwater potential areas; and

4. The normal *modus operandi* is that a number of boreholes pump the groundwater into a central storage area – be it a dam, reservoir or excavation. The water for the centre pivots is then pumped at a much higher rate into the system from these storage areas. Thus in areas of low groundwater potential a larger number of boreholes are required than normal and these all pump into a central storage facility. The lower the aquifer yield the greater the number of boreholes required to supply a centre pivot.

Groundwater is a valuable strategic resource around which a high degree of uncertainty exists. Mismanagement of this resource would have highly significant implications, and therefore, it is imperative that the precautionary principle should be adopted where groundwater is involved.

Map 2.2: Groundwater resource potential in the study area.



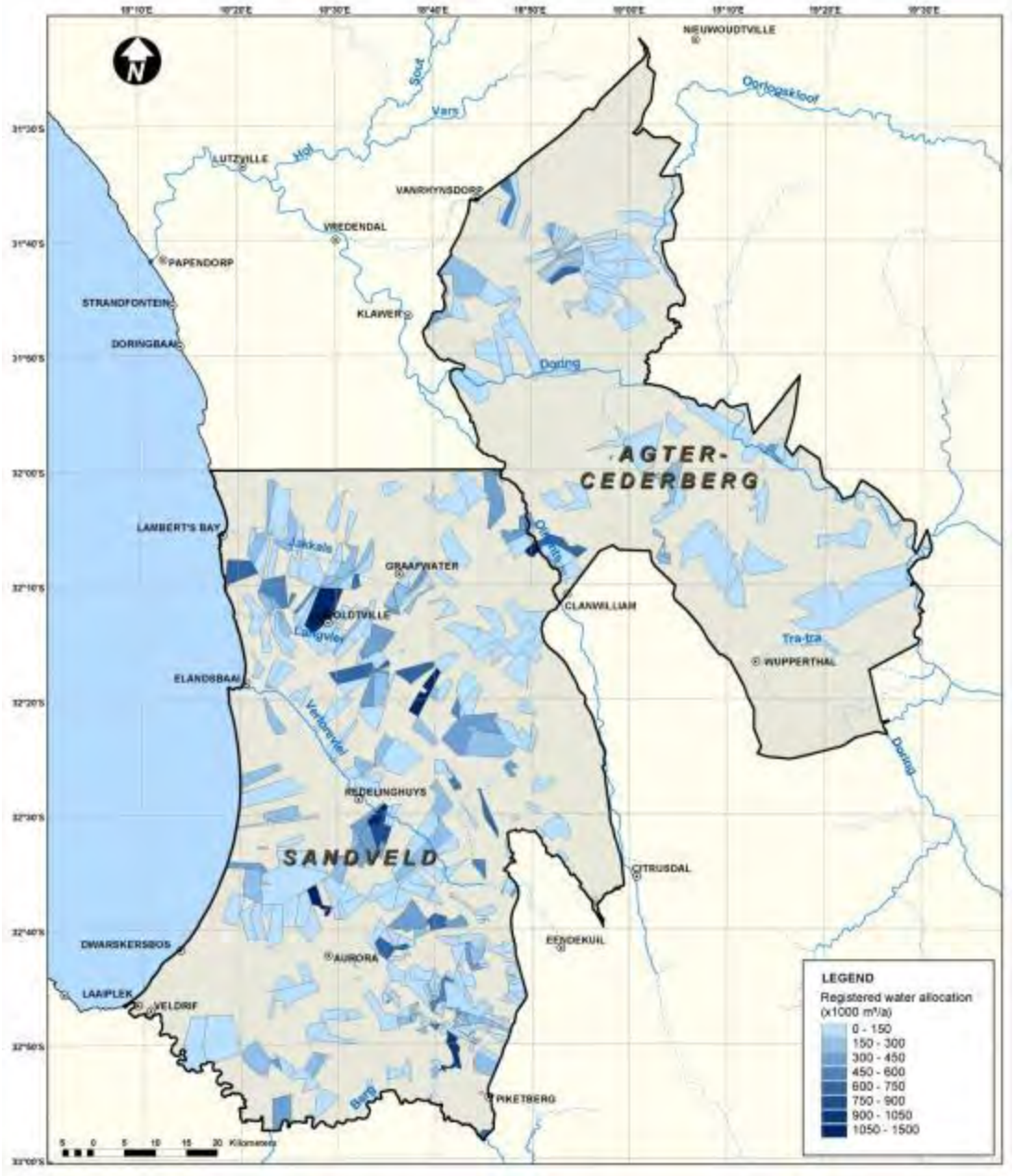
Source: Agri Informatics, 2014

2.1.4.1 Water rights

The National Water Act (Act No. 36 of 1998) stipulates *inter alia* the registration of irrigation water use by the land owner. Although the water registration in itself does not imply that the use is necessarily lawful, it does provide an indication of the availability of irrigation water *circa* 2000. An extract from the Water Authorisation Registration Management System (WARMS), was provided by the Department of Water & Sanitation. This data indicates a registered annual volume per cadastral unit and was used to compile Map 2.3. While it largely corresponds with the main areas of irrigation activity in the study domain, some anomalies do exist in that a number of cadastral units with high volumes of registered water do not have any irrigation activity. The opposite is also found, where farm portions that are actively involved in centre pivot irrigation, do not have any registered

water allocation. This may either reflect poor conformance to the water registration procedure, illegal water use or discrepancies in the WARMS dataset. Information does not currently exist for the entire study area. However, DWS is currently undertaking a validation and verification process that will result in a clear record of what farms have water use rights for and what they are already using.

Map 2.3: Water registrations as indicated on the Department of Water & Sanitation's WARMS database



Source: Agri Informatics, 2014

2.1.4.2 Agricultural pressure on water resources

In the Sandveld, agricultural pressures on the natural environment chiefly relate to impacts on groundwater resources, indigenous vegetation and their associated ecosystems. The major pressures in this regard are[44]:

- Increased abstraction from surface water and groundwater resources, resulting in reduced river flows and groundwater levels which, in turn, reduce the contribution of groundwater to base flows; these pressures and impacts coalesce in altered flow regimes that translate into impacts on especially aquatic ecosystems;
- Increased water resource abstraction that decreases freshwater input and aquifer recharge, resulting in increased saline intrusion and nutrient loading which cumulatively affect water quality; and
- Large-scale land clearance that results in the loss and modification of both terrestrial and aquatic ecosystems.

A key objective of the Sandveld EMF is therefore to achieve a sustainable balance between the protection and use of these water resources and their supporting ecosystems and catchments. This will require ongoing monitoring of groundwater resources and research to improve our understanding of these vital life-support systems in the Sandveld.

2.2 The biodiversity context

The biodiversity of the West Coast is highly diverse in terms of landscape and vegetation types, and also in terms of species and genera.[45]

This section introduces the biodiversity of the Sandveld study domain at a landscape or ecosystem scale. The reasons for following an ecosystem approach are twofold:

- Management actions can be focused on ecological processes that operate across a range of geographic scales and areas that are important for ecosystem-based adaptation to climate change, and not only individual species as was often the case in the past; and
- Best environmental practice can be achieved by addressing issues at the appropriate ecological scale, as opposed to site-based decision-making, which often fails to consider the ecological value of a site within its broader landscape and regional context.

The description of the respective ecosystems in the study domain therefore focuses on the key ecological drivers that need to be factored into land-use planning and environmental assessment so as to ensure the continued persistence and resilience of the agri-ecosystem resource base and its supporting processes.

[44] GEOSS (2006)
[45] Maree, K. and Vromans, D. (2010)

2.2.1 The Cape Floristic Region: A biodiversity hotspot

The study area falls within the Cape Floristic Region (CFR), one of the 35 global biodiversity hotspots that constitute exceptional concentrations of endemic species undergoing exceptional loss of habitat[46]. The study area spans the Fynbos and Succulent Karoo components of the CFR.

The Fynbos Biome is exclusively contained within the CFR. The biome is represented by various types of fynbos, renosterveld and strandveld vegetation[47]. Most of the remnant lowland vegetation in the Fynbos Biome is highly threatened due to cultivation, urban development and alien infestation.

The fynbos component of the CFR accounts for 70 to 80% of the region's flora with a high degree of alpha and beta diversity[48]. It is associated with the Sandveld component of the study domain and almost entirely coastal, occurring in leached, previously alkaline sands.

Strandveld occurs directly inland of areas exposed to sea spray along the West Coast, and is associated with stabilised, calcareous dune cordons.

The Succulent Karoo Biome is the world's only internationally recognized arid biodiversity hotspot. It has the highest species richness recorded for semi-arid vegetation and approximately 16% of the world's estimated succulent species occur here[49]. Nine Succulent Karoo vegetation types occur in the study domain.

2.2.2 Coastal and terrestrial ecosystems

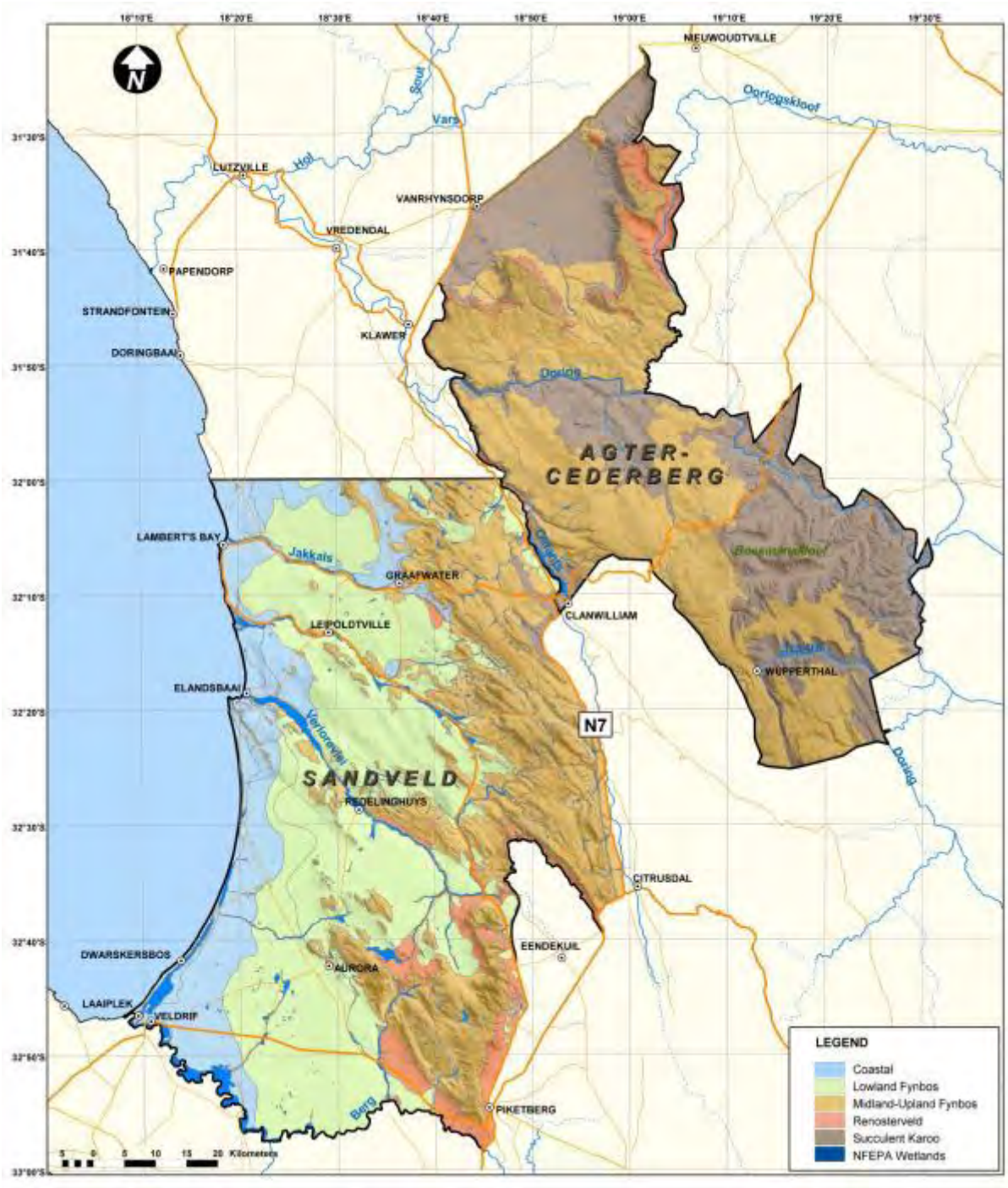
Approximately 40 vegetation types,[50] representing two biomes and five ecosystems (defined at the landscape scale) occur in the study domain (see Table 2.8 and Map 2.4 below). Many of these ecosystems correspond with, or contain, vegetation associated with a range of different wetland and river types. The vegetation types listed below are assigned to ecosystems as defined by the *Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape*[51] [52]

[46] Mittermeier *et al.* (2011)
[47] Esler *et al.*(eds)(2014)
[48] Manning J. (2007)
[49] UNESCO-World Heritage Centre (2009)
[50] As described by Mucina, Rutherford and Powrie (eds) (2005) *Vegetation Map of South Africa, Lesotho and Swaziland*, 1:1 000 000 scale sheet maps. South African National Biodiversity Institute, Pretoria, and updated by SANBI in 2009. See http://bgis.sanbi.org/vegmap/project.asp (accessed 07-12-2014)
[51] De Villiers *et al.* (2005)
[52] http://bgis.sanbi.org/rootfiles/FF_Ecosystem_Guidelines.pdf (accessed 07-12-2014)

Table 2.8: Major ecosystems in the Sandveld study domain

ECOSYSTEMS				
Coastal	Lowland fynbos	Midland-upland fynbos	Renosterveld	Succulent Karoo
▪ Estuaries, sandy shores and strandveld ▪ Cape Coastal Lagoons ▪ Cape Estuarine Saltmarshes ▪ Cape Inland Salt Pans ▪ Cape Flats Dune Strandveld ▪ Cape Seashore Vegetation ▪ Lambert's Bay Strandveld ▪ Saldanha Flats Strandveld ▪ Langebaan Dune Strandveld ▪ Namaqualand Strandveld	▪ Sand fynbos ▪ Cape Inland Salt Pans ▪ Cape Lowland Freshwater Wetlands ▪ Freshwater Lakes ▪ Hopefield Sand Fynbos ▪ Berg River Sand Fynbos* ▪ Leipoldtville Sand Fynbos ▪ Namaqualand Sand Fynbos	▪ Sandstone and quartzite fynbos ▪ Bokkeveld Sandstone Fynbos ▪ Cederberg Sandstone Fynbos ▪ Graafwater Sandstone Fynbos ▪ Grootrivier Quartzite Fynbos ▪ Kamiesberg Mountains Shrubland ▪ Klawer Sandy Shrubland ▪ Northern Inland Shale Band Vegetation ▪ Olifants Sandstone Fynbos ▪ Piketberg Sandstone Fynbos ▪ Swartruggens Quartzite Fynbos ▪ Winterhoek Sandstone Fynbos ▪ Southern Afrotemperate Forest	▪ Shale and silcrete renosterveld ▪ Cape Vemal Pools ▪ Swartland Shale Renosterveld ▪ Swartland Silcrete Renosterveld ▪ Vanrhynsdorp Shale Renosterveld	▪ Succulent shrubland, vygieveld, gannabosveld ▪ Agter-Cederberg Shrubland ▪ Citrusdal Vygieveld ▪ Doringrivier Quartzite Karoo ▪ Kamiesberg Mountains Shrubland ▪ Knersvlakte Dolomite Vygieveld ▪ Knersvlakte Shale Vygieveld ▪ Knersvlakte Quartz Vygieveld ▪ Namaqualand Riviere ▪ Namaqualand Spinescent Grassland ▪ Tanqua Karoo ▪ Tanqua Wash Riviere ▪ Vanrhynsdorp Gannabosveld ▪ Klawer Sandy Shrubland* ▪ Piketberg Quartz Succulent Shrubland ▪ Swartruggens Quartzite Karoo

Map 2.4: Major ecosystems of the Sandveld study domain



Source: Agri Informatics, 2016

2.2.3 Ecological drivers

Ecological drivers refer to the biophysical processes that maintain biodiversity pattern and, if modified, can result in degradation of ecosystem functioning, changes to the composition and structure of affected biodiversity, and, potentially, localised loss of species and destabilisation of the affected ecosystems. The maintenance of ecological drivers is therefore critical to the maintenance of an ecologically functioning landscape and ecosystems that are resilient to change.

A number of ecological drivers have been identified within the Sandveld EMF[53] study domain which contribute to a healthy functioning ecosystem. These are briefly outlined below:

- Fire is a crucially important ecological driver in fynbos and renosterveld ecosystems and can fulfil an important functional role by helping maintain a mosaic-type vegetation pattern strandveld in wetter and more temperate coastal environments. In lowland fynbos ecosystems, which include sand fynbos, fire frequency must ensure sufficient seed-set in slow-maturing species such as the Proteaceae
- High bird and animal densities are important for maintaining pollination and seed dispersal in strandveld, which often acts as an important ecological corridor for birds and mammals along the coastal strip.
- Variations in soil type (depth, moisture capacity, rockiness, mineral composition) are very important for micro-variation in strandveld and fynbos ecosystems and can have a dramatic effect on community structure.
- In sand fynbos, there can be a high incidence of species turnover along habitat or environmental gradients. There are also substantial unexplained variations in species richness, and concentration of rare and endemic plants, from area to area.
- All the aquatic ecosystems within the study area are largely groundwater driven or dependent on groundwater, and changes to run-off and infiltration patterns as a result of catchment modification can have serious impacts on the functioning and integrity of affected wetlands.
- Many of the rare localised species in Succulent Karoo ecosystems are restricted to distinctive habitats such quartz patches and rocky outcrops. Seaward-facing slopes and sites that catch the sea fogs are often very rich in localised endemics.
- Termitaria (heuweltjies) often are an important feature in lower-lying areas with loamy soils. Besides supporting distinctive plant communities, they are important browsing "hotspots" for smaller fauna.[54]

As the maintenance of ecological drivers is necessary for the maintenance of an ecologically functioning landscape and resilient ecosystems, these drivers are well-placed to serve as indicators to measure changes within the ecosystem function. These, along with factors such as the agricultural footprint, aquifer yield and groundwater quality should thus be monitored in order to measure the sustainability of land-use changes within the study area.

2.2.4 Biodiversity conservation priorities in the study domain

The study domain is located in a region of great global importance for biodiversity conservation owing to factors such its ecological uniqueness and the high degree of threat to many of its endemic plants and ecosystems. The importance of indigenous vegetation in South Africa is typified by the inclusion of a number of activities pertaining

[53] The following contributors to the *Fynbos Forum Ecosystem Guidelines* are acknowledged for this information: Nick Helme, Pat Holmes, Tony Rebelo, Liz Day and Nancy Job.

[54] See the 'Fynbos Forum ecosystem guidelines' for more specialised interpretation of the key ecological drivers and vulnerabilities of the ecosystems subject to the Sandveld EMF, and how these must be factored into projecting planning and environmental assessment.

to the clearing of indigenous vegetation in terms of section 24(2) of NEMA. A proponent of any activity listed or specified in terms of section 24(2) of NEMA is required to obtain Environmental Authorisation prior to commencing with the related activity. In the EIA Regulations 2014, a proponent is required to at least undertake a Basic Assessment process if he/she intends to clear 300 m^2 of indigenous vegetation within areas known to be of significant ecological importance (i.e. critically endangered or endangered ecosystems listed in terms of section 52 of the NEMBA, among others – See Activity 12 of Listing Notice 3, GNR. 985 of 4 December 2014). A Basic Assessment process is also required if a proponent wishes to clear more than one hectare of indigenous vegetation anywhere within South Africa (See Activity 17 of Listing Notice 1, GNR. 983 of 4 December 2014). However, a proponent is required to undertake Scoping and Environmental Impact Reporting process if he/she wishes to clear more than 20 hectares of indigenous vegetation anywhere within South Africa (See Activity 15 of Listing Notice 2, GNR. 984 of 4 December 2014). Both the Basic Assessment, and Scoping and Environmental Impact Reporting processes have been criticised for being costly, and have been a common constraint to legitimate agricultural expansion within the study domain. It is these regulatory requirements that the implementation of the Sandveld EMF, as referred to in the introductory chapter of this report, seeks to ameliorate.

The ecosystems and habitats within the study area would be representative of the south-western parts of the Fynbos Biome and, to a lesser degree, the Succulent Karoo Biome. Both these biomes embrace national priority areas for biodiversity conservation action that aim to:

- Reduce loss and degradation of natural habitat through, among others, mainstreaming biodiversity considerations into land use planning and environmental assessment;
- Protect critical ecosystems (e.g. through protected area expansion, biodiversity stewardship and protected high water yield areas); and
- Restore and enhance critical ecological infrastructure such that it provides society with essential ecosystem services.

Much of the remnant lowland ecosystems of the Cape Floristic Region in these areas are either highly threatened (especially in the Fynbos Biome, which contains the largest extent of Critically Endangered ecosystems of all South Africa's provinces) or host globally unique plants that have undergone unique evolutionary adaptations to their environments.[55] [56]

Whereas ecosystem status reflects how threatened vegetation is, systematic biodiversity plans provide an explicit basis for prioritising biodiversity conservation action on the ground.

This section therefore also introduces the principles and objectives of systematic biodiversity planning and summarises the background to biodiversity priority areas in the study domain, namely:

[55] WHC (2014)
[56] Department of Environmental Affairs (DEA) (2011)

Table 2.9: Biodiversity priority area types in the Sandveld study domain

Biodiversity Priority Areas	Definition in terms of the Study Domain
Protected areas (statutory and private)	Areas under statutory protection in terms of section 9 of the National Environmental Management: Protected Areas Act 57 of 2003, including: Provincial natural reserves and wilderness areas; World Heritage Sites; and Proclaimed Mountain Catchment Areas (MCAs)
Landscape conservation	The Greater Cederberg Biodiversity Corridor, a collaborative programme to establish a 'mega ecological corridor' between the West Coast and the inland escarpment.
Threatened ecosystems	Ecosystem listed in terms of section 52 of the NEM:BA "National list of ecosystems that are threatened and in need of protection" (GN 1002 of 9 December 2011) and updated by CapeNature's 2014 Western Cape Biodiversity Framework
Critical Biodiversity Areas and Ecological Support Areas	Most spatially-efficient network of sites to ensure continued persistence of biodiversity pattern, ecological processes and ecological infrastructure at a municipal or district municipal scale (Maree and Vromans, 2010).
National Freshwater Ecosystem Priority Areas (NFEPAs)	Rivers or wetlands required to meet biodiversity targets and support sustainable water use in terms of the NFEPA programme (Nel *et al.*, 2011; Driver *et al.*, 2011).
Focus areas for land-based expansion of protected areas	Large, intact and unfragmented areas of high biodiversity importance, suitable for creating and expanding large protected areas (DEA 2011; Driver *et al.*, 2012).
High water yield areas	Sub-quaternary catchments where mean annual rainfall is at least three times more than the average for the related primary catchment (Driver *et al.*, 2012).
Flagship free-flowing rivers	One of the 19 free-flowing rivers identified as representative of the last 63 free-flowing rivers in South Africa (Driver *et al.*, 2012; Nel *et al.*, 2011).
Special habitats and species of special concern	Features that are important for biodiversity conservation, which have not been mapped owing to the fine-grained scale of this information or restrictions on the publication of information about the distribution of Red List plants (Maree and Vromans, 2010; Helme, 2012).

2.2.4.1 Protected areas in the study domain

The Cederberg Wilderness Area and Matjiesrivier provincial nature reserves are located outside the boundaries of the study domain. The formally protected areas in the area covered by the Sandveld EMF are detailed in Table 2.10 below and displayed in Map 2.5.

Table 2.10: Formally protected areas in the Sandveld study domain

Title	Formal status	Location	Ecosystem
Protected areas in the Sandveld			
Doorspring	Private NR	Lambert's Bay	Coastal (strandveld)
Soopjeshoogte	Private NR	Lambert's Bay	Coastal (strandveld)
Elandsbaai	State Forest	Elandsbaai	Coastal (strandveld)

Title	Formal status	Location	Ecosystem
Rocher Pan	Provincial NR	Between Doringbaai & Elandsbaai	Coastal (strandveld)
Stalkrans	Private NR	Piketberg mountain	Midland-upland (sandstone fynbos)
Banghoek	Private NR	Piketberg mountain	Midland-upland (sandstone fynbos)
Rondeberg	Private NR	Olifants River valley	Midland-upland (sandstone fynbos)
Protected areas in the Agter-Cederberg			
Op-die-Berg	Private NR	Matzikammaberg	Midland-upland (sandstone fynbos)
Cederberg Wilderness Area	MCA	Western Cederberg, Pakhuis Pass to Buffelhoeks Pass	Midland-upland (sandstone fynbos)
Ramskop	Local NR	Clanwilliam	Succulent Karoo
Oorlogskloof	Provincial NR	Vanryhns Pass	Renosterveld

2.2.4.2 Conservation areas in the study domain

The Greater Cederberg Biodiversity Corridor

Off-reserve conservation in the study domain is indivisibly associated with the Greater Cederberg Biodiversity Corridor (GCBC) (see Map 2.5 below), a multi-stakeholder landscape programme which aims to secure a 'mega biodiversity corridor' between the West Coast and Roggeveld escarpment, about 160 km to the east.

The GCBC covers an area of over 180 000 km^2. It extends from Nieuwoudtville in the north to Groot-Winterhoek in the south and from Elandsbaai in the west to the Tankwa Karoo in the east. The corridor incorporates a mosaic of most agricultural land uses. The two major corridors being developed are the Sandveld Corridor and the Cederberg Corridor, which includes succulent Karoo areas as well as fynbos ecosystems. The GCBC is co-ordinated by CapeNature.

One of the main goals of the GCBC is to catalyse action to counter the impacts of climate change by maintaining opportunities for organisms to migrate across biogeographical boundaries and environmental gradients. The GCBC is also concerned with finding solutions to unsustainable pressure on groundwater, and to stem the loss of natural habitats.

The GCBC, through its steering committee headed by CapeNature and the activities of its strategic partners in the potato and rooibos production sectors, government agencies and non-governmental organisations – has played an influential role in catalysing collaborative, ecosystem-based conservation in the Sandveld. Key actions in this regard include:

- Biodiversity stewardship;

- The potato and rooibos biodiversity best practice initiatives with Potatoes South Africa and the Rooibos Council; and
- CapeNature's fine-scale biodiversity assessment and planning project in the Sandveld in 2007.

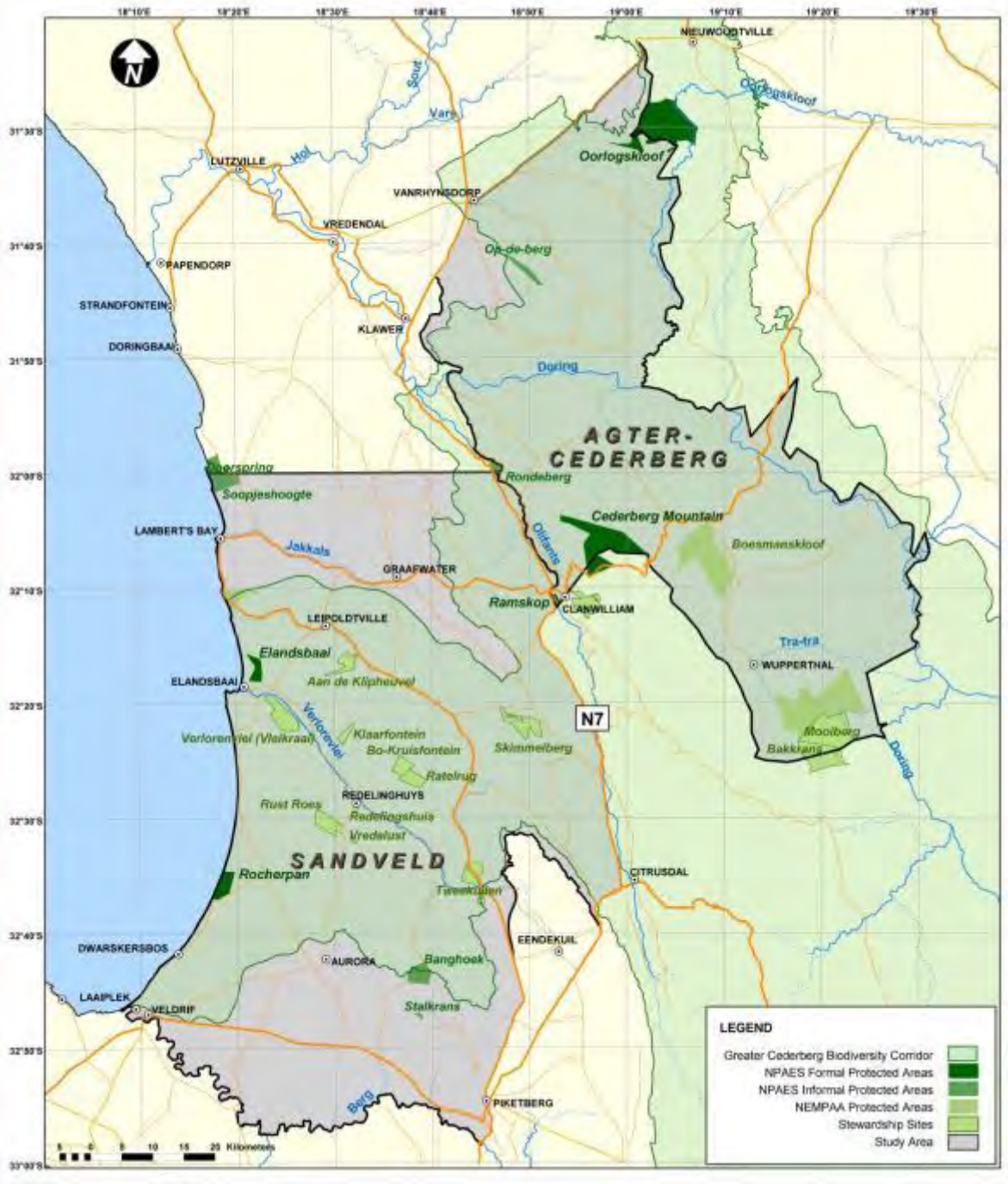
Biodiversity Stewardship Sites

Eleven biodiversity stewardship sites (see Table 2.11 and Map 2.5 below) are situated within the study area, comprising a total area of 11 321 ha. Five of these are Contract Nature Reserves for long-term biodiversity conservation, whilst the remaining six have Biodiversity Agreements in place to protect biodiversity in the medium term.

Table 2.11: Biodiversity stewardship sites in the Sandveld study domain

Site Name	Stewardship Type	Declaration Status	Size (ha)
Aan de Klipheuvel	Contract Nature Reserve	Declared	684.44
Augsberg	Biodiversity Agreement	Signed	1 138.77
Bakkrans	Contract Nature Reserve	Declared	2 281.07
Bo-Kruisfontein	Biodiversity Agreement	Signed	610.24
Klaarfontein	Biodiversity Agreement	Signed	330.67
Mooiberg	Contract Nature Reserve	Declared	3 185.10
Op die Berg	Contract Nature Reserve	Declared	423.32
Ratelrug	Biodiversity Agreement	Signed	670.33
Rust Roes	Biodiversity Agreement	Signed	891.77
Twee Kuilen	Contract Nature Reserve	Declared	878.86
Vredelust	Biodiversity Agreement	Signed	226.51
Skimmelberg	Contract Nature Reserve	Designated	1 265.70
Verlorenvlei (Vleikraal)	Contract Nature Reserve	Signed	1 471.29
Redelinghuys	Contract Nature Reserve	Signed	62.78

Map 2.5: Protected areas and stewardship sites within the Sandveld study domain in relation to the Greater Cederberg Biodiversity Corridor



Source: Agri Informatics, 2016

2.2.4.3 Threatened ecosystems

The degree to which an ecosystem is threatened is expressed by four categories: Least Threatened (LT), Vulnerable (VU), Endangered (EN) or Critically Endangered (CR). These categories reflect the 'ecosystem status' of vegetation types, wetlands and rivers.[57] [58]

[57] Department of Environmental Affairs (DEA) (2011)
[58] Driver *et al.* (2012)

'Threatened ecosystems' are VU, EN or CR. These are recorded in the *National List of Ecosystems that are Threatened and in Need of Protection*, which was gazetted in 2011 in terms of section 52 of the National Environmental Management Biodiversity Act 10 of 2004.

Quantitative biodiversity targets are linked to a number of thresholds that define the 'ecosystem status' of a biodiversity planning unit. In other words, 'ecosystem status' is a measure of the amount of habitat that remains in an ecosystem (in this case, vegetation types), relative to its target.

Biodiversity Targets

The National Biodiversity Assessment[59] defines biodiversity targets as the minimum proportion of each ecosystem type that needs to be kept in a natural or near-natural state in the long-term in order to maintain viable representative samples of all ecosystem types and the majority of species associated with those ecosystems. Depending on the species-richness of an ecosystem type, biodiversity targets range between 16% and 30% of the original extent of each ecosystem type. A standard biodiversity target of 20% is used for freshwater ecosystem types.

Thresholds for Determining Ecosystem Status

Ecosystem status is also linked to ecological thresholds which, in lay terms, provide a measure of 'ecosystem health' or 'integrity'; if remaining habitat drops below a specific threshold, this implies that an ecosystem is becoming increasingly degraded and key ecological processes may start breaking down and eventually lead to species becoming extinct (see Table 2.12 below).

Table 2.12: Thresholds used to assess the status of ecosystems ([60]; pp 40 & 41)

Threshold	Ecosystem status	Implications
Biodiversity target: 16-30% of original extent of ecosystem type (varies between ecosystem types)	Critically Endangered (CR) if remaining proportion of habitat in an ecosystem type is equal to or less than the biodiversity target.	CR ecosystems have undergone severe degradation of ecological structure, function or composition and are subject to an extremely high risk of irreversible transformation. Few natural or near-natural examples of these ecosystems therefore remain Any further loss of habitat must be strictly avoided. Remaining healthy examples of these ecosystem types should be the focus of urgent conservation action.
Biodiversity target plus15%.	Endangered (EN) if remaining habitat exceeds the target but is equal to or less than the target plus15%.	EN ecosystems have undergone degradation of ecological structure, function or composition as a result of human intervention and are close to becoming CR. Any further loss of habitat must be avoided. Remaining healthy examples should be the focus of conservation action.
Ecosystems that have been reduced	Vulnerable (VU)	VU ecosystems have lost at least 40% of their original extent but are still largely in a natural or

[59] Driver *et al.* (2012), p 39

[60] Note that the revised classification of threatened ecosystems in the Western Cape (CapeNature, 2014), only applied criterion A1 (habitat loss) and not criterion D1 (threatened plant species associations). If criterion D1 were to be added, it is likely that certain vegetation types may, in fact, be more threatened than reflected in the 2014 revision of the ecosystem status of indigenous vegetation in the Western Cape (K Maree, CapeNature, pers comm., 14-11-2014).

Threshold	Ecosystem status	Implications
to 60% or less of their original extent, but which are not EN.		near-natural condition. The ecological persistence of VU ecosystems becomes increasingly compromised and degraded with unchecked loss of habitat and the resulting fragmentation and isolation of remaining natural and near-natural areas

Criteria for Identifying Threatened Ecosystems

The following criteria have been used to identify threatened ecosystems in the study domain (see Table 2.13 and p 52 or Section 4.3, pp 36-43 of the national list of threatened ecosystems for further explanation):[58]

Table 2.13: Criteria that identify threatened ecosystems in the study domain

Criteria and definitions	Implications for project planning and environmental assessment
A1: Irreversible loss of natural habitat Ecosystems that have undergone loss of natural habitat, impacting on their structure, function and composition.	A strictly risk-averse approach should be followed in project planning, with avoidance being the primary strategy for impact mitigation. In CR and EN ecosystems, further loss of habitat in natural or near-natural remnants should be assigned the highest negative significance rating, subject to a specialist assessment. A similar approach should apply to habitat loss in VU ecosystems that are approaching the EN threshold.
D1: Threatened plant species associations Ecosystems that contain a high number of threatened species, indicating that the ecosystem itself is threatened, even if it has not been identified as threatened under the other criteria.	It is the high occurrence of threatened plant species rather than habitat transformation that underpins the listing of ecosystem types in terms of this criterion. Only ecosystems in the Fynbos Biome meet the high thresholds set for Criterion D1. Specialist botanical assessments must be mandatory when undertaking environmental assessments in areas that host indigenous vegetation listed on the basis of Criterion D1.

Table 2.14 sets out the threatened ecosystems that occur in the study area[61], whilst this is graphically represented in Map 2.6 below. Colour fills for vegetation types in Table 2.14 correlate with the legend of Map 2.6, and reflect the revised 2014 ecosystem status for each ecosystem.

Clearing indigenous vegetation within threatened ecosystems

The clearance of 300 m^2 or more of indigenous vegetation within threatened ecosystems as outlined in section 52 of the National Environmental Management Biodiversity Act 10 of 2004 is a listed and specified activity in terms of section 24(2) of NEMA (See Listed Activity 12 of Listing Notice 3, GNR. 985 of 4 December 2014). As such, a proponent of the aforementioned activity is required to follow the Basic Assessment process prior to

[61] CapeNature (2014)

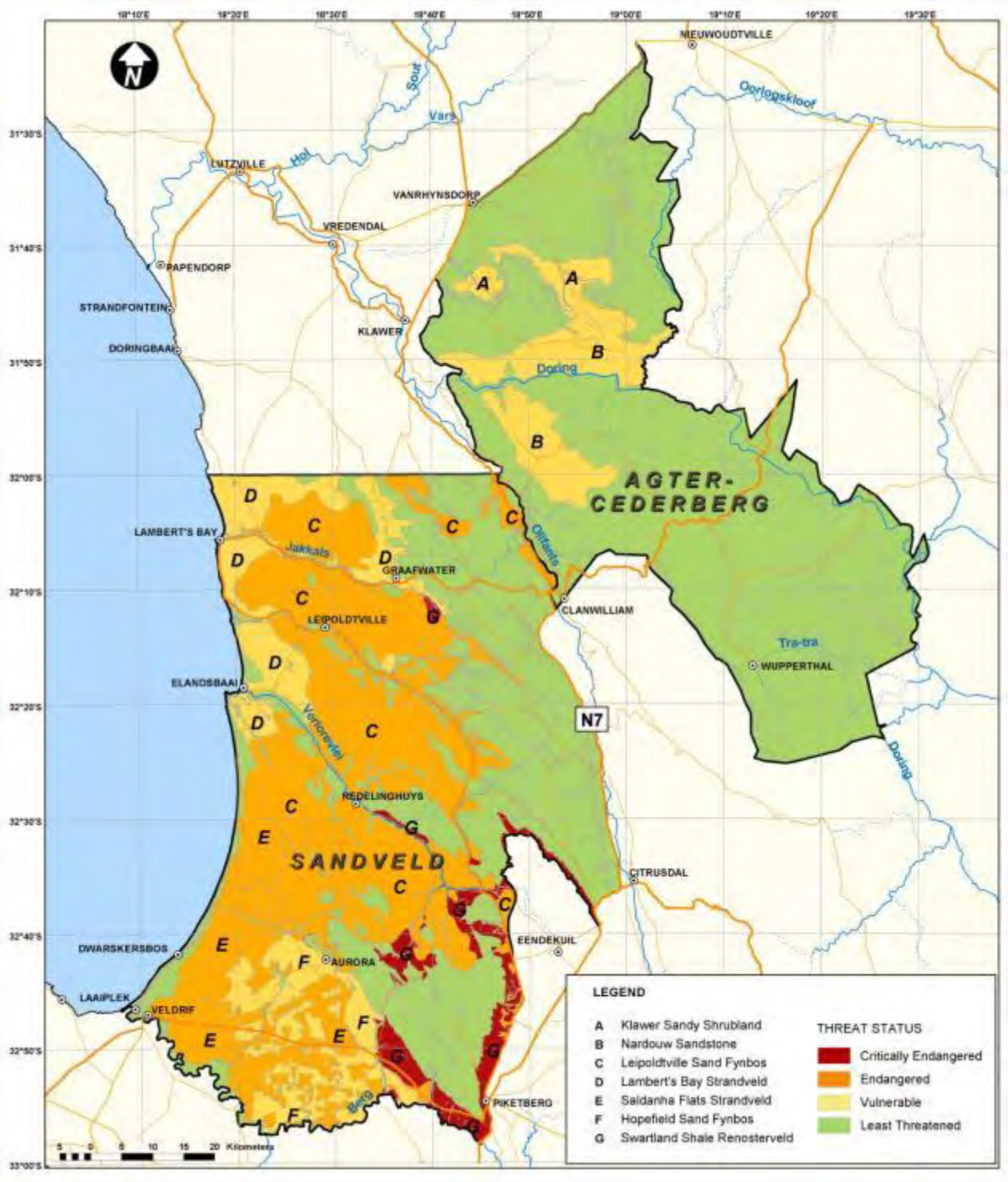
commencing with the activity, as outlined in Appendix 1 of the EIA Regulations 2014, in order to receive the requisite Environmental Authorisation.

Table 2.14: Threatened ecosystems found in the Sandveld in terms of the 2011 List of Threatened Ecosystems and CapeNature's revised assessment of ecosystem status of 2014

Vegetation types	DEA (2011)		CapeNature (2014)[62]		Improved status (+) Decreased status (-)	Approximate distribution	Ecosystem
	Status	Criterion	Status	Criterion			
Bokkeveld Sandstone Fynbos	VU	D1	LT	A1	(+)	Uplands north of Doring River	Midland-upland fynbos
Cederberg Sandstone Fynbos	VU	D1	LT	A1	(+)	Olifantsrivierberge Uplands south of Doring River	Midland-upland fynbos
Citrusdal Shale Renosterveld	—	—	EN	A1		Olifants River valley, between Citrusdal and Clanwilliam	Renosterveld
Hopefield Sand Fynbos	VU	A1, D1	No change	A1		Sandy flats south of Aurora	Lowland fynbos
Klawer Sandy Shrubland	LT	n/a	VU	A1	(-)	Between N7 and Gifberg	Midland-upland fynbos
Lambert's Bay Dune Strandveld	LT	n/a	VU	A1	(-)	North of Elandsbaai	Coastal (strandveld)
Leipoldtville Sand Fynbos	VU	A1, D1	EN	A1	(-)	Sandy flats and low hills north of Aurora	Lowland fynbos
Nardouw Sandstone Fynbos	—	—	VU	A1		Plateau of Nardouwberg	Midland-upland fynbos
Olifants Alluvium Fynbos	—	—	VU	A1		Middle reaches of the Olifants River, above Bulshoek dam to the top of the Citrusdal valley.	Midland-upland fynbos
Piketberg Sandstone Fynbos	VU	D1	LT	A1	(+)	Piketberg massif	Midland-upland fynbos
Saldanha Flats Strandveld	VU	A1	EN	A1	(-)	Inland of coast between Berg River and Verlorenvlei	Coastal (strandveld)
Swartland Shale Renosterveld	CR	A1, D1	No change	A1		Het Kruis-Krom Antoniesrivier-Banghoek-Koopmanskraal	Renosterveld
Swartland Silcrete Renosterveld	CR	A1	No change	A1		Lowlands around Piketberg and De Hoek (embedded in Swartland Shale Renosterveld)	Renosterveld

[62] Please note that the 2014 status is for information purposes only. For the purpose of identifying triggers for listed activities in terms of the NEMA EIA Regulations, the official status of the vegetation types in terms of section 52 of NEMBA are as reflected in the 2011 statuses.

Map 2.6: Ecosystem status of the vegetation types that occur in the Sandveld study domain



Source: Agri Informatics, 2016

Protection Levels of Ecosystems in the Sandveld study area

The second main 'headline indicator' used by the National Biodiversity Assessment of 2011 (NBA 2011) to assess the state of biodiversity in South Africa is ecosystem protection level. Whereas ecosystem status evaluates the state of intactness and functioning of an

ecosystem in relation to quantitative targets and thresholds, ecosystem protection level provides a measure of the degree to which ecosystem are protected.

Besides sandstone fynbos types confined to, particularly, the Cederberg Mountains, most ecosystems in the study area are either poorly protected or not protected at all. The protection levels for threatened ecosystem types (as defined by the 2011 List of National Threatened Ecosystems and the 2014 Western Cape Biodiversity Framework) in the study area are as set out in the table below.

Table 2.15: Protection levels of threatened ecosystems in the study domain

	2011		2014	
Ecosystem (vegetation) type	Status	Protection level[63]	Status	Protection level
Citrusdal Shale Renosterveld	EN	Not protected	EN	Not protected
Hopefield Sand Fynbos	VU	Poorly protected	VU	Poorly protected
Klawer Sandy Shrubland	LT	Not protected	VU	Hardly protected
Lambert's Bay Dune Strandveld	LT	Poorly protected	VU	Hardly protected
Leipoldtville Sand Fynbos	VU	Not protected	EN	Poorly protected
Nardouw Sandstone Fynbos	N/A	Not listed	VU	Not protected
Olifants Alluvium Fynbos	N/A	Not listed	VU	Poorly protected
Saldanha Flats Strandveld	VU	Moderately protected	EN	Poorly protected
Swartland Shale Renosterveld	CR	Not protected	CR	Hardly protected
Swartland Silcrete Renosterveld	CR	Not protected	CR	Hardly protected

2.2.4.4 Systematic biodiversity planning

The process of prioritising areas for conservation action is called systematic biodiversity planning, a scientific method for calculating how much habitat is required, relative to quantitative targets and thresholds, for conserving a representative sample of a region's biodiversity and the ecological and evolutionary process that ensure its persistence, in the most spatially efficient manner[64 65 66].

[63] The NBA 2011 defines ecosystem protection levels as the proportion of biodiversity thresholds or targets that are met in a protected area. Ecosystems are 'not protected' if <5% of habitat required to meet targets is not protected; in the case of 'poorly protected' the proportion is 5-49% of the target; 'moderately protected' 50-99% of the target; and 'well protected' ≥100% of the target.

[64] Driver *et al.* (2003)

[65] Cadman *et al.* (2010)

[66] DEAT (2009)

A key goal of systematic biodiversity planning is to reduce, as far as possible, the amount of land that is needed to secure a functioning and ecologically viable network of critical biodiversity areas and their ecological support areas.

The following outputs of systematic biodiversity planning have been integrated into the process of developing the Sandveld EMF:

- The 2011 National Biodiversity Assessment;
- The National List of ecosystems that are threatened and in need of protection (GN R. 1002 of 9 December 2011);
- The National Freshwater Ecosystem Priority Areas (NFEPA) programme;
- The biodiversity sector plan for the Saldanha Bay, Bergrivier, Cederberg, and Matzikama municipalities; and
- The 2014 Western Cape Biodiversity Framework
- CBAs as identified by CapeNature (15-02-2016)

Critical Biodiversity Area Maps and Biodiversity Sector Plans

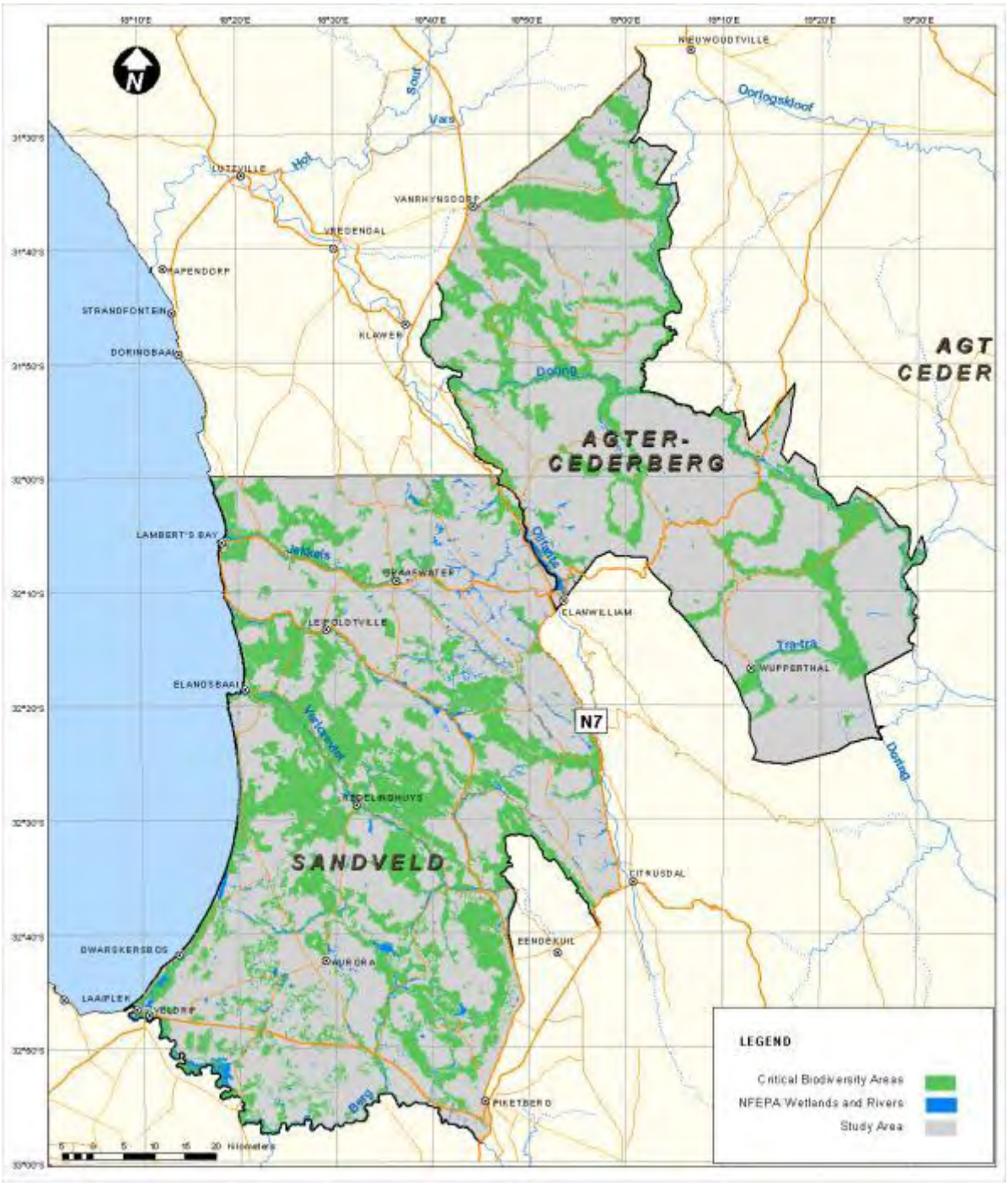
CBA maps identify the most efficient network of sites that are required to ensure the continued persistence of:

- Biodiversity pattern (e.g. species, habitats, vegetation types and ecosystems);
- Ecological infrastructure' and the services and goods that it provides to society and human settlement (such as provision of water, grazing for livestock, protection against floods, or pollination); and
- The ecological processes and disturbance regimes by which this biodiversity pattern is maintained.

CBA maps depict categories that are linked to desired management objectives which provide guidance on how habitat in the different categories should be managed. Important biodiversity features or categories depicted on Critical Biodiversity Area Maps include:

  - Critical Biodiversity Areas (CBAs) are terrestrial (land) and aquatic (water) features (e.g. vleis, rivers and estuaries) whose safeguarding is critically required in order to meet biodiversity pattern and process thresholds; and
  - Ecological Support Areas (ESAs) are supporting zones or areas required to prevent the degradation of Critical Biodiversity Areas and Protected Areas.
  - Other Natural Areas (ONAs) are those areas of natural or near-natural vegetation identified on the map whose safeguarding is not required in order to meet national thresholds.

Map 2.7: Critical Biodiversity Areas and NFEPAs in the Sandveld study domain



Source: Agri Informatics, 2016

As the CBA network is the most optimal spatial configuration of land needed to reach the set conservation targets, any encroachment into this network will result in a less-optimal reconfiguration of the CBA network, resulting in a greater reduction in the land available to expansion and development.

Table 2.16: Management objectives for the different biodiversity categories

Critical Biodiversity Areas	Ecological Support Areas	Other Natural Vegetation
Maintain as natural land. Rehabilitate degraded areas to a natural or near-natural state. Manage against further degradation and for no further habitat loss	Maintain in a near natural state to ensure that they remain functional (some loss of habitat can be tolerated)	Areas favoured for land-uses other than biodiversity conservation. Manage for sustainable land-use

Biodiversity Sector Plans

In the Western Cape, several municipalities – including the local municipalities in the Sandveld study domain[67] – have 'biodiversity sector plans' which are based on systematic biodiversity planning. These 'biodiversity sector plans' comprise three elements:

- A handbook with guidelines on land and resource use;
- Municipal biodiversity profiles; and
- CBA maps for each of the municipalities concerned (in this case, the Saldanha Bay, Bergrivier, Cederberg and Matzikama local municipalities).

2.2.4.5 National Freshwater Ecosystem Priority Areas (Nel *et al.*, 2011; Cadman *et al.*, 2013)

Maps produced for South Africa's NFEPA project depict areas that have been prioritised for conserving freshwater ecosystems and supporting sustainable use of water resources (see Map 2.7 above)[68].

FEPA maps promote an ecosystem perspective in environmental assessment in that they introduce a broader scale to impact identification than is often the case with site or property-specific impact assessment. These maps and implementation guidelines emphasise the functional attributes of biodiversity by providing spatial or geographic surrogates for ecological processes that may otherwise not be readily evident if an assessment were limited to a particular site or property.

Land uses that negatively impact on the condition of FEPAs must be avoided. Planning must aim to change land use practices that have already resulted in degradation of FEPAs, and degraded FEPAs must be prioritised for restoration.[69]

The NFEPA project has produced maps for eight types of priority freshwater ecosystems:

- River FEPAs and associated sub-quaternary catchments: Areas that are essential for achieving targets for river ecosystems and threatened or near-threatened fishes and in a 'natural' (A) or 'largely natural' (B) ecological condition; the sub-catchment must be managed to maintain an A or B condition.
- Wetland or estuary FEPAs.

[67] Maree & Vromans (2010)
[68] Nel *et al. (2011)*
[69] See The Implementation Manual for Freshwater Ecosystem Priority Areas (Driver *et al.*, 2011).

- Wetland clusters: These are groups of wetlands in relatively natural landscapes that must be managed in support of maintaining ecological processes.
- Fish sanctuaries and associated sub-catchments: Rivers in an A or B condition that are essential for protecting threatened and near-threatened indigenous freshwater species (a red fish on a FEPA map indicates that Critically Endangered and/or Endangered fish species may be present).
- Fish support areas and associated sub-catchments: Rivers with an ecological condition lower than A and B that are important for conserving and supporting the migration of threatened or near-threatened indigenous fish species.
- Upstream management areas: These are sub-quaternary catchments that need to be managed to prevent degradation of downstream FEPAs and fish support areas.
- Phase 2 FEPAs: Moderately modified ('C' condition rivers) that may be needed to meet biodiversity targets and therefore should not be further degraded.
- Free-flowing rivers: These are represented by 19 rivers nationally that, due to their rarity as undammed systems, should never be impounded.
- A mandatory minimum buffer width of 100 m is recommended for all river and wetland FEPAs, prior to more detailed delineation.

Detailed guidelines have been published on the purpose, interpretation and application of FEPA maps to environmental impact assessment and development planning in general.[70]

NOTE: The information reflected in the NFEPA products has been digitised at a variety of scales, not all of which would be suitable for environmental impact or farming planning – although, as pointed out above, the broad scale at which freshwater biodiversity has been addressed by the NFEPA programme promotes a landscape approach to planning and impact assessment. For example, river FEPAs were digitised at the scale of sub-quaternary catchments, whereas the input layer on river conditions, etc. was digitised at a scale of 1:500 000.

2.2.4.6 The National Protected Areas Expansion Strategy

The National Protected Areas Expansion Strategy (NPAES; as shown on Map 2.5)[71] seeks to achieve cost-effective protected areas expansion that enhances ecological sustainability and resilience to climate change. [72]

Focus areas for land-based protected areas expansion are large, intact and un-fragmented areas of high biodiversity importance that are suitable for the creation and expansion of large protected areas.[73] Focal areas identified by the NPAES may also serve as a trigger for environmental authorisation in terms of Listing Notice 3 of the 2014 NEMA EIA Regulations. Focal areas for expansion within the study domain are detailed in Table 2.17 and Map 2.8 below.

[70] Driver *et al.* (2011)
[71] DEAT (2010)
[72] Cadman *et al.* (2010), p 36 – 41
[73] Driver *et al.* (2012)

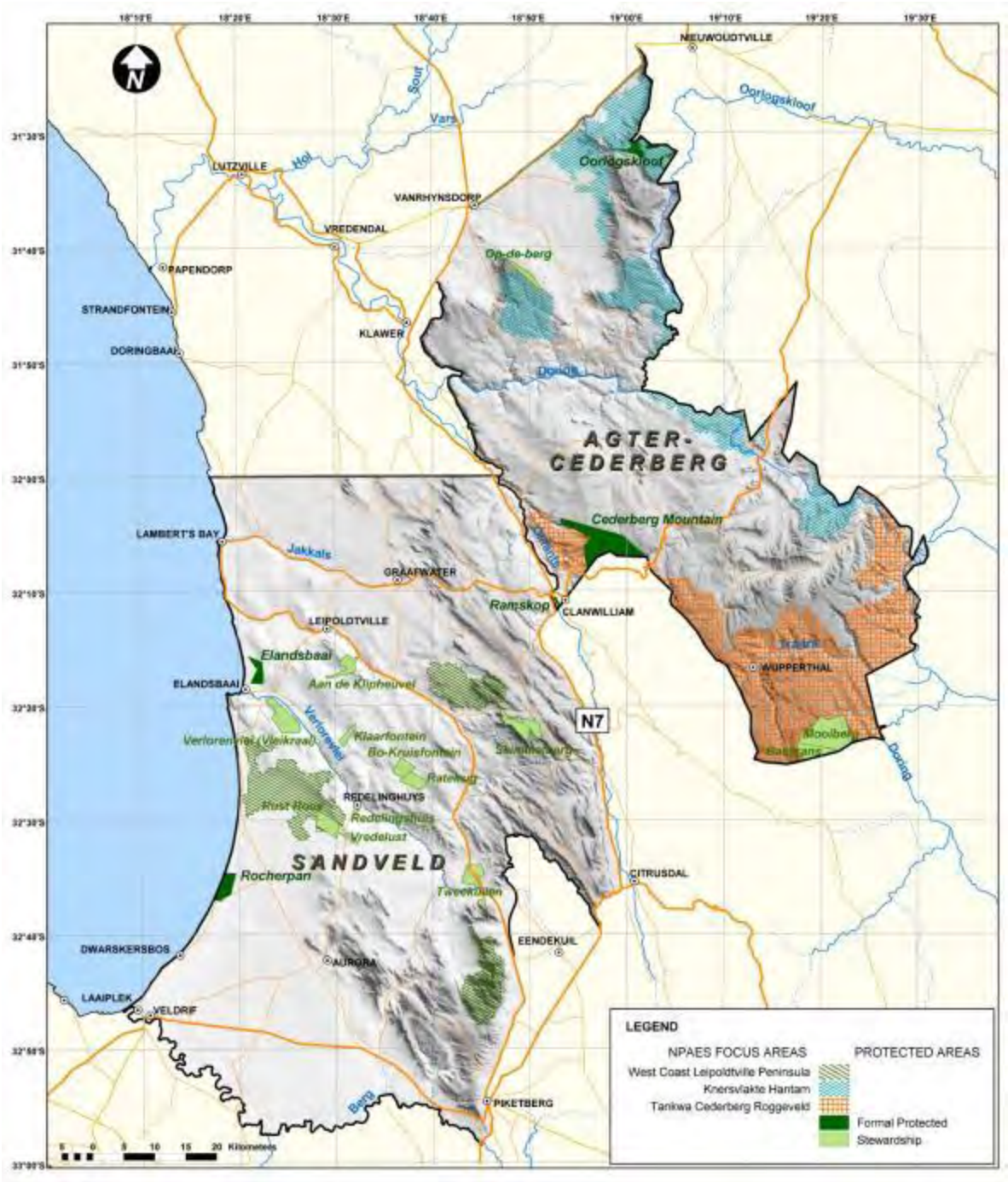
Table 2.17: Focal areas in the study domain which form part of the National Protected Areas Expansion Strategy (DEA, 2011; http://bgis.sanbi.org)

Focal Area	Rationale for inclusion
Knersvlakte/ Hantam Focal area 18	Spectacular Succulent Karoo priority area which straddles the Western Cape and Northern Cape. It intersects with the northern parts of the Agter-Cederberg, in the plains between the Matzikammaberg and Koebeeberge. This focal area contains numerous quartz patches, and provides opportunities to protect whole intact river reaches. This reinforces the importance of the current expansion of the Knersvlakte Nature Reserve (DEA, 2011, p 27).
Tankwa/ Cederberg/Roggeveld Focal area 36	This focal area also straddles the Western Cape and the Northern Cape provinces. A significant proportion of the Tankwa-Cederberg-Roggeveld focal area occurs along the southern perimeter of the Agter-Cederberg portion of the study domain. It is exceptionally important for freshwater biodiversity. It includes a large portion of the important Doring River, the third largest free-flowing river in the country, which plays a crucial economic role in sustaining the high levels of utilisation of the Olifants River and meeting the water requirements of the Olifants estuary. In addition, it presents opportunities for protecting several threatened river types and important fish sanctuary areas that harbour endemic and threatened freshwater fish (DEA, 2011, p 27).
West Coast Leipoldtville Peninsula Focal area 41	Broadly located in the vicinity of the Rondeberg (south of Elandsbaai), in the Olifantsberge south of Graafwater, and the Piketberg. It incorporates significant tracts of two vulnerable ecosystems, Leipoldtville Sand Fynbos and Piketberg Sandstone Fynbos, each of which is characterised by a high association with threatened plant species. These focal areas also contain upland-lowland interfaces and soil transitions that form important vegetation boundaries.

It is crucial that land use planning and decision making avoids further fragmentation of these areas as they provide the most efficient and effective options for protected areas expansion in the future.[74]

[74] Driver *et al.* (2012), p 160

Map 2.8: Focal areas in the study domain identified by the National Protected Area Expansion Strategy (DEA, 2011)



Source: Agri Informatics, 2016

2.2.4.7 Special habitats in the Agter-Cederberg

Special habitats include areas that are rare within the region, or which support species of special concern, as well as ecosystems or ecological processes. Species of special

concern are red data listed species, some of which are listed in terms of the Threatened or Protected Species ("TOPS") regulations.[75]

Special habitats include listed threatened ecosystems and other habitats protected by legislation, namely wetlands, estuaries and indigenous forests. The most prominent special habitats occurring within the study domain include rocky outcrops along the coast (pre-eminently Bobbejaanpunt at Elandsbaai), wetland mosaics, inselbergs (isolated mountain peaks) and rocky coastal gorges.

Such special habitats identified by the municipal biodiversity sector plans for the Sandveld EMF study area[76] are detailed in the table below.

Table 2.18: Special habitats identified by the municipal biodiversity sector plans for the Sandveld EMF study domain (Maree & Vromans, 2010)

Special Habitat	Rationale for inclusion
Kliphout forest and sandstone inselbergs of Lambert's Bay area	The sandstone inselbergs (koppies) occur along the coastline from Wadrift Soutpan to north of Donkin's Bay. They are surrounded by Lambert's Bay Strandveld and range in size from 0.5 ha to 3 ha. The inselbergs support unique assemblages of plant species, including localized species such as the vygie, *Oscularia cremnophila*.
Baboon Point	Baboon Point is the most significant outcrop falling within the study domain. It lies south of Elands Bay about 300 m from the coast. It is exposed to regular sea fogs and this elevated moisture level coupled with the stable substrate has allowed for the development of extremely rich succulent and bulb communities, including a number of local endemics.
Lowland acid sand wetlands	There are very few of these wetlands on the coastal plain, comprising permanently damp acid sands and supporting a group of plant species more typical of Sand Fynbos about 100 km to the south. Many of the component species have not been recorded so far north and are therefore of major geographic interest and ecological value.
Graafwater Flats	This habitat is special as the meeting point of several different vegetation types and plant communities. Unique species occur here and there are unusual habitats, such as rocky flats.
Verlorenvlei River below Het Kruis.	Here, exposed clay banks support small patches of what may be classified as Piketberg Quartz Succulent Shrubland or Swartland Shale Renosterveld (CR), essentially patches of Succulent Karoo deep within the Fynbos Biome. These areas are dominated by succulents, such as *Euphorbia burmanii, E. mauritanic*, *Ruschia* and *Drosanthemum*.

In addition to special habitats, a number of plants and animal species that occur within the study area have also been identified as being of special concern.[77] These are listed below.

[75] GN R. 151 and GN R. 152, of 23 February 2007, and GN R. 1187 on 14 December 2007; published in terms of s 56 of the NEM: Biodiversity Act 10 of 2004
[76] Maree & Vromans (2010)
[77] RedList (2014)

Table 2.19: Plant and animal species that have been identified as being of special concern in the study domain (RedList, 2014)

Class	Species
Plants	The area hosts many endemic, rare or threatened plant species. Leipoldtville Sand Fynbos is thought to contain about 25 species that are restricted to this vegetation type Helme, 2012). For a list of the species of concern within each vegetation type, refer to Helme and Koopman, 2007.
Birds	Several endemic bird species occur in this area, for example Barlow's Lark (*Certhilauda barlowi*). Other species include the Black Harrier (*Circus maurus)*, vulnerable, Karoo Bustard (*Eupodotis vigorsii*), Ludwig's Bustard (*Neotis ludwigii*), Karoo Chat (*Cercomela schlegelii*), Dune Lark (*Certhilauda erythrochlamys*), and Dusky Sunbird (*Nectarinia fusca*). Estuaries and lagoons support thousands of sea birds and waders.
Mammals	Mammal species that are endemic or near endemic to the area are Van Zyl's Golden Mole (*Cryptochloris zyli*), Cape Dune Molerat (*Batyergus suillus*), Cape Gerbil (*Tatera afra*) and Grant's Golden Mole (*Eremitalpa granti*). The leopard (*Panthera pardus*) is threatened by habitat loss and persecution of this apex predator in order to protect domestic stock. Leopards have nonetheless been recorded in the Groot-Winterhoek and Cederberg protected areas, as well as in the vicinity of Het Kruis, Leipoldtville and Citrusdal. This is a flagship species for conservation by CapeNature and the Cape Leopard Trust.
Reptiles	The diversity of reptile species is relatively high in the drier Succulent Karoo area along the West Coast. Seven species of girdled lizards of the genus *Cordylus*, including the armadillo girdled lizard (*Cordylus cataphractus*, vulnerable) are endemic to the area. Two endemic tortoise species occur in the area, namely the Namaqualand tent tortoise (*Psammobates tentorius trimeni*) and the Namaqualand speckled padloper (*Homopus signatus signatus*). The Critically Endangered Geometric Tortoise (*Psammobatus geometricus*) has lost more than 90% of its renosterveld habitat. They are exceedingly vulnerable to habitat loss and fragmentation, illegal collection and invasive species.
Insects	The northern reaches of the West Coast constitute the southern-most tip of an area of endemism for darkling beetles (tenebrionid family, which includes toktokkies). Another group, found almost exclusively in southern Africa, are the monkey beetles which are concentrated in this area. Along with many types of wasps and bees, these beetles pollinate the West Coast's immense range of plant species. Perhaps the most unusual invertebrates found here are the long-tongued flies (Memestrinidae), which can have mouthparts up to 50 mm long. The level of richness and endemism in insect species is likely to be similar to the extraordinary richness exhibited by the plant life. Preliminary studies show that more than half of the species in some insect groups are endemic to the area, occurring nowhere else in the world.
Fish	The primary catchment of the Olifants-Doring river system is very special in terms of its freshwater fish species. It has the highest number of endemics in Southern Africa, hence its title as a freshwater fish hotspot. The area contains nine endemic fish species and an additional three indigenous fish species, all of which are threatened by invasive alien fish species, unsustainable water abstraction and habitat degradation.

2.2.5 Botanical assessment undertaken for the Sandveld EMF

The botanical assessment, undertaken by Dr. Dave McDonald, set out to ground-truth existing maps and information to determine the current status of natural vegetation and the veracity of CBA maps for the Sandveld planning domain. It focused on the 'hotspots'

that had been identified by the spatial analysis of land use trends in the Sandveld planning domain.

Field-work was conducted between 3—5 September 2014 and 13—18 October 2014. The first period was within the 'spring' season, which was most desirable whereas the second was in early summer when much of the annual and ephemeral flora had already dried out. Notwithstanding the sampling periods, adequate data were assembled from which to draw conclusions.

Altogether 28 sites were sampled (see Map 2.9 below). The original intention was to sample 37 'hotspot' sites, but this was not possible to physical conditions in the field, i.e. locked gates, impassable tracks, absent landowners and geographically remote locations.

Map 2.9: Botanical sample sites in the Sandveld study area

Source: Agri Informatics, 2016

Figure 2.4: Some of the vegetation types encountered in the study area

The following findings are highlighted from the study -

- There was generally fair correspondence between the Vegetation Map of South Africa, Lesotho & Swaziland (Mucina *et al.* 2005) [VEGMAP] and the groundtruthed sites. Five sites were found to be potentially misclassified on the VEGMAP and survey agreed with the units mapped by Helme (2007) in the Fine-scale Planning exercise.
- The study was biased towards sites within undisturbed natural vegetation. Connectivity improved in areas that did not have deep sand suitable for cultivation. Rocky ridges provided the best connectivity.
- Leipoldtville Sand Fynbos occurred at the majority of sites that were sampled. It has been assessed as being ENDANGERED by the 2014 Western Cape Biodiversity Framework.
- Most of the sampled sites were important for the Critical Biodiversity Network and no further agricultural expansion should occur in these areas.
- Two species of conservation concern[78] were found in this investigation (see below): *Felicia josephinae* (Endangered) and *Argyrolobium velutinum* (Endangered). There were undoubtedly more species of conservation concern present in the Sandveld. However, a comprehensive list of these would require intensive field-work and collection over a period of a few years in optimal seasons, which was beyond the scope of this project.

[78] As documented by Helme (2013)

Figure 2.5: Endangered species *Felicia josephinae* found in the study area

Figure 2.6: Endangered species *Argyrolobium velutinum* found in the study area

Conclusions:

- Results from the study showed good correspondence with the mapping of the Sandveld by Helme (2007). Similar to Helme (2007) it was found that there are areas of the Sandveld which have not been accurately mapped in the VEGMAP.[79]
- Use of the Helme (2007) fine-scale map of the Sandveld must be promoted and used for all planning exercises e.g. the Sandveld Environmental Management Framework and environmental assessments, since this map is the most accurate available.

[79] Mucina *et al.* (2015)

- Notwithstanding the good level of accuracy of the fine-scale vegetation map of the Sandveld there are some inaccuracies and limitations. This has been translated into inaccuracies in determining CBAs in some places in the Sandveld. Overall the CBA maps for the Sandveld Domain should be supported, but there would still be the need to conduct site assessments (screening assessments) for applications for disturbance of virgin veld, as there is no 'rule-of-thumb' or 'one-size-fits-all' that can be applied generally even within a specific vegetation type e.g. Leipoldtville Sand Fynbos since populations of threatened plant species can be localised within the greater vegetation matrix and would be missed if a general wide-scale approach is applied.
- Therefore, in general the CBAs for the Sandveld should be supported with the proviso that they be constantly checked and updated.
- The natural vegetation of the Sandveld EMF planning domain remains under threat from increased transformation for agriculture.
- Opportunities for restoration or rehabilitation of disturbed land e.g. abandoned potato or rooibos tea fields did not appear to be great. Although restoration should be encouraged, it takes a long time and very seldom results in vegetation that resembles the original vegetation both in species composition and structure.

2.3 Socio-economic context

2.3.1 The Sandveld and Agter- Cederberg: A rural, farming landscape

The study area is largely rural and dominated by agriculture and associated industries and services. It spans varying portions of three local municipalities (Bergrivier, Cederberg and Matzikama) which, with the Saldanha Bay and Swartland municipalities, fall under the administrative ambit of the West Coast District Municipality which has its headquarters in Moorreesburg. A portion of the study area within the Agter-Cederberg, namely the settlements of Heuningvlei, Wupperthal, Eselbank, Langkloof and surrounds (approximately 365 km^2), fall on Moravian Church grounds. Ownership of these properties lie with the Moravian Church, and is occupied and used by the inhabitants of the area, who are members of the church who lease the land from the church.

2.3.2 Population

The study area does not embrace the full, geographical extent of each of the subject municipalities, which makes it difficult to accurately reflect the numbers of people who live and work within the domain of the Sandveld EMF. Estimated population densities (persons/km^2) are detailed in the table below.)

Table 2.20: Estimated population densities for the local municipalities within the study domain

Local Municipality	Population (2011 census)	Geographical area (km^2)	Estimated density (persons/km^2)
Matzikama	68 414	12 981	5.26
Cederberg	50 615	8 007	6.3
Bergrivier	62 639	4 407	14.2

Population densities in rural, predominantly agricultural areas in the respective municipalities can even be half of the figures presented above. Wupperthal and its outlying satellite settlements ('buitestasies') represent one of the most isolated settlements in the study domain.

2.3.3 Unemployment and poverty

Despite relatively low levels of unemployment, poverty rates in the study area are a cause for concern. Figures for the overall percentage of people living in poverty in the largely rural municipalities of the West Coast District are as follows: Cederberg (42.7%), Bergrivier (33.8%) and Matzikama (31.7%). The poverty rates in the Cederberg Local Municipality are particularly alarming.

2.3.4 Tourism in the Sandveld and Agter-Cederberg: A West Coast Perspective

Tourism is regarded as the fastest growing economic sector in the world and therefore is a sector that has the potential to stimulate global economic recovery. [80]

Being a labour-intensive industry, tourism has a major capacity to create jobs. Since it contributes to a variety of economic sectors it forms the backbone of the economy for many towns on the West Coast,[81] which has a long-standing reputation as a desirable tourism destination thanks to its spectacular and diverse scenery, showy spring flower displays, rural charm and ease of access from Cape Town.[82]

Viewed from a provincial economic perspective, the tourism sector is geographically well-dispersed; it is labour intensive, a foreign exchange earner and has close linkages to agriculture and with rural communities.[83]

Tourism is the 3rd biggest economic driver on the West Coast and every 21 visitors to an area result in one permanent job and every 8 visitors to an area result in one temporary job. The 3% increase in visitors to the West Coast compared to 2013–2014, proves that the region's tourism sector is on the right track, and the growth in black-owned tourism businesses on the West Coast indicates that the tourism strategy is being implemented successfully.

Tourism contributed nearly R760 million to the West Coast economy in 2014/2015, and accounted for 4 270 jobs. See Table 2.21 for comparative figures for the 2012/2013 and 2013/2014 financial years.[84]

[80] Wesgro (2014)
[81] DEA (2011b)
[82] Unless otherwise indicated, this section on tourism trends in the West Coast District Municipality is sourced from information provided by Wesgro, the official Investment and Trade Promotion Agency for the Western Cape, namely Cape West Coast: Regional Visitor Trends 2014 file:///C:/Users/admin/Downloads/2014_Barometer_Cape_West_Coast.pdf (accessed 01-03-2016)
[83] Western Cape Government Provincial Treasury Provincial Economic Review and Outlook 2013 Climate and climate change_150216.docx(accessed 01-03-2016)
[84] Monthly statistics collected from West Coast Tourism offices – pers. comm. Mrs Helena van Rooyen, Tourism Manager, West Coast Tourism (01-03-2016).

Table 2.21: Contribution of tourism to the West Coast economy

	2012 / 2013	2013 / 2014	2014 / 2015
Economic activity relating to tourism (R'000)	736 725 000	745 565 700	767 932 671
Employment in tourism (no)	3 142	3 233	4270

West Coast Tourism is based on the Namaqua (Vredendal), West Coast (Velddrift), Cederberg (Clanwilliam) and Berg River (Saldanha) regions. See Table 2.22 below for key tourism attractions in these regions.

2.3.4.1 Agri-tourism

Agri-tourism also offers important opportunities for farmers and local communities to diversify income streams, which is becoming increasingly desirable in the face of economic and climatic pressures on agriculture, in particular.

The impacts of agri-tourism on farm profitability are poorly understood[85] and data are not readily available on the contribution of farm-based tourism to the overall West Coast tourism economy and regional domestic product (See box below).[86]

This is a gap that certainly warrants future research in order to better understand the actual and potential contribution of farms to tourism in the West Coast region and the domain of the Sandveld EMF. The latter has a rich cultural and environmental heritage that needs to be optimally utilised to the advantage of its people, and the conservation and enjoyment of the landscapes, ecosystems and communities which define and underpin its special value for visitors.

Examples of agri-tourism enterprises or resources in the domain of the Sandveld EMF include holiday chalets, campsites and hiking and 4x4 trails on farms, the rooibos tea factories at Clanwilliam and Wupperthal, and old stone-packed donkey trails, 'kraals' and threshing floors in the Agter-Cederberg.

What is agri-tourism?

Agri-tourism is the form of tourism which capitalizes on rural culture as a tourist attraction.

It is similar to ecotourism except that its primary appeal is not the natural landscape but a cultural landscape. If the attractions on offer to tourists contribute to improving the income of the regional population, agri-tourism can promote regional development.

To ensure that it also helps to conserve diversity, the rural population itself must have recognized agri-biodiversity as valuable and worthy of protection.

There are a range of other forms of rural tourism which are not necessarily a part of agri-tourism in the strict sense, e.g.

- Ethno-tourism,
- Project tourism,
- Health tourism, historical tourism,
- Cultural tourism, or
- Adventure tourism.

[85] Schilling *et al.* (2014)

[86] Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH *Agrotourism and agricultural diversity* http://www.conservation-development.net/Projekte/Nachhaltigkeit/CD1/LaenderDesSuedens/Themenblaetter/PDF/AgrobiodivAgrotourism.pdf (accessed 01-03-2016)

2.3.4.2 Provincial tourism trends, 2014

Key visitor trends gathered across the regions of the Western Cape for 2014 revealed a positive percentage of overseas (40.2%) and domestic (58.8%) visitors to the province. The top markets were Germany, United Kingdom, Netherlands and the United States. The top domestic markets were Western Cape, Gauteng, Eastern Cape and Kwa-Zulu Natal. Visitors enjoyed travelling in pairs (51.9%), while the majority (90.4%) came to the province for holiday and leisure. The bulk of visitors spent on average daily R501 - R1 000, which makes a positive contribution to the economy. The main activities visitors enjoyed were scenic drives (20.5%), culture/heritage (14.9%) and gourmet restaurants/cuisine (13.2%).

2.3.4.3 Cape West Coast

The West Coast region attracts a rich share of domestic travellers and accounted for 77.3% of respondents in 2014 that travelled to the region. The domestic market was led by the Western Cape (59.6%), followed by Gauteng (18.5%) and KwaZulu-Natal (5.2%)

The region also welcomed a share of 21.4% from the international market and was largely represented by visitors from Germany (30.7%), the United Kingdom (28.5%) and the Netherlands (10.1%). These markets together with Switzerland and the United States ranked as the region's top five markets in 2014.

Wesgro's[87] findings indicated that the local Cape Town market has grown to be the West Coast region's strongest share of travellers from the domestic market. Local events such as Darling Rocking the Daisies, Riebeeck Valley Olive Festival, and Paternoster Jazz on the Rocks, amongst the many others, are extremely well attended by the local Cape Town market and holds a strong share of return visitors who attend these events annually. However, from the share of domestic respondents, the Gauteng market retained its position as the second largest contributor to domestic travel to the Cape West Coast, indicating an improving share across the last five years.

The Western Cape Department of Economic Development and Tourism have also prioritised the development of tourist routes that links Cape Town with the outlying regions of the Province, including the West Coast.[88] The latter route currently consists of four nodes with room for more to be added in the future. The nodes are:

- !Khwa ttu at Yzerfontein;
- West Coast Fossil Park;
- Clanwilliam Living Landscape Project; and
- Griqua Ratelgat.

A share of 54% of respondents stayed overnight and indicated an average length of stay of one (42.1%), two (30.2%) and three (11.2%) nights. Top accommodation choices enjoyed by these visitors included self-catering (43%) and guesthouses (18.2%) for the duration of their stay.

[87] Wesgro is the official destination, marketing, investment and trade promotion agency for the Western Cape

[88] Department of Economic Development and Tourism Western Cape ANNUAL PERFORMANCE PLAN 2014/15 https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/assets/departments/economic-development-tourism/app_2014_15_english.pdf (accessed 01-03-2016)

Visitors to the Cape West Coast primarily travelled for holiday/leisure (91.6%) with scenic drives, culture/heritage, gourmet restaurants, flowers and wine tasting ranking as their top activities. Most visitors (54.5%) travelled in pairs, in their own vehicle (61.7%) although 35.2% of respondent made use of rented cars. Nearly half (42.2%) of visitors were in the 51-70 year-old age group, and 26.5% between 36 and 50 years of age.

In terms of overseas and domestic preferences respectively, the top three tourism activities in the West Coast were:

Overseas		Domestic	
Scenic drives	27.6%	Scenic drives	23.3%
Outdoors activities	14.6%	Culture/heritage	13.3%
Gourmet restaurants	9.7%	Flowers	13.1%

The largest share of respondents from the overseas market indicated a daily expenditure of R501 - R1 000 (45.2%), while the domestic market spent on average R201 - R500 per day. A moderate share of 2.9% from each market indicated a daily expenditure of more than R2 000, which serves as a strong economic boost for the tourism sector and the economy of the region as a whole.

Table 2.22: Key tourism attractions in the region of the study area

West Coast Tourism Region	Towns within the Sandveld and Agter-Cederberg	Tourism attractions	Tourism office	Contact details
Namaqua West Coast Tourism	Klawer Vanrhynsdorp	Spring flower displays (August-September) Olifants River wine route Mountain peaks such as the Gifberg, Maskam and Koebee Whale-watching from July	37 Church Street Vredendal 8160	Tel: +27 27 201 3376 Fax: +27 27 213 4819 Email: info@namaquawestcoast.com Web: www.namaquawestcoast.com
Cederberg Tourism	Citrusdal Clanwilliam Elands Bay Graafwater Lamberts Bay Leipoldtville Wupperthal	Olifants River Valley citrus industry and irrigation canals Rooibos tea farms and factories San rock art Cederberg Wilderness Area and surrounding farms (hiking, camping, rock climbing) Wupperthal Moravian Mission Station (historical buildings, veldskoen factory, vegetable plots, hiking) Cederberg Heritage Route (hiking, slackpacking, donkey cart riding) Beaches at Lambert's Bay and Elandsbaai (fishing, crayfish diving, surfing, dolphin-spotting August-November) Bird-watching (Bird Island, Lambert's Bay, Verlorenvlei, Roscher Pan and other wetlands)	PO Box 5 Clanwilliam 8135	Tel: +27 27 482 2024 Fax: +27 27 482 2361 Email: cederberg@lando.co.za Web: www.cederbergtosea.co.za
Bergrivier Tourism	Aurora Goedverwacht Piketberg Porterville Redelinghuys Velddrift Wittewater	Berg River: wine farms, fishing, bird-watching, annual canoe marathon, sailing Port Owen deep-water marina. Groot-Winterhoek Wilderness Area Historical mission station villages of Goedverwacht and Wittewater Verlorenvlei (birding)	Voortrekker Road Velddrift 7365	Tel: +27 22 783 1821 Fax: +27 22 783 1821 Email: velddriftoerisme@telkomsa.net

2.3.5 Agriculture in the study area

Notwithstanding apparently unfavourable conditions for intensive agricultural activity (limited winter rainfall, summer drought and sandy, low fertility soils), the Sandveld component of the study domain is one of the main potato production regions of South Africa. This is chiefly due to the availability of irrigation water from reliable groundwater resources. The study area is also home to the rooibos industry, as the rooibos plant (*Aspalathus linearis*) thrives under the natural conditions.

2.3.5.1 The Potato Sector

Potato production is the core economic activity and employer in the Sandveld.[89] It accounts for 41% of the Cederberg Local Municipality's agricultural production income and is the largest cash crop in the municipality.[90] The Sandveld potato industry is largely labour intensive and an increasing number of low skilled job opportunities are to be found in this irrigation agriculture. At present, it provides approximately 3 640 seasonal (unskilled and semi-skilled) on-farm jobs.[91] The potato industry also has an employment multiplier effect in transport, processing, independent trading, retail, packaging, informal trading and in restaurants and fast food outlets.

Potatoes are produced for three distinct market segments: table (or fresh) potatoes, processing (or ware) potatoes and seed potatoes. There is currently a clear trend towards greater production of table potatoes and processing. Whereas altogether 17% of South Africa's total table potato production was processed in 2011, only 9% of the Sandveld table potato yield was processed. This figure remains unchanged for 2015, with the majority of the processing taking place at Lambert's Bay.

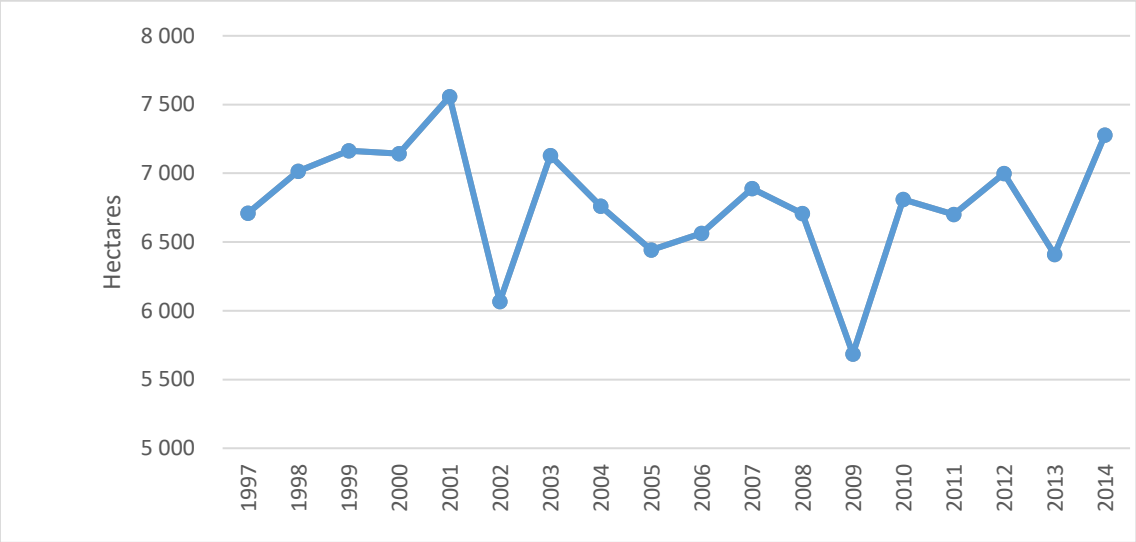
The Sandveld seed potato industry experienced its peak in 1999 when an area of more than 4 000 ha was planted. Slightly more than a decade ago (2003/2004) the Sandveld was still South Africa's largest seed potato production region (i.e., 3 230 ha or 34% of national production). The Western Free State was then the next biggest region at 2 003 ha. The total area used for potato seed production in South Africa was then 9 383 ha. Today, the Sandveld accounts for less than 5% of South Africa's seed production, whilst the national total production has remained approximately constant. [92]

The number of hectares planted in the Sandveld reached a high of 7 500 ha in 2001, after which it declined to 5 700 ha in 2009, and rebounded to over 7 000 ha in 2014 (Figure 2.7). With rotations taken into account, the total land use was 35 000 ha in 2001, 26 000 ha in 2009 and 33 500 ha in 2014. Total potatoes production in the Sandveld was 337 000 tonnes (t) in 2014 (15% of national production), up from 282 000 t in 2013 (13% of national production).[93]

[89] CK Rumboll & Partners (2013)
[90] CNdV africa (2013)
[91] FH Knight, pers. comm. (15-02-2016)
[92] De Wit (2016)
[93] Potatoes SA (2015)

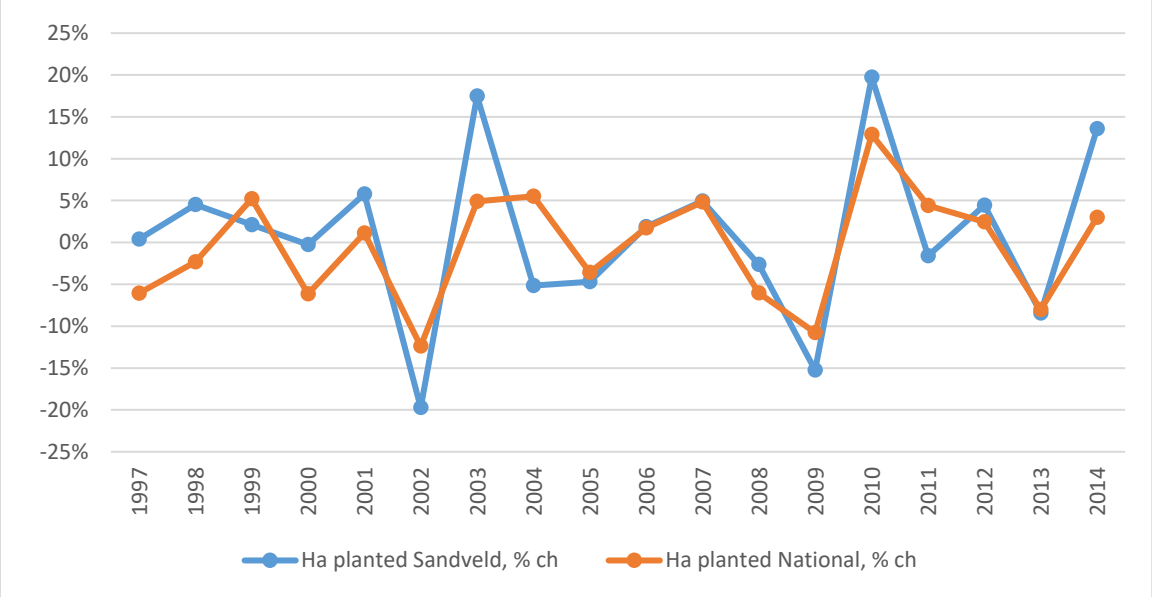
Changes in the number of hectares that are planted nationally and in the Sandveld show close similarities. In most years over the period 1997-2014, decreases or increases in the number of hectares planted in the Sandveld are in line with what happened at national level (Figure 2.8).

Figure 2.7: Hectares of potatoes planted in the Sandveld



Sources: Knight *et al.* (2007), SAKO, Potatoes SA, De Wit Sustainable Options

Figure 2.8: Hectares of potatoes planted in South Africa and the Sandveld (YoY % change)

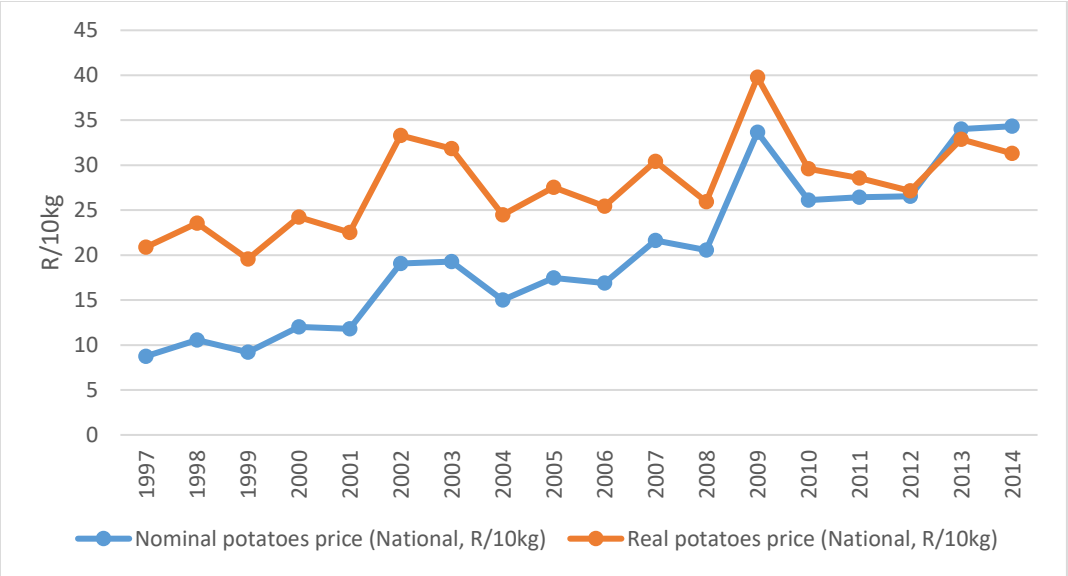


Source: De Wit Sustainable Options, 2016

Average national potato prices increased in nominal terms from R10/10kg in 1997 to R34/10kg in 2014, although in real terms (after accounting for inflation (CPI 2012=100)) prices rose slower from R20/10kg in 1997 to R30/10kg in 2014 (Figure 2.9). In real terms, prices have remained relatively stable in the last decade. Prices for Sandveld potatoes are closely related to national price trends. Price trends are important for the potatoes industry, as the turnover of the potato farming industry, both nationally and in the

Sandveld, are more closely linked to the movements in price than to the number of hectares planted.[94]

Figure 2.9: Nominal and real potato prices (R/10kg; National)



Source: De Wit Sustainable Options (2016) as based on Potatoes SA, Statistics SA.

The total production value of the industry in the Sandveld is estimated at R1 billion to R1.2 billion. Due to the high input cost and volatility in market prices, some potato producers have withdrawn from production. In the Sandveld, the number of potato producers had decreased by more than 15% from 116 in 2008 to 84 in 2014, signifying a long-term trend towards economies of scale.[95]

However, the input costs of potato production have increased substantially in the last number of years. The cost of potato production in the Sandveld is currently estimated at ±R177 184/ha[96], including depreciation. This implies that the cost of producing on a single 20 ha centre pivot field amounts to R3.5 million.

The CSIR developed enterprise budgets for potatoes in the Sandveld and estimated that electricity costs are likely to become a limiting factor to irrigation production[97]. Additionally, increasing fertilizer and fuel prices from 2007/8 onwards has significantly increased the costs of potato production in especially the Sandveld.[98] With stable market prices and rising input costs, potato producers are experiencing a cost-price squeeze that will affect the sustainability of the industry.[99]

2.3.5.2 The Rooibos Sector

Rooibos is a leguminous shrub which is endemic to the Cederberg Region and has not been cultivated successfully elsewhere either in South Africa or the rest of the globe. The

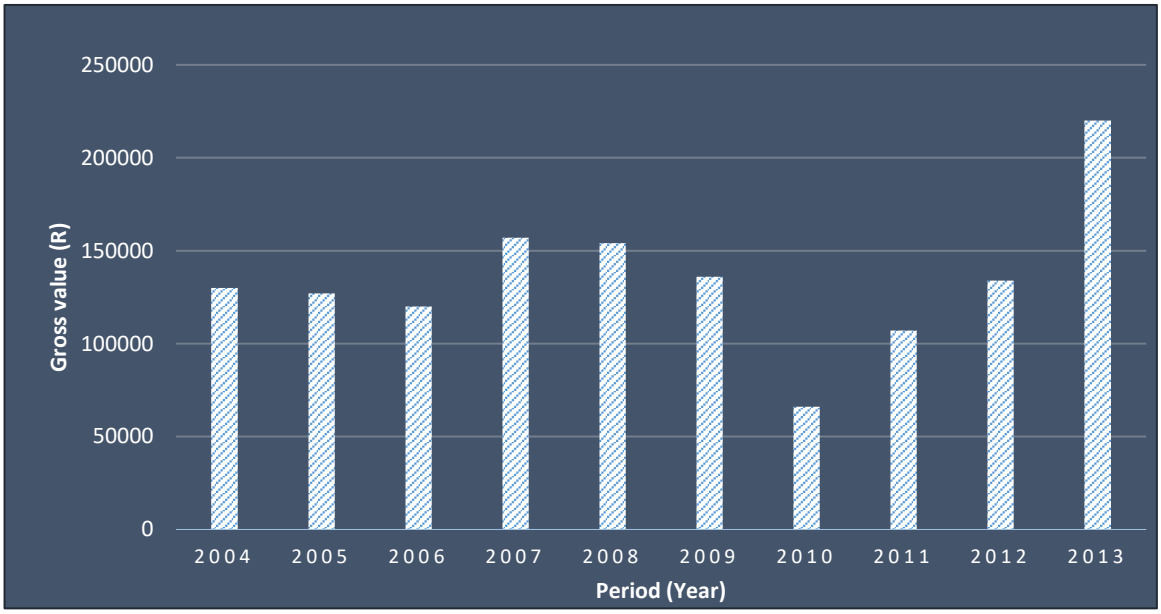
[94] De Wit (2016)
[95] De Wit (2016)
[96] Mr Pieter van Zyl, Information Manager, Potatoes SA, pers. comm., 01-03-2016
[97] De Lange & Mahumani (2012)
[98] NAMC (2009)
[99] Potatoes SA (2013)

plant has long been recognised for its aroma and flavour and is best known for the world renowned tea which is made from its leaves. Rooibos farming and further processing plays a critical role in the economy of the study area. It supports a significant number of livelihoods both directly and indirectly. It also contributes to the positive, healthy image that the region is able to project which benefits other sectors such as tourism.

Rooibos is a perennial crop with a limited lifespan of 4 to 6 years, depending on the climate and soil properties. Farming rooibos can entail allowing land to lay fallow for 2 to 4 years between periods of cultivation. The actual area under production in South Africa was estimated to be about 36 000 ha in 2009.[100] According to DAFF (2014), 12 500 t of rooibos tea was produced in 2013, approximately 9% higher than in the previous year. DAFF estimated that between 350 and 550 producers were actively farming with rooibos.

Rooibos has experienced an increase in demand in recent years. Figure 2.10 shows that the annual gross local value of production before processing was R157 000 in 2007. After that, it dipped (in 2010 most notably) and then gradually increased to R218 750 in 2013.

Figure 2.10: Rooibos tea gross value of production



Source: DAFF, 2014

A factor contributing to the change in gross value over time is the market price of rooibos. Because of fluctuations in this price, producer prices dropped from R16.50/kg in 2004 to R4.50/kg in 2010.[101] Since then prices have risen sharply to reaching R17.70/kg in 2014, comprising a base price of R15.00/kg plus R2.70/kg profit share. This increase in the gross value of rooibos tea production is also attributed to an increase in demand abroad, which has led to increases in both the quantity and price of rooibos products sold in recent years.[102] Less than half of the Rooibos produced is consumed locally, with the remaining produce going to over 60 countries around the globe.

[100] Pretorius (2009)
[101] DAFF (2014)
[102] DAFF (2014)

The value chain for rooibos is multi-faceted, and includes products such as herbal teas, fruit juice mixes, milk blends, food flavourings, alcoholic drinks, cosmetics and personal care products, anti-microbial additives, medicinal/pharmaceutical products, and pet food.

Secondary processing of rooibos is done by a number of processors, with *Rooibos Limited* claiming a dominant 70% market share. The total value of the industry is estimated at between R500 million. This figure takes processing and exports into account as the gross farm income from rooibos production estimated to be in the order of R200 to R250 million. More than 5 000 people are employed in the Rooibos Industry[103] of which about 1 200 are farm workers (i.e. one worker per 50 ha).

A number of grower's co-operatives have emerged in the rooibos sector. These are a way for small-scale farmers to band together and share resources. They allow them to save on the costs of capital in particular, thus benefitting from economies of scale. Another major benefit is that collectively they have a much better chance at accessing funding from development initiatives, as well as accessing the services of marketing agencies that can ensure that their products reach a high-end market, through effective marketing and by applying for certifications such as Fairtrade. Rooibos certified as Fairtrade receives a premium of approximately R5/kg[104], and reflects the premium which high-end consumers are willing to pay to ensure a sustainably sourced product. Around 18 t of Fairtrade rooibos is exported each year.[105]

An example is the Heiveld Co-operative, which represents a collection of small-scale farmers in the Suid Bokkeveld area. The Co-operative was established in 2001 and within five years it had attracted 36 members, including nine women. These small-scale producers had never been able to afford pesticides or fertilisers, which made it difficult for them to compete with large-scale, mechanised producers who were able to produce Rooibos at a lower cost per ton. This apparent disadvantage had an upside though. After doing market research, the Co-operative realised that they were able to get their produce certified as organic. So although it had been relatively costly to produce, they were able to command a premium price from the nine countries to which they ended up exporting their product. Today the Heiveld Co-operative has 64 members who collectively produce between 50-80 t annually for export to 11 countries. They have gained a vast amount of knowledge in the area of ecologically sustainable agriculture and they use it to earn an income which was, in 2009, twice the legislated minimum wage for the area.[106]

Another example is the Wupperthal Co-operative (established in 2009), which attained Fairtrade certification in 2010. This Co-operative has 93 members, most of whom farm an area of less than 2 ha per person in the area surrounding Wupperthal. Being in such a remote area, Wupperthal has a very limited economy, and most people subsist on small-scale farming for a living. It thus appears that being able to produce a cash-crop like

[103] GreenChoice (2009)
[104] G. Pretorius pers. comm. (18-04-2016)
[105] DAFF (2014)
[106] O-Donoghue & Fox (2009)

rooibos has had a positive impact on the local economy[107]. Approximately 60 t of rooibos is produces in the Wupperthal area.[108] Given their level of reliance on rooibos production, climate change is likely to impact these communities severely by increasing the likelihood of drought and also the risk of fire.[109][110]

The growth of rooibos production particularly in the wider Cederberg region, as well as the way in which it has developed in a community-focussed manner, has given the industry a unique and intriguing character. Rooibos tends to appeal in particular to consumers who value health and healthy lifestyles. The growth of co-operatives able to command premium prices also indicates a willingness among consumers to be part of positive initiatives.

In essence, the image of rooibos is a positive and healthy one. The presence of the sector in the area thus contributes to it being able to project a positive image. This is particularly important for tourism where the image of rooibos has contributed to the attractiveness and marketability of the region. It has been a good compliment to the other tourism offerings for which the Cederberg is known, namely a renowned place of natural beauty with a healthy, outdoor focus and an interesting history.

The growth of tourism-agriculture linkages in the rooibos industry is evident in the establishment of the Rooibos Route in 2012 by the owners of the Rooibos Teahouse in Clanwilliam. The Route essentially markets rooibos cultivation tours and restaurants specialising in rooibos related cuisine alongside the Region's other attractions. Links to accommodation in the area complete the package which can be offered to tourists who are seeking a healthy, informative form of leisure.

2.3.5.3 Other Crops in the Study Area

Other crops cultivated in the study area include table grapes, wine grapes, deciduous fruit, citrus, wheat, oats, lupins, maize and cultivated fynbos flowers. The areas occupied by these crops are relatively small, compared to potatoes and their impact /potential impact on biodiversity and groundwater is considered to be less significant.

2.4 Pressures that contribute to social, ecological and/or economic change in the Sandveld study domain

Humans, and their values, beliefs, expectations, institutions and actions, are integral to understanding the state of the environment in the Sandveld study domain, for human agency and environmental resilience are intrinsically related. Before illustrating the pressures that human agency – specifically potato and rooibos farming –contribute to environmental change in the study domain, it is necessary to place these sectors within a regional socio-economic context.

[107] Rooibos expansion at Wuppertal has apparently been suspended since 2010 owing to a moratorium declared by the Church which has impeded local growth in the industry and impacts on crop rotation.
[108] G. Pretorius pers. comm. (2016)
[109] Lotter & Maitre (2014)
[110] This is already being reflected in current harvest figures.

2.4.1 Drivers of Potato Production and Expansion

The rapid increase in potato production under centre pivots in the Sandveld since *circa* 1980 is *inter alia* attributed to:

- The availability of new drilling technology that enabled the drilling of boreholes in very sandy soils; and
- The introduction of ESKOM power to the area, which significantly improved borehole pumping capacity, and facilitated the abstraction of water from deeper levels than had previously been possible.

Prior to this, the main agricultural activity was extensive livestock farming, mainly sheep.

The dramatic decline in the Sandveld's contribution to seed potato production, nationally, is attributed to an escalation in the occurrence of virus infections and soil borne diseases, which negatively impact on the quality of the seed potatoes. The total area under potato production has remained relatively stable around ±7 000 ha, which implies a major shift from seed potatoes to fresh potatoes. In 2011 the Sandveld was the second biggest fresh potato production region in South Africa at 307 000 t or14% of the national crop. This crop was produced on 6 818 hectares, converting to a yield of 45 t/ha.

In terms of industry trends, seed potato production peaked in 2003/2004, with more than 3 000 ha planted. Plantings steadily declined thereafter, reaching an eight-year low in 2011/2012 when some 500 ha were planted, or roughly 16% of the total area under potatoes in 2003/2004. The number of producers in the Sandveld potato sector has also dropped. In 2008, there were 116 potato producers, compared to 2011 when numbers had dropped by 15% to 99 active producers.

However, the decline in the physical potato 'footprint' and a shrinking producer base may only be temporary. Firstly, global population growth is likely to be matched by an increased demand for potatoes and potato products in all regions. Secondly, cost recovery in the face of major increases in input costs may serve as a far more immediate 'driver' of an expanded potato production effort in the Sandveld.

In this analysis, rising input costs and lower margins places pressure on producers to expand production in order to maximise the benefits from economies of scale in the production of potatoes. Real input costs for potato production appear to be rising faster than real prices for potatoes, which places pressure on net revenues and an incentive to expand in order to recover costs by placing more produce on the market.

2.4.2 Drivers of Rooibos Production and Expansion

Unlike potatoes, rooibos production seems to be largely driven by fluctuations in price. An overproduction drives the price down, causing producers to plant fewer hectares of rooibos in the subsequent planting seasons. This in turn eventually results in an undersupply, which drives the price up again, incentivising the planting additional hectares of rooibos in the upcoming season – driving an almost cyclical process.[111]

[111] DAFF (2012)

In addition to the supply-and-demand induced price fluctuations, as an often exported product, movements in the exchange rate also affect the competitiveness of the commodity,[112] thereby further incentivising additional planting or reduced production.

Although there is evidence to suggest that the local and international demand for rooibos will increase over time, thereby spurring additional planting, this is hampered by issues such as certification, cyclical production volumes and regulation of quality.[113]

2.5 Agri-ecological Impacts Resulting from Intensified Groundwater Abstraction and Vegetation Clearance

The two major suites of impacts on the natural environment of the Sandveld domain are:

- Clearance of indigenous vegetation in support of agricultural expansion; and
- Abstraction of groundwater for the purposes of irrigation.

The impacts of cultivation on indigenous vegetation have been far more severe in the Sandveld than in the Agter-Cederberg. This is reflected in the recent (March 2014) reclassification of Leipoldtville Sand Fynbos as EN, and the conversion of 10.8% of CBAs in the Sandveld to agriculture between 2008 and December 2013.

2.5.1 Ecosystem Status as a Measure of Habitat Loss

Habitat loss has been most acute in the following five vegetation types (all of which are poorly protected and confined to the Sandveld component of the study domain), as is reflected in their threatened ecosystem status summarised in the table below.

Table 2.23: Threatened ecosystems in the Sandveld as a result of habitat loss

Vegetation type	Threat status 2014 (2011)	Target (% of original extent)	% remaining	Level of protection	Location in study domain Sand fynbos and strandveld types are vulnerable to agricultural expansion.
Swartland Shale Renosterveld	CR (CR)	29	6.79	Hardly protected	Het Kruis-Krom Antoniesrivier-Banghoek-Koopmanskraal
Swartland Silcrete Renosterveld	CR (CR)	26	7.95	Hardly protected	Lowlands around Piketberg and De Hoek (embedded in Swartland Shale Renosterveld)
Leipoldtville Sand Fynbos	EN (VU)	29	43.75	Hardly protected	Sandy flats and low hills north of Aurora, west of Olifantsrivierberge
Saldanha Flats Strandveld	EN (VU)	24	35.47	Poorly protected	Inland of coast between Berg River and Verlorenvlei
Hopefield Sand Fynbos	VU (VU)	30	57.96	Poorly protected	Sandy flats south of Aurora

Impacts on Leipoldtville and Hopefield sand fynbos are widely distributed throughout the lowland fynbos ecosystem component of the Sandveld, and include:

- Direct loss of habitat which may also entail loss of highly localised populations of Red Data List plants;

[112] DAFF (2012)
[113] DAFF (2012)

- Habitat fragmentation, reduction in patch size, disruption of fire regimes, exacerbated edge effects and degradation of habitat quality;
- Reduced ecological connectivity, both within these respective ecosystems, as well as between sand fynbos types and adjacent vegetation types; and
- Habitat fragmentation that may – by limiting ecological connectivity with, particularly, upland-lowland gradients that serve as climate change refugia – indirectly contribute to heat-related plant mortalities in mesic fynbos that is reportedly less adapted to drought than vegetation in more arid areas that is better adapted to heat and water stress.

Similar ecological impacts apply to particularly Saldanha Flats Strandveld (EN) in the south-western parts of the Sandveld component of the study domain.

2.5.2 Loss of Habitat in CBAs Attributed to Agriculture

Table 2.24 below, presents the impact that vegetation clearance for agricultural development has had in the study domain in the recent past. The marked disparities between the magnitude of vegetation clearance in the Sandveld and Agter-Cederberg, and the impact that this has had on CBAs in the study domain, are apparent in the figures listed in Table 2.24 below.

A subsequent update (2016) of the CBA map took these losses into account and excluded them from being incorporated into the new CBA map. Therefore, at present, the maps reflect very little to no loss of critical habitat due to agricultural expansion given the recency of the revised CBA map.

Table 2.24: Magnitude of vegetation clearance in the two components of the Sandveld study domain[114]

	2008		Dec 2013	
Component of the study domain	Habitat mapped as CBAs (ha)	% of area	Extent of CBAs transformed by agriculture (ha)	% of CBAs transformed
Sandveld	213 044	38.4	23 107	10.8
Agter-Cederberg	107 646	28.3	958	0.9

A GIS-based analysis was used to identify properties or potential 'hotspots' where there is high probability of future agricultural expansion that will impact on CBAs.

Given the high degree of convergence between the specific crop management, irrigation and spatial requirements of potato production and biodiversity conservation priorities, the GIS analysis specifically sought to assess and predict farming trends with respect to pressures and impacts at farm level, where management interventions are most necessary and most useful.

This was achieved by quantifying the relative probability of conversion of CBAs by future expansion of (a) the irrigation footprint in the Sandveld part of the study area and (b) the cultivated footprint in the Agter-Cederberg part of the study area. The relative probability

[114] Since the mapping and calculation of habitat loss, a total of 113 new centre pivot circles with a total area of 1643 ha were made in the study domain. Hereof a total of 47 pivot circles with a combined area of 633 ha were made entirely or in some cases, partially in previously uncultivated natural veld. The methodology applied in the compilation of the 2016 CBAs excluded the incorporation of presently cultivated areas into CBAs. Therefore, despite the additional expansion, no cultivated land is currently mapped as CBA.

of conversion was deemed proportional to the area of the CBA as a percentage of the undeveloped land.

The GIS-based analysis had the following results:

- Identifying farms where further expansion of potato circles was most likely (farms that were equipped with centre pivots in 2008 had an almost tenfold greater chance of expanding than farms without pivots); and
- Identifying farms where such expansion had the greatest likelihood of intruding into CBAs (the higher the proportion of habitat in CBAs, relative to non-CBA habitat, the greater the risk of conflict between farming and biodiversity conservation).

The information was used to:

- Direct the botanical survey to assess the condition and floristic significance of those 'botanical hotspots' that are potentially at most risk of transformation and which may result in the further erosion of intact or near-natural habitat in the CBA network;
- Identify situations, based on the botanical assessment, where (a) additional habitat loss in CBAs may be considered, provided that alternative options for adequately compensating such loss are available and pursued, or (b) where any further expansion into CBAs would be highly undesirable and therefore pre-emptively flagged as providing compelling and scientifically-defensible grounds for refusing environmental authorisation; and
- Highlight those parts of the Sandveld where, owing to an above-average risk of conflict between agricultural and biodiversity conservation objectives, farming and farm management would most benefit from detailed Farm-Level Management Plans and the identification of sustainable alternatives to the transformation of critical habitats and ecosystems.

3 Environmental priorities and their land-use implications

The pressures of agricultural expansion on the natural environment of the Sandveld are well-documented but less so for the Agter-Cederberg, which has been largely over-shadowed by the high level of public scrutiny and scientific investigation to which, particularly, potato production in the Sandveld has been subjected over the past 15 or so years.

However, as indicated in the previous section, agriculture has had a significantly greater impact on the natural environment of the Sandveld than in the Agter-Cederberg, and where pressures on biodiversity and its long-term persistence on farmland have been most acute.

In the case of the Sandveld, agricultural pressures on the natural environment chiefly relate to impacts on indigenous vegetation, groundwater resources and their associated ecosystems. The major pressures[115] in this regard are:

- Large-scale land clearance that results in the loss and modification of both terrestrial and aquatic ecosystems; and
- Abstraction of groundwater for irrigation.

Vegetation clearance represents the most pervasive negative environmental impact in the Agter-Cederberg.

3.1 Impacts on Indigenous Vegetation and Terrestrial Ecosystems

There are nine threatened ecosystems in the area spanned by the Sandveld EMF. Of these, five are classified as Vulnerable, two as Endangered, and two as Critically Endangered. One threatened ecosystem occurs in the Agter-Cederberg (Nardouw Sandstone Fynbos, VU); the remainder are all within the Sandveld component of the EMF.

One of these vegetation types – Leipoldtville Sand Fynbos – has been shifted into a higher category of threat (EN) owing to the impacts of agricultural expansion[116] in the period 2006 to 2011, and just over 10% of the CBA network in the Sandveld has been transformed for agricultural purposes. However, this change in status had not been updated in terms of section 52 of NEMBA at the time of drafting of the EMF.

Ecosystems in the study domain which had been reduced by more than 500 ha in extent by agricultural expansion between 2006 and 2011 are presented below in descending order of habitat loss, with their current ecosystem status.[117]

[115] GEOSS (2006)
[116] Pence (2014)
[117] CapeNature (2014)

Table 3.1: Habitat loss due to agricultural expansion in the Sandveld (CapeNature, 2014)

Vegetation type	Threat status 2014 (2011)	Target (% of original extent)	Remaining % (2014)	Original extent (ha)	Current extent (ha) (2014)	Total ha converted 2006-2011
Leipoldtville Sand Fynbos	EN (VU)	29	43.75	197 640	86 499.07	4 853.05
Swartland Shale Renosterveld	CR (CR)	29	6.79	496 037	33 712.71	3 832.69
Graafwater Sandstone Fynbos	LT (LT)	29	76.44	129 613	99 110.43	1 778.97
Hopefield Sand Fynbos	VU (VU)	30	57.96	97 614	56 613.12	1 716.26
Saldanha Flats Strandveld	EN (VU)	24	35.47	158 482	56 260.09	1 397.82
Cederberg Sandstone Fynbos	LT (VU)	29	88.92	251 222	223 365.66	1 092.75
Nardouw Sandstone Fynbos	VU (-)	24	54.09	54 773	19 833.96	960.30
Namaqualand Strandveld	LT (LT)	26	68.96	418 266	118 070.20	776.91
Lambert's Bay Strandveld	VU (LT)	24	52.3	70 572	36 946.35	548.61
Namaqualand Sand Fynbos	LT (LT)	29	82.18	112 569	101 659.00	527.09

The loss of Leipoldtville Sand Fynbos accounts for the single greatest agricultural impact on indigenous vegetation in the Western Cape between 2006 and 2011, and amounts to just over nine percent of all vegetation loss attributed to agricultural expansion for this period.

Impacts on Leipoldtville Sand Fynbos are widely distributed throughout the lowland fynbos ecosystem component of the Sandveld, and include:

- Direct loss of habitat which may also entail loss of highly localised populations of Red Data List plants;
- Habitat fragmentation, reduction in patch size, disruption of fire regimes and exposure of isolated or poorly-connected patches and vegetation corridors to edge effects and degradation of habitat quality;
- Reduced ecological connectivity, both within these respective ecosystems, as well as between sand fynbos types and adjacent vegetation types; and
- Habitat fragmentation that may – by limiting ecological connectivity with, particularly, upland-lowland gradients that serve as climate change refugia – indirectly contribute to heat-related plant mortalities in mesic fynbos that is reportedly less adapted to drought than vegetation in more arid areas that is better adapted to heat and water stress.

The remnant extent of Leipoldtville Sand Fynbos is 2 000 ha short of the extent required to meet national biodiversity targets.[118]

[118] G Pence, pers. comm. (17-11-2014)

3.2 Impacts Resulting from Intensified Groundwater Abstraction

Groundwater abstraction for irrigation in the Sandveld has resulted in the following impacts on aquifer yields and water quality:[119]

- Reduction of groundwater flow at the springs in the lower Langvlei River area with significant impact on certain springs and associated ecosystems:
  The lower Wadrift area has been significantly impacted by over-abstraction of groundwater. There were too many boreholes in close proximity to each other and close to a wetland. The boreholes were production boreholes for the town of Lamberts Bay and also irrigation boreholes for farming. The groundwater level was reduced to the extent that the upper wetland zone desiccated;
- There is also the possibility of the baseflow contribution to the river systems having been reduced. However, this cannot be substantiated as the only river flow gauging station in the Sandveld is at Het Kruis (which leaks). The flow monitoring station at the Redelingshuys Bridge over the Verlorenvlei River has been removed. Also the groundwater base flow to riparian zones may also have been reduced, although this aspect is difficult to quantify; and
- At one particular site, where over-abstraction of groundwater has occurred, there has been an associated increase in groundwater salinity.

Overall, groundwater monitoring shows that certain areas have been over-abstracted, with a concomitant drop in groundwater levels. In the more critical Lower Langvlei River, intervention has occurred with boreholes being closed down and the points of abstraction being distributed over a much wider area.

These interventions have shown clear signs of recovery both in terms of groundwater levels and quality. The other localised areas where negative trends are evident the land owners have been informed and are aware of the problems.

The main negative influence on groundwater quality derives from farming activities such as the application of fertilizers and the over-abstraction of groundwater leading to groundwater contamination and/or pollution, and reduced groundwater recharge.

The nitrification of groundwater is unlikely to have a negative long-term impact on agricultural production. However, a reduction in groundwater recharge will directly impact on the potato industry's production capacity as a result of reduced water availability for irrigation. It must be noted, however, that although there has been some localised evidence of over-abstraction, the paucity on groundwater data and the methods of recharge within the study area, make it difficult to predict the long-term impacts of over-abstraction of groundwater.

3.3 Agri-ecological Priorities

The most important sustainability priorities for the Sandveld EMF are:

- Preventing any further loss of Leipoldtville Sand Fynbos that would further compromise the ecosystem status of this Endangered vegetation type;

[119] GEOSS (2013)

- Preventing any further loss of habitat or opportunities for maintaining ecological connectivity that would jeopardise the objectives of the CBA network within the western reaches of the Greater Cederberg Biodiversity Corridor;
- Maintaining the existing groundwater monitoring programme to ensure that utilisation of aquifers within planning domain remains within acceptable limits for water yields and quality and, where appropriate, abstraction practises are adapted to maintain sustainable utilisation of the groundwater resource; and
- Adjust agricultural practises to stem degradation of wetlands and rivers, and to promote their rehabilitation to a 'moderate' or better ecological state.

The following areas within the Sandveld domain have been prioritised for proactive biodiversity conservation action by CapeNature[120] [121] and therefore represent key areas for a high degree of caution in environmental planning, regulation and management:

- Large intact patches of Hopefield Sand Fynbos bordering existing public or private conservation areas;
- Leipoldtville Sand Fynbos around Aurora, between Redelingshuys and the Engelsman-se-Baken area; the area from Redelingshuys to Paleisheuwel and from Paleisheuwel north to Alexandershoek due to the likelihood of endemic plant species;
- All remaining Graafwater Sandstone Fynbos patches, especially those containing wetlands or special species;
- The entire remainder of Varkvlei Shale Strandveld as it is a unique feature within the region occurring nowhere else;
- Large contiguous patches of Bergrivier Flats Strandveld, especially those patches with known occurrences of Red Data listed species;
- All remaining large patches of Graafwater Flats, Bergrivier Flats and Lambert's Bay Strandveld;
- Because most areas of Renosterveld have been cleared for agricultural crops, all Graafwater Shale, Citrusdal Shale, Swartland Silcrete Shale and Swartland Shale Renosterveld patches are of conservation importance. Especially important areas include the Swartland Shale Renosterveld on the slopes of the Piketberg, Weltevrede-Kleigat area north of Engelsman-se-Baken and north west of Aurora;
- Kobee Pass and Gifberg Pass portions of Kobee Succulent Shrubland; portions of Klawer Sandy Shrubland north of Gifberg which are rich in rare species and have high bulb densities;
- All remaining Piketberg Quartz Succulent Shrubland (the Otterdam site being the best known example) should receive the highest conservation priority rating owing to its limited extent and large number of rare, localised or undescribed species (not yet given a scientific name);
- All Vanrhynsdorp Gannabosveld, as it is already highly fragmented and is situated between Knersvlakte and Fynbos vegetation types;
- Alongside the Berg River mouth, Cape Estuarine Saltmarsh vegetation is found, which urgently requires safeguarding owing to its high biodiversity value and vulnerability to continuing development pressures;

[120] Adapted from Helme (2007)
[121] Maree & Vromans (2010)

- Other conservation-worthy areas include the extensive saltmarshes north of the Berg River and along the Sout River, both of which are home to a number of rare and threatened plant species; the Rocher pan area, parts of the Wadrift Soutpan and the edges of the Verlorenvlei; all Arid Estuarine Saltmarshes owing to their limited occurrence and high ecological value; intact Namaqualand rivers below the Doring-Olifants confluence, Holgat River and Troe-Troe river;
- The Cederberg area is a priority freshwater fish conservation area and therefore has several aquatic CBAs. Rivers and wetlands in the region provide essential ecosystem services. Those that are ecologically healthy are usually vitally important for conserving remnants of what was once a much more widespread and abundant indigenous aquatic biota;
- All remaining patches of healthy vegetation units which had an original extent of 5 000 ha or smaller. These ecosystems are much more vulnerable to land use pressures and fragmentation than their larger counterparts. It can take one development to convert a small, non-threatened ecosystem to remnants that are Critically Endangered; and
- All ecosystems that are listed on the national list of threatened ecosystems[122] or categorised as Endangered or Critically Endangered by fine-scale conservation plans.[123]

3.4 Land Use Categories for the Sandveld EMF

The sustainability objectives for the Sandveld area are matched to distinct categories of land use, comprising:

- Areas that must be managed in support of specific biodiversity outcomes;
- Areas of remaining indigenous vegetation that may be available for cultivation; and
- Areas that are utilised for intensive agricultural production.

Land that has not been cultivated for 10 years or longer is viewed as 'virgin soil' or 'indigenous vegetation'.[124]

[122] DEA (2011a)
[123] CapeNature (2014)
[124] Note that the Conservation of Agricultural Resources Act 43 of 1983 requires that the cultivation of land which has not been cultivated in the preceding 10 years may only proceed in terms of a permit issued in terms of CARA Regulation 2 (GNT 1048 of 25 May 1984).. In terms of the 2014 EIA Regulations, "indigenous vegetation" refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation, and where the topsoil has not been lawfully disturbed during the preceding 10 years.

Map 3.1: Current land uses in the Sandveld study domain

Source: Agri Informatics, 2016

3.4.1 Areas that must be managed in support of biodiversity outcomes

The table below sets out areas that must be managed in order for biodiversity outcomes to be realised. These include protected area, CBAs and ESAs.

In terms of Listed Activity 12 of Listing Notice 3, conservation orientated land-use categories outlined in Table 3.2 may coincide with hardened/built areas due to the coarseness of remote sensing taken into the mapping process. It is necessary that the status of an area is groundtruthed prior to the identification of applicable listed and

specified activities to proposed land use changes. Proponents are advised to approach the competent authority in instances where the findings from groundtruthing differs from this Environmental Management Framework.

Table 3.2: Areas that must be managed in support of biodiversity outcomes

Land-use category	Spatial planning category	Definition
Protected areas	Core 1 (PA)	This category refers to statutory protected areas as defined by section 9 of the National Environmental Management: Protected Areas Act 57 of 2003, as well as proclaimed private nature reserves. Protected areas are not available for any other land use other than that prescribed by the relevant legislation, and management plans for, particularly, provincial nature reserves and wilderness areas insofar as these may occur within the boundaries of the Sandveld EMF.
Critical Biodiversity Areas (CBAs)	Core 1 (CBA)	This land-use category consists of CBAs as identified by CapeNature (15-02-2016) .
Ecological Support Areas and remnants of EN vegetation	Core 2	Ecological support areas refer to those components of the landscape that must be managed in support of especially aquatic CBAs or may be necessary for maintaining ecological processes by means of corridors, vegetation interfaces and gradients, or 'stepping stone' habitat.

3.4.2 Areas of remaining indigenous vegetation that may be available for cultivation

The second set of land-use categories represents non-threatened indigenous vegetation that has not been incorporated into the CBA network and may, under specified conditions, be considered for intensive agricultural utilisation. The land-use category entails 'Other Natural Areas' 1 and 2, and corresponds with the Buffer 1 and Buffer spatial planning categories.

Table 3.3: Areas that may be available for cultivation

Land-use category	Spatial planning category	Definition
Other Natural Areas 1	Buffer 1	The 'Other Natural Areas 1' category equates with 'Buffer 1', or non-threatened indigenous vegetation that abuts CBAs and habitat in CR or EN ecosystems.
Other Natural Areas 2	Buffer 2	The 'Other Natural Areas 2' category refers to free-standing patches of non-threatened indigenous vegetation located within a matrix of cultivated or otherwise developed areas.

3.4.3 Areas that are utilised for intensive agricultural production

Besides continued utilisation for intensive farming, areas designated as either 'Cultivation 1' or 'Cultivation 2' could be used to establish farm buildings or additional dwellings, provided that they are separated from CBAs (Core 1 areas) by adequate buffers of indigenous vegetation.

Table 3.4: Areas that are suitable for intensive agricultural production

Land-use category	Spatial planning category	Definition
Cultivation 1		The 'Cultivation 1' category refers to all fields utilised for centre pivot production by December 2013. Management in these areas

Land-use category	Spatial planning category	Definition
	Intensive agriculture	should be consistent with sustainable potato production and farm management practices as advocated by the Biodiversity Best Practice Guidelines for Potato Production in the Sandveld (Knight *et al.* 2014).
Cultivation 2		The 'Cultivation 2' category refers to all drylands (e.g. wheat and rooibos fields) captured by the field boundary dataset of the Department of Agriculture, Forestry and Fisheries in 2011. Management would be as for Cultivation 1, and be guided by sound soil conservation practices and protection of water resources, etc. Farming practice relating to the production of rooibos should be guided by the best practice guidelines for the rooibos sector (Pretorius, 2009).

3.5 Land Use Management Objectives: Sandveld EMF

Land-use management objectives were recommended for each of the proposed land-use management categories identified in Section 3.4 above. These are outlined in Table 3.5, whilst Table 3.6 illustrates these categories within the Sandveld study domain. The desired land uses for the study domain are depicted on Map 3.2.

Table 3.5: Land-use management objectives for the identified land-use categories

Land-use category	Management objectives
Protected Areas	The overarching management objective for Core 1 (PA) areas is the protection and conservation of ecologically viable areas that are representative of South Africa's biodiversity, including that of the Western Cape. Land use in protected areas must be in accordance with the relevant protected area management plans. Core 1 areas also include stewardship sites and private nature reserves.
Critical Biodiversity Areas (CBAs)	Management in CBAs must focus on maintaining undisturbed habitat in a natural condition. If habitat within CBAs is degraded, it must be restored to a natural or at least a near-natural condition. Land-uses that would not compromise the achievement of biodiversity conservation objectives may be contemplated. Impacts of any development in CBAs must be reversible in the event of such development being discontinued. Prospective development and related decision-making in CBAs must be consistent with the 'Guidelines for managing rural land-use change' (Chapter 7 of the WC Rural Land-use Planning and Management Guidelines). Overall, the expansion of agricultural development into any Core 1 areas where there is undisturbed or recovering natural vegetation must be strongly discouraged. All findings about the condition and potential contribution of indigenous vegetation and natural habitats to biodiversity conservation targets and thresholds MUST be based on a specialist botanical assessment, using the basic terms of reference for the Sandveld EMF Botanical Terms of Reference CapeNature must advise on instances where the potential presence/absence of plant species of special concern cannot be predicted with 'medium' to 'high' confidence.
Ecological Support Areas	The primary management objective for ESAs is to manage these features in support of maintaining ecological processes. Note that remnants of Endangered vegetation that have not been mapped as CBAs must be treated as falling within the Core 2 (ESA) land-use category. ESAs must be managed/restored to maintain: – Ecological processes in support of aquatic CBAs and/or – Ecological corridors that link CBAs across the landscape.

Land-use category	Management objectives
	Compatible land uses may include biodiversity conservation and low density, low impact tourism development.
Other Areas 1	Non-threatened vegetation in 'Other Natural Areas 1' must serve as undeveloped buffers between CBAs and cultivated areas. Optimal buffer widths must be determined by a biodiversity specialist. Prior to transformation, these patches should be suitably managed to keep their ecological integrity intact. This would include keeping the areas free of alien invasive species and burning ground cover in patches of at least 50 ha in extent. Areas smaller than 50 ha should be burnt in one go. These areas may be developed provided that: – Adequate authorisation in terms of the pertinent legislation has been obtained for such development; and – Fragmentation is discouraged.
Other Areas 2	Non-threatened vegetation in 'Other Natural Areas 2' may be developed but management must be consistent with sustainable agricultural practices as defined by the best practice guidelines for the potato and rooibos sectors. Prior to any transformation, these patches should be kept free of alien invasive species and burnt in patches of at least 50 ha.
Cultivation	These are established, cultivated fields that must be managed in support of sustainable agricultural production with regard to soil conservation and maintenance of soil health, control of run-off and contaminants, protection of water resources. Areas classified as 'Cultivation 1' one must be managed in accordance with the best practice guidelines for the potato sector. Management in 'Cultivation 2' areas must be guided by the best practice guidelines for the rooibos sector.

CONSISTENCY OF PROPOSED ACTIVITIES WITH MANAGEMENT OBJECTIVES

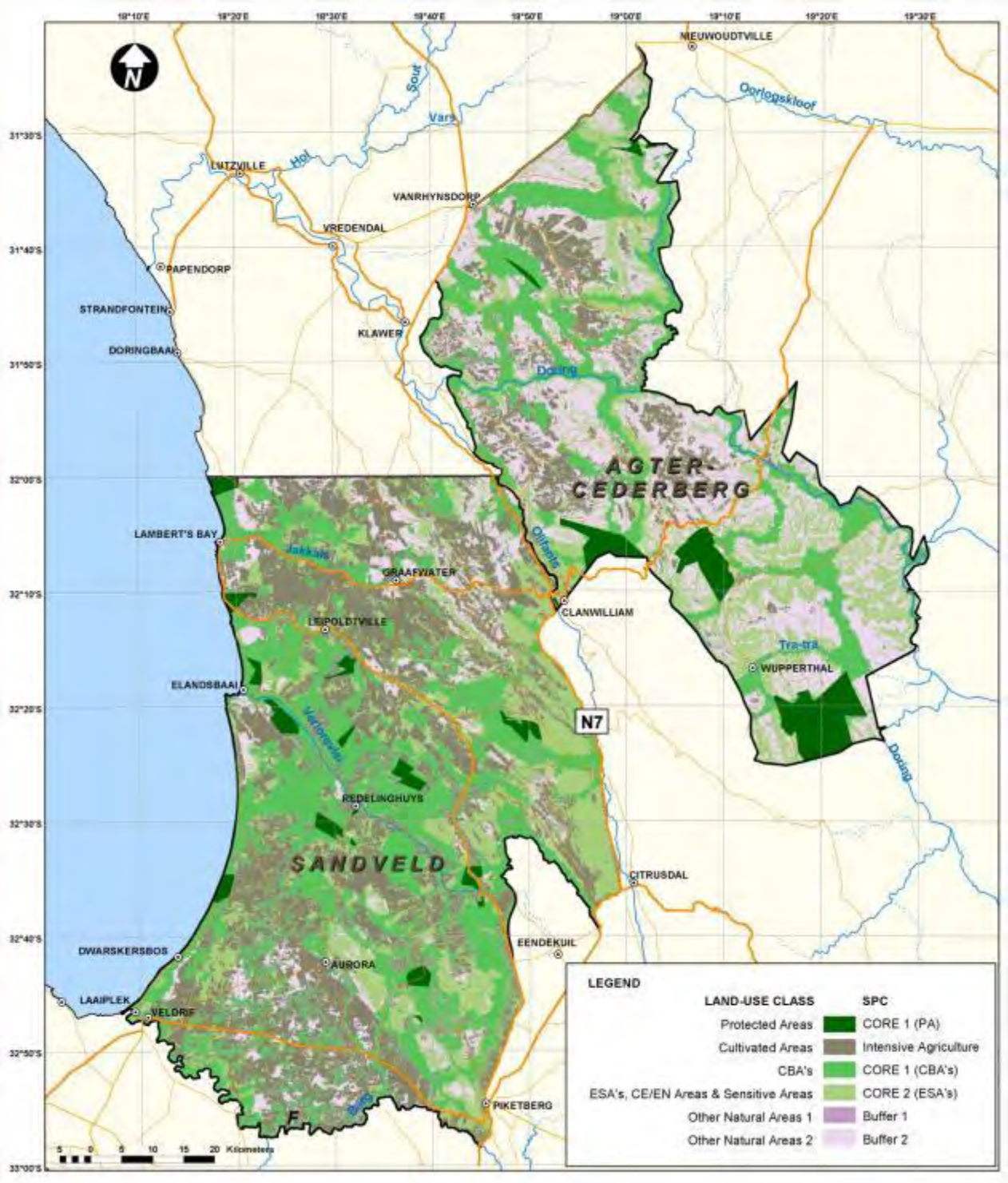
- Activities or land uses that are consistent with the management objectives for a particular land-use category would be desirable in such areas.
- Activities or land uses that are inconsistent with the management objectives for a particular land-use category would be undesirable in such areas.

Table 3.6: Consolidated land-use categories and objectives for the Sandveld

LAND-USE CATEGORY	DEFINITION	SPATIAL PLANNING CATEGORY (SPC)	MANAGEMENT OBJECTIVES	LAND USES
Protected areas	Statutory protected areas as defined by section 9 of the NEM:PAA 57/2003	Core 1 (PA)	Protection and conservation of ecologically viable areas that are representative of South Africa's biodiversity	Land use must be in accordance with protected area management plans and objectives
CBAs	CBAs as identified by CapeNature (15-02-2016)	Core 1 (CBAs)	Management must: – Maintain undisturbed habitat in a natural condition; or – Aim to actively restore degraded habitat to a natural or at least near-natural condition, and manage it accordingly.	Biodiversity conservation Small, low density, low impact development (temporary structures, tents, boardwalks, etc.)
ESA	Ecological support areas (ESAs) as identified by CapeNature (15-02-2016) Endangered vegetation not included in CBAs	Core 2 (ESAs)	Manage/restore to safeguard: – Ecological processes in support of CBAs; and/or – Ecological corridors that link CBAs across the landscape. Corridors in strip-ploughed land must be at least 100 m wide, if managed. Ecological corridors managed for biodiversity conservation purposes must be at least 300 m wide.	Subject to a ground-truthing exercise, in the absence of alternatives, and provided that wetlands and ESA watercourses are adequately buffered, cultivation in these areas can be contemplated . Compatible land uses may include: – Biodiversity conservation – Extensive agriculture – Low density, low impact resort, holiday, tourism etc. development.
Other Natural Areas (ONA) 1	Non-threatened indigenous vegetation abutting CBAs	Buffer 1	Buffer 1 areas must serve as undeveloped buffers between CBAs and cultivated areas. Optimal buffer widths must be determined by an ecologist, but buffers should be at least 30 m wide.	– These areas must primarily serve as buffers between CBAs and cultivated lands. Agricultural expansion into Buffer 1 areas may be considered if No other areas are available for cultivation.
ONA 2	Free-standing patches of non-threatened indigenous vegetation, located within a matrix of	Buffer 2	Buffer 2 areas must be managed for sustainable development of current land uses in the area.	Activities and uses directly relating to the primary agricultural enterprise, providing this does not entail fragmentation of farm cadastral units. Land uses would include:

LAND-USE CATEGORY	DEFINITION	SPATIAL PLANNING CATEGORY (SPC)	MANAGEMENT OBJECTIVES	LAND USES
	cultivated or otherwise developed areas.			– Farm buildings (dwellings and sheds); – Internal roads; and – Small-scale holiday accommodation A maximum of 5 additional non-alienable dwelling units/10 ha may be permissible.
Cultivation 1	Centre pivots	Intensive agriculture	Manage in support of sustainable agricultural production with regard to soil conservation and maintenance of soil health, control of run-off and contaminants, protection of water resources, etc.	Compatible land uses may include: – Cultivation – Farm buildings – Additional dwellings
Cultivation 2	Dryland fields			

Map 3.2: Desired land-uses for the Sandveld study domain



Source: Agri Informatics, 2016

Access to this information at a cadastral scale is available on:

- The online Western Cape Government Environmental and Planning Atlas; and
- Cape Farm Mapper.

Additionally, a copy of this data can be obtained from the GIS component of either the DEA&DP or CapeNature.
Sample maps at a low resolution have been attached.

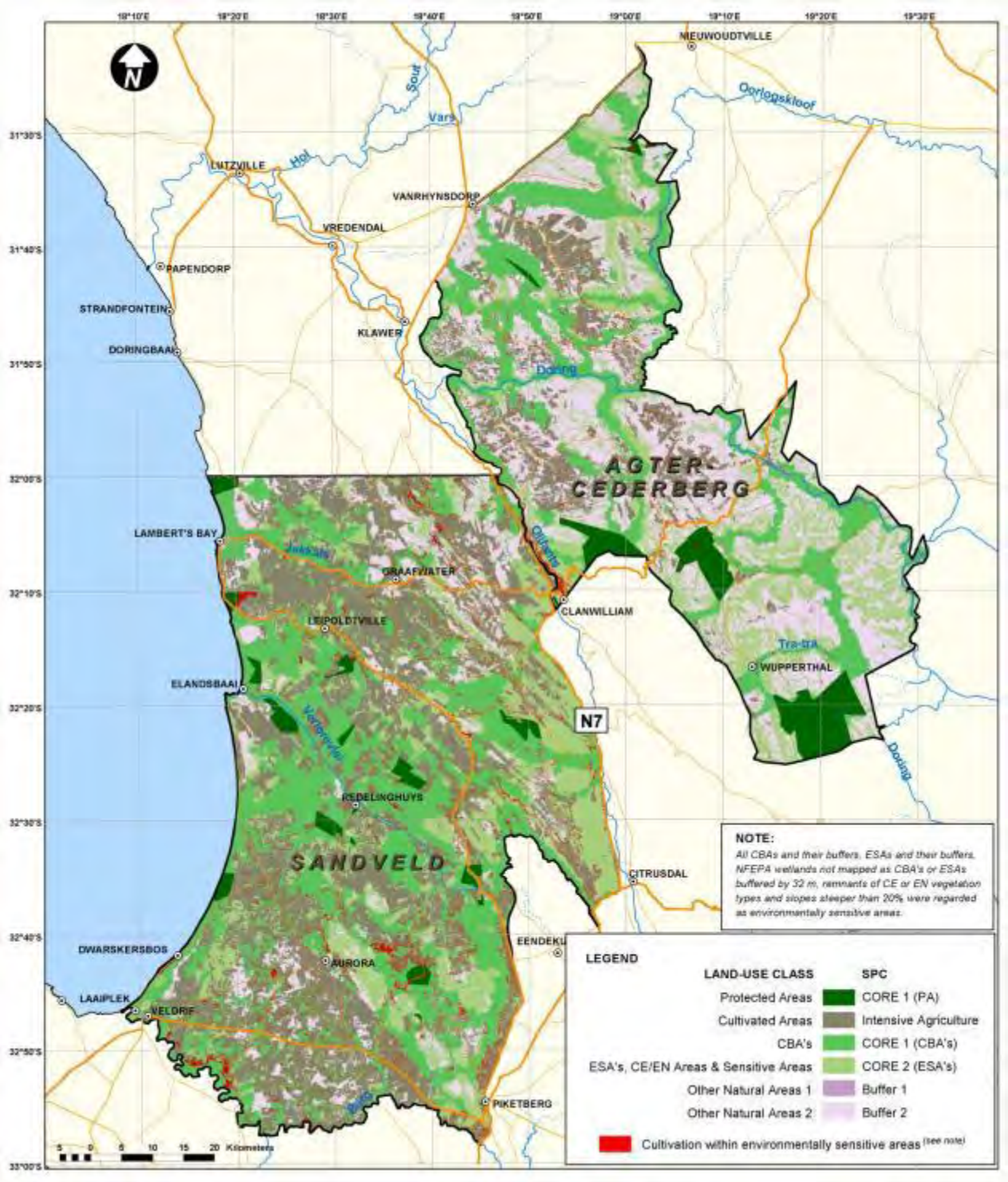
3.6 Areas of Land-use competition

All cultivated fields (drylands and centre pivots) that overlapped with CBAs (both aquatic and terrestrial), NFEPA wetlands or slopes steeper than 20% were identified as being in potential conflict with sustainability objectives.

It must be noted that during the public participation process many land owners indicated that environmental authorisation was obtained for a portion of these areas, however, the verification of such authorisations falls beyond the scope of this study.

The result of the spatial analysis as depicted in Map 3.3 therefore indicates all land where cultivation overlaps with areas considered environmentally sensitive.

Map 3.3: Areas of potential conflict between current and desired land-use-objectives in the Sandveld study domain



Source: Agri Informatics, 2016

3.6.1 Proposed Environmental Management Priorities (Actions) to Resolve Conflict

Potential conflicts between incompatible land-uses should be avoided and managed through a holistic approach to land-use planning on farms and identification of alternatives that hold the least risk to achieving the biodiversity management objectives

of the respective land-use categories. If there is conflict, the project proponents will need to follow the required environmental process and apply for environmental authorisation in terms of the relevant Environmental Impact Assessment Regulations.

4 Realising the aims and objectives of the EMF

The development of the Sandveld EMF forms phase one of the proactive component of the Sandveld Strategy. The second phase entails the implementation of the EMF through a regulatory mechanism that will outline specifications for proposed land cultivation and safeguarding of natural resources to ensure that such cultivation is in keeping with the findings of this EMF. If a proponent is able to comply with all such specifications, he/she/it will be eligible to undertake such cultivation in an expedited manner. In short, if a proponent can ensure that cultivating land and safeguarding of natural resources is in keeping with this EMF, the conservation sector will move a step closer to meeting national biodiversity targets and farmers will receive regulatory relief. Therefore, it is in this second phase that the two overarching aims of the Sandveld EMF will be realised. These two overarching aims, as mentioned in the introduction, are:

1. Protecting the natural resources and their interactions (i.e. ecosystems) on which human wellbeing and economic activities, especially agriculture, depend, and
2. Reducing the regulatory requirements for the appropriate expansion of cultivated lands.

Although the EMF sets the strategic context and foundation for meeting these aims, the implementation of the EMF will determine whether these two overarching aims are realised.

4.1 Objectives of the EMF

In order for the aims mentioned above to be realised, it is imperative that the EMF delivers on its objectives.

The first objective of the EMF is to generate a policy that promotes sustainable development through strategic planning that supports efficient application and decision-making procedures in terms of environmental legislation, thereby minimising potential obstacles to legal compliance. An output of the EMF process is a geographical representation of the most sustainable configuration of land use within the study area. Additionally, the EMF provides guidance regarding the sustainable management of the different land use categories. This information will inform applicants of the suitability of their proposed land use for the land in question, and will also facilitate decision-making when considering such applications. Generating this information reduces uncertainty in achieving legal compliance.

The second objective of the EMF is to arrive at a document that proactively guides new development away from important ecological areas. An output of the EMF process is a graphical representation of land use categories, which clearly depicts areas of high ecological importance, and the land uses that would not undermine this importance.

Thirdly, the EMF intends to utilise farm-level planning to assist producers in making informed decisions about new expansion and sustainable use of agricultural resources. Significant ecological degradation stemming from the expansion of cultivated land is avoided in the study area through farm-level planning that is consistent with the findings of the EMF. As such, farm-level planning that adopts a holistic approach to farm management will be required for EIAs undertaken in the Sandveld study area that seek authorisation exclusively for activities listed in Table 1.1. Additionally, an alternative regulatory mechanism through which this EMF can be implemented that will provide the proponents of such appropriate agricultural expansion with further regulatory relief for the listed activities identified in Table 1.1 will be explored in future

The fourth objective is to encourage participation in the EMF planning process that will allow local stakeholders, particularly the Sandveld farming community, to take co-ownership of, and accountability for, the strategic environmental planning for the Sandveld (through the EMF) and the subsequent implementation thereof. The EMF process has adopted a participatory approach which involved providing stakeholders with an opportunity to review, query, and suggest amendments to the EMF during two clearly defined periods within the project's lifecycle. Additionally, the EMF has a five-year review period, which will accommodate unforeseen challenges.

Finally, the EMF sets out to establish the proactive component of the Sandveld Strategy as a best practice initiative towards the goal of sustainable agricultural practices, within a market that is increasingly demanding the production of environmentally friendly products. Retailers selling products from the study domain, and their consumers, have the peace of mind that biodiversity conservation and management objectives for sustainable agriculture have been considered and defined by this document.

In summary, although this EMF provides an essential strategic context for the study domain, it is necessary to include a local or farm-level context in achieving the aforementioned overarching aims. The aforementioned local or farm-level context is derived by farm-level planning.

4.2 Phase two: Implementation of Sandveld EMF

Phase two of the proactive approach to the Sandveld Strategy entails implementing the findings of this EMF through the Environmental Impact Assessment (EIA) process or through a regulatory mechanism that is still to be developed (which will be gazetted for public comment prior to adoption). A requirement of any regulatory tool used, as well as applicable Environmental Impact Assessment, would be adopting a farm-level planning approach (see point 4.2.1 for a detailed description of this approach). The regulatory tool would have to clearly outline when it can be used. It must also be noted that any regulatory tool developed in this regard would not absolve the proponent/applicant from the responsibility of complying with the National Water Act, Act 36 of 1998, the Conservation of Agricultural Resources Act, Act 43 of 1983, the National Heritage Resources Act, Act 25 of 1999, and any other applicable Act. Below, the farm-level planning approach is outlined.

4.2.1 Farm-level planning

An underlying principle of the Sandveld Environmental Management Framework is that the agricultural expansion catered for herein has been maximised on the premise that such activities will be undertaken in accordance with the recommendations and measures outlined herein. It is therefore necessary to evaluate a farm as a whole in terms of this framework, and to manage all components of the farm in such a way that aligns with the Environmental Management Framework. Assessments and reports emanating from the consideration of agricultural expansion in terms of this framework must comprise of multiple components that transpose the findings of the EMF to a farm-level, and that outline the way in which a farm, must be used and managed in order to ensure that such use and management is in line with the objectives of this EMF (i.e. used and managed in an agriculturally and ecologically appropriate manner). Such an approach is referred to herein as a Farm-level planning approach, and the suggested processes associated with such an approach are outlined below.

4.2.1.1 Stage 1: Pre-delineation stage

This stage of farm-level planning involves processes that are necessary in order to understand the ramifications of the Sandveld EMF for the farm unit and proponent in question. It is recommended that the following be undertaken during this stage in order to facilitate the processes required in the next stage of the farm-level planning approach.

4.2.1.1.1 Identification of proponent and proposal

It will be necessary for the proponent and the farm unit to be defined as far as possible to ensure that farm-level planning provides an accurate description of both. This would include a title deed search on the properties in question in order to identify the landowners in each instance. It will also be necessary to obtain an accurate electronic representation of the properties in question for use in Geographical Information System (GIS) mapping (i.e. a shapefile of the cadastral units in question).

OUTPUT

The aforementioned process would give rise to information that must be included in the Farm-Level Management Plan regarding the proponent and the farm unit, such as the proponent's name, identifying number, physical address, postal address, contact number, email address, and if a company, the company registration number, registration date, and the particulars (as listed above) for a company representative.

In addition to details pertaining to the proponent, details regarding the land upon which the proponent wishes to cultivated land must also be captured in order to ensure that the properties can be easily located from the information recorded. Details for the landowners of the property/ies involved must also be captured in order to ensure that these individuals/entities can be readily contacted by the competent authority. It is recommended that Shapefiles for the cadastral units in question, in the desired format, should form part of the Farm-Level Management Plan.

A detailed description of the status of the farm should also be provided, including an indication of the different farming practices underway on the farm, as well as the area of cultivated land and crop (if possible), the rotation cycle currently implemented by the farmer where applicable, the number of livestock units allowed to graze the farm in question, along with an indicating of the grazing capacity of the farm. In addition to describing existing farming practices, the agricultural scientist must evaluate the sustainability of such practices, and include recommendations for improving the sustainability of these practices (i.e. implementation of conservation agriculture practices).

A detailed description of water resources and water use associated with the activities on the farm should be included in the Farm-Level Management Plan, along with an indication of the water use rights awarded to the farm and whether the allowable water use is exceeded by the current farming practices. It would also be necessary for the agricultural and geohydrological (where needed) specialists to evaluate whether the proposed expansion of cultivated land would be in keeping with the water use rights available to the farmer. All authorisations, water use licences, and permits must form part of the Farm-Level Management Plan.

Additionally, the description of the farm should include an overview of the threats present on the farm that may threaten the ability of the farmer to achieve the objectives of the EMF. These characteristics may include, but are not limited to, groves of alien or invasive species, evidence of soil erosion or a high likelihood of erosion, areas of the farm where fire management is lacking (i.e. areas being burnt too frequently/infrequently). These areas should form part of the terms of reference for specialist investigation including recommendations from the specialists as to how these threats should be managed in future.

4.2.1.1.2 Identification of areas for cultivation

The proponent will need to carefully consider the cultivation options available to her/him/it in order to derive a map that outlines where the proponent wishes to cultivate land on the farm in question. Consideration must be given to the need and desirability to cultivate, the availability of water use rights, the feasibility of cultivating the land in question in terms of irrigation (if irrigated crops are proposed), the viability of portions of the farm for cultivation given underlying geology, and any other aspects that would limit the viability of the proposed cultivated land. Areas that are not ecologically sensitive, but excluded from cultivation for a different reason may be captured as such through the farm management map (see below).

OUTPUT

The output of farm-level planning should include a map (both a hard and soft copy) outlining where the farmer wishes to cultivate land, and the crops proposed for these areas. The map should also take access and irrigation into consideration, showing how both access and irrigation will be catered for. The purpose of this map is to show where the farmer wishes to cultivate land. In the subsequent processes, the specialists will

evaluate the congruence of the proposed cultivation with the findings and objectives of this EMF.

4.2.1.1.3 Coordinating a groundtruthing visit

Subsequent to the initial information gathering processes, it is necessary to evaluate the proposed farming practices against the findings of this EMF and whether the proposed practices would be in keeping with the objectives of this EMF. Given the technical nature of this EMF, suitably qualified specialists would need to be appointed to undertake the aforementioned evaluation, and the farm-level planning approach outlined herein would need to be incorporated into the terms of reference for such specialists.

Given the resolution of this EMF (undertaken at a regional scale), it is necessary for the specialists in question, along with the farmer, to conduct the required evaluation (described above) at a farm-level. It is recommended that all the required persons conduct a site visit together as part of the aforementioned evaluation. It may also be necessary for the specialists to familiarise themselves with the EMF and the sensitivities of the areas in question to maximise the utility of such a site visit.

OUTPUT

The output of the aforementioned process would be a date for the site visit that suits all involved, a series of maps at a suitable scale indicating the findings of the EMF for the property in question as well as the proposed cultivation wanted by the farmer (see the output of 4.2.1.1.2), a general plan regarding the approach required in terms of evaluating the proposed cultivation, and preparation of all the necessary field guides required for the site visit. The site visit marks the start of the second stage of the farm-level planning approach, which is described below.

4.2.1.2 Stage 2: Delineation stage

This stage is characterised by the processes undertaken to arrive at the delineated boundaries of various land use categories of a farm in terms of the Sandveld EMF.

4.2.1.1.4 Groundtruthing the Sandveld EMF

This process consists of multiple sub-processes, such as requiring that:

- the specialists in question are familiar with the contents and objectives of this document, and
- the specialists undertake desktop analyses in order to ensure that they are familiar with the sensitivities of the area in question, and compile maps that would aid in undertaking a groundtruthing assessment (i.e. a map displaying the findings of this EMF for the subject properties, a map displaying where the farmer intends to cultivate land, and a map indicating sensitive environmental features).

The outcomes of these sub-processes would feed into the groundtruthing exercise in order to ensure that such an exercise is informed and coordinated.

The groundtruthing process would entail evaluating the accuracy of the land use categories of this EMF for the properties in question (i.e. evaluating whether the characteristics that dictate a particular land use category are indeed present) as well as delineating the boundaries of these land uses for implementation at a farm-level (this is necessary as this EMF adopted a regional scale approach, which would be too coarse a scale for project level implementation). It would be necessary to have all required specialists undertaking this process as a consolidated team, as it is highly likely that the delineation of boundaries would likely require consensus in terms of the different perspectives this EMF attempts to balance. In addition to delineating the boundaries of land use categories, specialists must also suggest appropriate management measures for these categories, including the identification of any sensitive environmental features that require special management, such as areas of heavy alien or invasive species infestation, and areas of soil erosion (gullies).

The recommended land use categories to be delineated are as follows:

Table 3.7: land use categories and sub-categories to be utilised in the farm use map and the farm management map

Land use categories of the Farm-Level Management Plan	Sub-categories	Management measures
Protected areas	None	Areas of a farm unit delineated as part of a protected area must be managed in accordance with the Protected Area Management Plan (PAMP) associated therewith. If the registered entity does not have authority to implement measures outlined in the PAMP, he/she/it must notify the entity with such authority of a perceived lack of implementation of the PAMP. Proof of such notification must be kept by the registered entity for a period of five years.
Areas to be protected	Critical Biodiversity Areas	Critical Biodiversity Areas must be managed to maintain or enhance their ecological functioning. These areas may not be altered in any way as part of the Farm-Level Management Plan, other than in order to fulfil the management measures outlined herein. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to Fire Management is available to guide specialists in regard.

		Alien vegetation management The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the Farm-Level Management Planning. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard. Soil conservation Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention. Carrying capacity Grazing of livestock will not be permitted in Critical Biodiversity Areas. ALTERNATIVELY Proponents will not be allowed to stock more than 50% of the total livestock/wildlife permitted for the Critical Biodiversity Area in terms of the Western Cape Carrying Capacity Map.
	Ecological Support Areas	Ecological Support Areas must be managed to maintain or enhance their ecological functioning. These areas may not be altered in any way as part of the Farm-Level Management Plan, other than in order to fulfil the management measures outlined herein. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to Fire Management is available to guide specialists in regard. Alien vegetation management The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the

		Farm-Level Management Plan. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard. Soil conservation Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention. Authorisation holders / registered entities must be cognisant of the legal implications of moving material in and out of watercourses, and must not undertake a management measure that triggers a listed activity for which authorisation has not been given. Carrying capacity Authorisation holders / registered entities are allowed to make use of these areas for the grazing of livestock so long as the livestock units remain below the thresholds of the Western Cape Carrying Capacity Map for the vegetation type in question, and so long as such extensive agricultural practices uphold the canons of sustainable agriculture.
	Other Natural Areas (including areas unviable in terms of farming e.g. steep slopes, shallow bedrock, or other)	Other natural areas must be managed to maintain or enhance their ecological functioning. These areas may not be altered in any way as part of the Farm-Level Management Plan, other than in order to fulfil the management measures outlined herein. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to Fire Management is available to guide specialists in regard. Alien vegetation management

		The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the farm-level planning. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard. Soil conservation Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention. Authorisation holders / registered entities must be cognisant of the legal implications of moving material in and out of watercourses, and must not undertake a management measure that triggers a listed activity for which authorisation has not been given. Carrying capacity Authorisation holders / registered entities are allowed to make use of these areas for the grazing of livestock so long as the livestock units remain below the thresholds of the Western Cape Carrying Capacity Map for the vegetation type in question, and so long as such extensive agricultural practices uphold the canons of sustainable agriculture.
Cultivated lands	Existing irrigated agriculture	<u>Land for which sufficient water use rights exist:</u> Efficient water use Water use for irrigation must be used sparingly in order to ensure that the alteration of land immediately abutting irrigated lands is minimised as far as possible. Infrastructure necessary for the delivery of water (i.e. borehole pumps, pipes) must be monitored for leaks on an on-going basis. If a leak is detected on such infrastructure, the irrigation system must be decommissioned and the leak fixed. The infrastructure can only be re-commissioned once the leak has been fixed. Every effort must be made to ensure that the

		artificial introduction of water to natural areas is avoided. Alien and invasive vegetation management These areas must be closely monitored for the presence of invasive ruderal species (this includes unwanted indigenous species). Clarity regarding likely indigenous invasive species that must be managed must be provided by the specialist who conducted the groundtruthing of the Sandveld EMF when identifying areas of the farm currently infested with alien invasive species. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard.
	Existing dryland agriculture	Alien and invasive vegetation management These areas must be closely monitored for the presence of invasive ruderal species (this includes unwanted indigenous species). Clarity regarding likely indigenous invasive species requiring management must be provided by the specialist who conducted the groundtruthing of the Sandveld EMF. This information must be accompanied by a map that identifies areas of the farm currently infested with alien invasive species. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard.
	To be rehabilitated	In instances where existing cultivated land must be decommissioned, the following management measures must be undertaken to ensure that these areas do not undermine the agricultural and ecological importance of the farm unit. A farmer must consider reinstating areas of the farm management map delineated under this sub-category prior to cultivating intact natural vegetation. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to Fire Management is available to guide specialists in regard. Alien vegetation management The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the

		Farm-Level Management Plan. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. (The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard). Soil conservation Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention. Authorisation holders / registered entities must be cognisant of the legal implications of moving material in and out of watercourses, and must not undertake a management measure that triggers a listed activity for which authorisation has not been given. Carrying capacity Authorisation holders / registered entities are allowed to make use of these areas for the grazing of livestock so long as the livestock units remain below the thresholds of the Western Cape Carrying Capacity Map for the vegetation type in question, and so long as such extensive agricultural practices uphold the canons of sustainable agriculture.
Land to be cultivated	Proposed irrigated agriculture	<u>Land for which water use rights exist:</u> Prior to cultivating lands identified for future cultivation, these areas must be managed to maintain their ecological status. This is the case in order to ensure that their ecological utility is maintained until they are cultivated, and that they do not become havens for alien vegetation infestations, soil erosion or fire hazards to surrounding ecologically important land. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to

Fire Management is available to guide specialists in regard.

Alien vegetation management

The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the farm-level planning. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard.

Soil conservation

Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention.

Authorisation holders / registered entities must be cognisant of the legal implications of moving material in and out of watercourses, and must not undertake a management measure that triggers a listed activity for which authorisation has not been given.

Carrying capacity

Authorisation holders / registered entities are allowed to make use of these areas for the grazing of livestock so long as the livestock units remain below the thresholds of the Western Cape Carrying Capacity Map for the vegetation type in question, and so long as such extensive agricultural practices uphold the canons of sustainable agriculture.

Water use

Land to be cultivated cannot be cultivated if insufficient water rights exist to operationalise these lands. An authorisation holder / registered entity that cultivates land for irrigated agriculture without sufficient water use rights will not benefit from the regulatory relief from this initiative.

		Note that once these areas have been cultivated, the management measures of the "cultivated lands" category will apply.
	Proposed dry land agriculture	Prior to cultivating lands identified for future cultivation, these areas must be managed to maintain their ecological status. This is the case in order to ensure that their ecological utility is maintained until they are cultivated, and that they do not become infested by alien or invasive species, degraded by soil erosion or constitute fire hazards to surrounding ecologically important land. Fire management The prescribed burning regime must be outlined by the specialist who conducted the groundtruthing assessment of the Farm-Level Management Plan, including the fire management map associated therewith. The CapeNature Fact Sheet: Landowner's Guide to Fire Management is available to guide specialists in regard. Alien vegetation management The prescribed alien vegetation management measures must be outlined by the specialist who conducted the groundtruthing assessment for the Farm-Level Management Plan. This should include a map of alien infestations on the farm unit and measures of eradicating such infestations. The Best Practice Guideline: alien vegetation management document, endorsed by CapeNature is available to guide specialists in this regard. Soil conservation Areas that have been burnt must be monitored for signs of soil erosion. If a runnel or rill is detected after periods of heavy rain, the necessary precautions must be taken to reduce the velocity of Hortonian overland flow so as to reduce its erosive potential in these areas. These early precursors to widespread soil erosion must be monitored in order to prevent the formation of gullies. If the measures outlined herein are insufficient to abate the erosion, the Competent Authority must be contacted for intervention. Authorisation holders / registered entities must be cognisant of the legal implications of moving material in and out of watercourses, and must not undertake a management measure that triggers a listed activity for which authorisation has not been given.

	Carrying capacity Authorisation holders / registered entities are allowed to make use of these areas for the grazing of livestock so long as the livestock units remain below the thresholds of the Western Cape Carrying Capacity Map for the vegetation type in question, and so long as such extensive agricultural practices uphold the canons of sustainable agriculture.

OUTPUT

The result of the previous groundtruthing exercise should be mapped by a suitably skilled individual, including electronic copies in either *.shp or *.kmz format. The accuracy of delineated boundaries should not exceed a deviation greater than 2.5 metres from reality. These maps should make use of farm camp maps that might already exist for the farm unit in question, or establish a new camp system with the farmer if applicable. The incorporation of such a camp system allows for improved referencing when describing features of the farm, and will assist the farmer when management measures are suggested.

It is recommended that a first map, the "farm use map", outlining the land use categories outlined in Table 34 above, should be drafted at a suitable scale to allow a farmer to implement the map to an accuracy of 2.5 metres. If it is necessary to create a series of maps in order to meet the aforementioned resolution requirement, an overview map, showing the entire extent of the farm and the proposed uses must also be included, with extent windows of the map series displayed on the overview map. The overview map of a farm use map series, or the single farm use map (where a series of maps does not exist) should include:

- a north arrow;
- a title;
- a scale bar or ratio;
- if applicable, extent windows including reference numbers relating to the farm use map series;
- details regarding the date of compilation and the organisation/person compiling the map;
- a descriptive paragraph including:
    - the name of the proponent,
    - the name of the property/ies in question with their surveyor general numbers;
- a legend indicating the colour of each land use category and their title as captured in Table 34,
- a declaration to be signed by the farmer that:
    - he/she/it will manage the farm in accordance with the map,
    - that sufficient water rights exist for the proposed irrigated cultivated land, and

    - that farming practices will remain within allocated water rights; and
- sufficient space to allow for endorsement from:
    - the national department responsible for water,
    - the provincial department responsible for agriculture, and
    - CapeNature.

A second map, the "farm management map", should be drafted from the farm use map, and depict the sub-categories outlined in Table 34. All other recommendations mentioned above also apply to this map. All GIS information utilised to create these maps should be provided to the Competent Authority as part of the EIA process, or when utilising any future regulatory mechanism developed to implement this EMF.

A detailed text description of the farm use map and farm management map should be included in the Farm-Level Management Plan under separate headings. These descriptions, including the management measures required for the uses/characteristics in question should be written in a manner that is most accessible to the farmer. General management measures for the farm as a whole, such as burning regimes or pre-cultivation search and rescue efforts, should also be included in this description.

Post-delineation stage

This stage of the farm-level planning process is the final stage with the farmer. In this process, it would be necessary for the specialists to relay their findings to the farmer in a succinct manner and ensure that the farmer is fully aware of the commitments made, as the farmer will be required to uphold such commitments if environmental authorisation is awarded. Processes likely to arise during this stage include remapping to accommodate necessary changes.

OUTPUT

The output of the final stage of the farm-level planning approach are maps, and management measures, that ensure the Farm-Level Management Plan is in keeping with the findings of this EMF. A farm-level planning approach will be required for all EIA applications that fall within the Sandveld study area, and are limited to the activities listed in Table 1.1. Avenues to allow farmers to avoid applying for Environmental Authorisation for the cultivation outlined within the FLMP are being explored.

5 Gaps and uncertainties

The following are seen as limitations to the current study:

1. The vegetation survey was limited to the western part of the EMF study domain as no botanical sample sites had been earmarked in the Agter-Cederberg and south of the Berg River (although it was recognised that 'sandveld'-type habitats occur in the latter area). Only 28 of the 37 sample sites could be accessed due to locked gates, the absence of landowners, remote locations and/or impassable roads. Field-work was conducted in two periods, 3 - 5 September 2014 and 13 - 18 October 2014. The first period was within the 'spring' season which was most desirable whereas the second was in early summer when much of the annual and ephemeral flora had already dried out. The confidence level of the vegetation survey was, however, high (80% and higher) with more than adequate data assembled from which to draw conclusions. It is nonetheless essential to ground-truth areas earmarked for cultivation as populations of threatened plant species could be localised within the greater vegetation matrix and would otherwise be missed if a general, wide-scale approach was to be applied. This detailed level of botanical assessment would have to be undertaken when conducting groundtruthing assessments in compliance with the regulatory mechanism used to implement this EMF, or prior to any application for environmental or agricultural authorisation that entails the clearance of indigenous vegetation in CBAs or threatened ecosystems.
2. No aquatic assessments were undertaken, meaning that all information about the type, distribution and condition of different hydro-geomorphic units in the study domain is based on existing published data that was not verified by the Sandveld EMF project. It can be noted, however, that the mechanism used to implement this EMF will not exclude the need to obtain Environmental Authorisation for listed activities pertinent to watercourses and wetlands, or amend, in any way, a farmer's requirements in terms of the National Water Act, Act 36 of 1998.
3. The Water Registration and Management System (WARMS) of the Department of Water and Sanitation provided an incomplete dataset of water use registrations. This limited the utility of this data for any calculations on the ground or surface water resources in the study domain.[125]
4. The observation points used to compile the dataset on Groundwater Yield and Quality are limited and do not cover all parts of the study area equally well. The map is therefore a presentation of the best available information, but extrapolation into some areas with little or no data may limit the reliability of the map in these circumstances.
5. Recent and accurate statistics on labour and job opportunities within the agricultural industries of the study area do not exist and limited the quantification of the social impact of the main land-use categories.

[125] DWS had commenced with the process of validating and verifying water uses within the study domain at the time of publication of this report.

6. No information was obtained on schemes or projects for new entrant farmers, which potentially biases the EMF in favour of established commercial agriculture or draws conclusions about desired land use patterns and practices that may not be feasible or affordable for historically disadvantaged people who are entering farming for the first time.

6 Recommended interventions that cannot be facilitated by the EMF

1. The following aspects of farming need to be researched so as to reduce the imperative for regular land clearance as part of the potato production cycle, and to improve yields on established lands:
   - Pests, and pest-resistant varietals;
   - Re-use of old fields by practising conservation agriculture; and
   - Maximisation of yields on old fields.
2. Further research is needed to assess the contribution of wetlands in the Sandveld to groundwater recharge, and to accurately identify the main recharge zones in intensively farmed areas as these may need special protection that cannot be offered by the EMF.
3. The monitoring and evaluation system for the Western Cape Climate Change Response Strategy and Action Plan (2015) must be finalised with the objective of *inter alia* undertaking more localised monitoring and evaluation of potential shifts in climate, and climate-related impacts on agricultural productivity and ecosystem services in one or more of the agri-climatic zones within the Sandveld study domain.
4. Research is also necessary to (a) better understand agricultural and broader societal dependencies on ecosystem services in the Sandveld and Agter-Cederberg, and (b) understand how land use practice and climate change may influence the delivery of particularly those provisioning and regulatory services that, if reduced, hold adverse implications for farming, farming-dependent communities and the regional economy. These changes need to be anticipated and pre-empted by appropriate adaptive strategies as recommended by the 'SmartAgri' study.
5. Research is needed to determine the contribution of agri-tourism to the regional domestic product, and how to promote and diversify sustainable options for agri-tourism in the domain of the Sandveld EMF.

7 Revision of the EMF

The Sandveld EMF will be reviewed and updated every five years. The revision schedule for the EMF will be synchronised with the revision schedule of its main spatial informants, i.e. the relevant SDFs and CBAs. All plans stemming from this EMF that still award rights to the farmer in terms of NEMA will also be reviewed for continued alignment with this dynamic EMF.

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National Environmental Management Biodiversity Act 10 of 2004 (NEMBA)

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National Water Act 36 of 1998 (NWA)

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NEMA Framework Regulations GN R547 of 2010

Spatial Planning and Land-use Management Act 16 of 2013 (SPLUMA)

Western Cape Biodiversity Framework 2014

Western Cape Department of Agriculture Strategic Plan 2015/16 – 2020/21

Western Cape Rural Land-use Planning and Management Guidelines 2009

Western Cape Strategic Plan 2014 – 2019

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Appendix A: Regulatory and Planning Framework

As with all other laws and official decision-making in South Africa, the EMF must comply with the benchmark standards set by the Constitution of the Republic of South Africa, 1996.

The Constitution

The Constitution, through the Bill of Rights, provides the fundamental measures by which all laws and official actions – such as those affecting the environment – must be assessed. If they do not pass the test set by the Bill of Rights, they can be reviewed and set aside in court. At the national level, our Constitution grants everyone the right to an environment that is not harmful to health or wellbeing. It also grants everyone the right to have the environment protected – for the benefit of present and future generations – through reasonable legislative and other measures that:

- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

Besides the immensely important environmental right, the Constitution entrenches the right to administrative action that is lawful, reasonable and procedurally fair.

The National Environmental Management Act 107 of 1998 ('NEMA') fleshes out the environmental right and constitutional provisions relating to co-operative governance in support of integrated environmental management. NEMA lays down principles that must be applied to the actions of departments and officials that may significantly affect the environment, as well as the Duty of Care (see below).

Forward planning and regulatory control

Responsibility for land-use regulation in South Africa is spread across all three spheres of government (municipal, provincial and national), and can be categorised in terms of:

- Forward or development planning (proactive procedures): Plans that aim to guide or inform proposed development and decisions, but do not confer or take away rights in land;
- Land-use (reactive) controls: Measures that confer or control legal rights in land, authorise listed activities in terms of the NEMA EIA Regulations or the use of water, or award prospecting and mining rights, etc.

The EMF spans both these aspects of land use planning and regulation in that it:

- Provides a strategic context to guide agricultural planning and farm management in the Sandveld and Agter-Cederberg; and also
- Provides a statutorily-endorsed framework for official review of applications for environmental, water and/or agricultural authorisations.

The National Environmental Management Act 107 of 1998 (NEMA)

NEMA is framework legislation that embraces all three fields of environmental concern, namely the conservation and exploitation of resources, pollution control and waste management, and land-use planning and development[126] and *inter alia*:

- Fleshes out the right to "reasonable legislative measures" for environmental protection;
- Lays down "bed-rock" national environmental management principles that apply to all administrative actions by organs of state that may significantly affect the environment, thereby providing a justiciable basis for 'ecologically sustainable development';
- Prescribes a 'Duty of Care' towards the environment; and
- Establishes general objectives for integrated environmental management (which, in turn, provides the basis of the environmental assessment and management regime in South Africa).

<u>The National Environmental Management Principles</u>

The national environmental management principles are particularly relevant to decisions concerning agricultural development in the Sandveld. These 'sustainability' principles among others require that:

- Environmental management must place people and their needs at the forefront its concern;
- The disturbance of ecosystems and loss of biodiversity must be avoided, minimised and remedied;
- Ecosystem integrity must not be jeopardised
- The best practicable environmental option must be pursued by means of integrated environmental management;
- The participation of all interested and affected parties (I&APs) in environmental governance must be promoted, including participation by vulnerable and disadvantaged persons;
- Intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment must be promoted;
- The environment must be protected as the people's common heritage; and

The NEMA EIA Regulations

(8 December 2014)

The NEMA EIA Regulations constitute a package of prescribed measures to achieve the objectives of integrated environmental management. The main components are:

- The actual regulations, which lay down the rules conducting either a basic assessment or scoping and EIA (GN R. 982).
- Listing Notice 1: Lists activities that may not commence without environmental authorisation, and which require a basic assessment (GN R. 983).
- Listing Notice 2: Lists activities that may not commence without environmental authorisation, and which require scoping and EIA4).
- Listing Notice 3: Lists activities in specified geographical areas that may not commence without environmental authorisation, and which require a basic assessment (GN R. 984).

NEMA provides for the exclusion of listed activities from the requirement for environmental authorisation, provided that such excluded activities:

- Have been specified in spatial development tools or environmental management instruments adopted by the competent (environmental) authority; or
- Comply with prescribed norms and standards.

It is an offence to commence a listed activity without environmental authorisation.

[126] Glazewski (2000), p 166

- Specific attention must be paid to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

The Duty of Care

Section 28(1) of NEMA reads:

> *Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation 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 to the environment...*

The environmental authorities may issue a directive to enforce the 'Duty of Care' provisions and the state can recover the costs of rehabilitation or other remedial measures from the polluter.

The NEMA environmental impact assessment (EIA) regulations

EIA is mandatory for a wide range of prescribed ('listed') activities and circumstances. EIA or 'environmental assessment' refers to the regulatory or administrative process by which the environmental impact of a project and reasonable alternatives is determined.

In terms of general EIA practice and South African legislation, the actual EIA represents the second of two major phases that comprise the EIA process, the first being 'scoping' or the identification of feasible alternatives and issues that would need further investigation to ensure an informed decision. The process of investigation and impact assessment, and which often relies on specialist studies, is the 'environmental impact assessment'.

Besides analysing the environmental impacts of the proposed development and alternatives, EIA also evaluates the significance of these impacts – a process of judgement by which societal values are used to determine if an impact is 'positive' or 'negative', acceptable or not.

The EIA Regulations provide for two 'routes' by which environmental authorisation must be applied for. The first is the Basic Assessment process, currently a more streamlined version of the scoping and EIR procedure than before. The EIA Regulations specify which activities require a Basic Assessment. The second 'route' is that of the fully-fledged scoping and EIR option, which applies to a somewhat shorter list of gazetted activities.

Basic Assessment, Scoping and EIR all require public participation. The EIA culminates in an 'environmental impact report' or EIR. An EIR is meant to be an objective tool for assisting the state in making an informed decision on the basis of the relative environmental merits or demerits of a development proposal and its alternatives. NEMA provides for a right to appeal against an environmental decision.

An applicant may apply for exemption from aspects of the EIA Regulations (such as the requirement to appoint an independent consultant), but cannot be exempted from the need to obtain authorisation for an activity listed in the EIA Regulations.

The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA)

NEMBA gives legislative effect to South Africa's obligations under the Convention on Biological Diversity. It does so by:

- Outlining the legal framework for systematic biodiversity planning and 'mainstreaming' of biodiversity priorities into municipal planning;
- Establishing legally-binding opportunities to manage land in support of biodiversity considerations outside the boundaries of statutory protected areas;
- Providing for the definition and gazetting of threatened ecosystems (which serves as a trigger for environmental authorisation), and threatened and protected species;
- Providing for the listing of invasive alien species and their control and eradication; and
- Sealing the relationship between the achievement of national biodiversity conservation priorities and the 'NEMA' system of environmental regulation.

Spatial Planning and Land Use Management Act 16 of 2013 (SPLUMA)

SPLUMA aims to provide a uniform, effective and comprehensive system of spatial planning and land use management throughout South Africa. It emphasises redressing spatio-developmental imbalances of the past, while promoting the sustainable and efficient use of land.

The Act lays down principles that are important for planning and decision making that may affect agricultural land, i.e.

- The *Principle of spatial sustainability* requires that spatial planning and land use management must:
  - Ensure that special consideration is given to the protection of prime and unique agricultural land
  - Uphold consistency of land use measures in accordance with environmental management instruments
  - Promote land development in locations that are sustainable and limit urban sprawl (this closely accords with the principle of positive planning which seeks to proactively guide development towards areas that are not important for biodiversity conservation purposes limiting urban sprawl is a key strategy for securing highly threatened biodiversity in and around cities such as Johannesburg and Cape Town).
- The *Principle of efficiency'* requires that decision-making procedures must minimise negative financial, social, economic or environmental impacts; and
- The *'Principle of spatial resilience'* states that spatial plans, policies and land use management systems must be sufficiently flexible to ensure sustainable livelihoods for communities most likely to suffer the impacts of economic and environmental shocks.

SPLUMA also provides for:

- A nested hierarchy of spatial development frameworks, from the national to the provincial and the local spheres respectively;
- The management and facilitation of land use by means of legally-binding land use schemes;
- Aligning land use measures with environmental management instruments;
- Strategic assessments of environmental pressures and opportunities within municipal areas; and
- A 20-year spatial development perspective for municipal planning.

Forward-planning instruments

Besides the Sandveld EMF, other spatially-based strategic planning frameworks include the spatial development frameworks (SDFs) for the following municipalities:

- The West Coast District Municipality;
- The Matzikama Local Municipality;
- The Cederberg Local Municipality; and
- The Berg River Local Municipality.

The Municipal Systems Act and the SPLUMA require that each municipality must prepare an SDF, that has to be reviewed every five years as part of the review of municipal integrated development plans (IDPs). In terms of the SPLUMA, SDFs must:

- Be informed by a long-term spatial development vision and plan (that ideally should include sustainability objectives and the maintenance of thresholds in support of ecological resilience and the sustained delivery of key ecosystems goods and services);[127]
- Represent the integration of trade-offs of all relevant sector policies and plans (particularly relevant when seeking to guide development that is consistent with the principle of 'no net loss');[128]
- Identify the long-term risks of particular spatial patterns of growth and development, and the policies and strategies necessary to mitigate those risks; and
- Take cognisance of any environmental management instrument adopted by the relevant 'environmental management authority'.[129]

Provincial SDFs must delineate areas in which development, or particular types of development would not be appropriate.[130]

Provincial Spatial Development Framework (2014)

The PSDF is specifically relevant and the key spatial planning policy in the Western Cape. The PSDF (2014) identified key policies, strategies and objectives that are considered relevant to the Sandveld EMF study, as follows:

Spatial objectives:

- Spatial justice
- Sustainability and resilience
- Spatial efficiency
- Accessibility
- Quality and liveability

The PSDF identified escalating *risks* to the provincial space-economy that require mitigation and/or adaptation responses, including the following risks specifically relating to the agricultural sector:

- Climate change and its impact on the province's eco-system services, economic activities (particularly agricultural production), and sea level rise associated with extreme climatic events;

[127] Section 12(1)(b), SPLUMA 16/2013
[128] Section 12(1)(c), SPLUMA 16/2013
[129] Section 12(1)(m), SPLUMA 16/2013
[130] Sections 14(e) and 16(b), SPLUMA 16/2013

- Energy insecurity and high levels of carbon emissions, given an energy intensive provincial economy and spatial patterns that generate high levels of travel;
- -Water quality and quantity deficits; and
- -Food insecurity.

The PSDF identified the following *key challenges* relating to natural resources and biodiversity:

- Land transformation: loss of biodiversity due to urban development & cultivation;
- Climate change: impact on biodiversity;
- Over abstraction and modification of natural watercourses; and
- Collapse of ecosystems.

Lastly, the following policies, identified in the PSDF, relate to the environmental and agricultural sector:

R1: Protect Biodiversity & Ecosystem Services

- The biodiversity network should inform planning and land use decisions
- Key conservation and biodiversity areas should be identified and mapped in SDF's

R2: Manage, Repair & Optimise Provincial Water Resources

- Improve farming practices
- Optimise ground water extraction in a sustainable way
- Protect river systems
- Develop agricultural water demand management programmes

R3: Manage, Protect & Sustainably Use Agricultural Resources

- Retain high potential agricultural land
- Promote agri-tourism and agri-processing
- Promote on-farm diversification to alternative energy
- Apply & promote water wise farming methods

R5: Protect & Manage Provincial Landscape and Scenic Assets

- Prevent inappropriate land use changes

E1: Diversify & Strengthen the Rural Economy

- Protect agricultural resources
- Establish appropriate complimenting land uses, subject to requirements of the specific spatial planning categories
- Promote rural skills base
- Consider farm worker settlements

In addition to the above-mentioned PSDF (2014), the previous PSDF (2009) included a series of provincial guidelines, which are deemed relevant to rural and agricultural areas, as follows:

- Guidelines for Resort Development in the Western Cape (2005); and
- Rural Land Use Planning & Management Guidelines (2009).

Local Municipal SDFs

The Sandveld EMF study area comprises three local municipal areas, being the Bergriver Municipality, the Cederberg Municipality and the Matzikama Municipality.

Each of these municipal areas are unique with different spatial assets, challenges and opportunities, which inform and contribute to its space economy and development trends, while the distribution of the typical Sandveld agricultural produce occurs cross municipal boundaries.

The Spatial Development Frameworks (SDF), which are sector plans of the Integrated Development Plan, as required by the Municipal Systems Act (MSA) (Act 32 of 2000), are as follows:

- Bergrivier Municipality SDF: Council Approved SDF, revised May 2013;
- Cederberg Municipality SDF: Draft SDF, April 2017; and
- Matzikama Municipality SDF: Draft SDF, 2014

The implications of the local SDFs for the Sandveld EMF mainly relates to future urban expansion of existing towns within each of the municipal areas and the designation of Spatial Planning Categories with associated permissible land uses, which should be consistent with the CBA mapping in this document. The references of the local SDFs in **terms of rural and regional planning, specifically relating to CBA's and associated Spatial** Planning Categories are summarised below:

Cederberg SDF (2017)

The Cederberg SDF (2017) includes, as part of its spatial vision, the following statement that includes the Sandveld study area:

An economically prosperous region and sustainable liveable environment for all Cederberg residents

As stated above, the local municipal SDF of Cederberg is focussed primarily at improving the socio-economic conditions of the area whilst preserving the natural resource base within which these socio-economic systems exist. The SDF further outlines three strategies in the addressing of strengths, weaknesses, opportunities and threats as follows:

- *To protect resources to ensure their use in perpetuity*
- *To change from a functionalist and modernist planning approach to a human and nature centred approach*
- *To grow opportunities to ensure convenient and equal access*

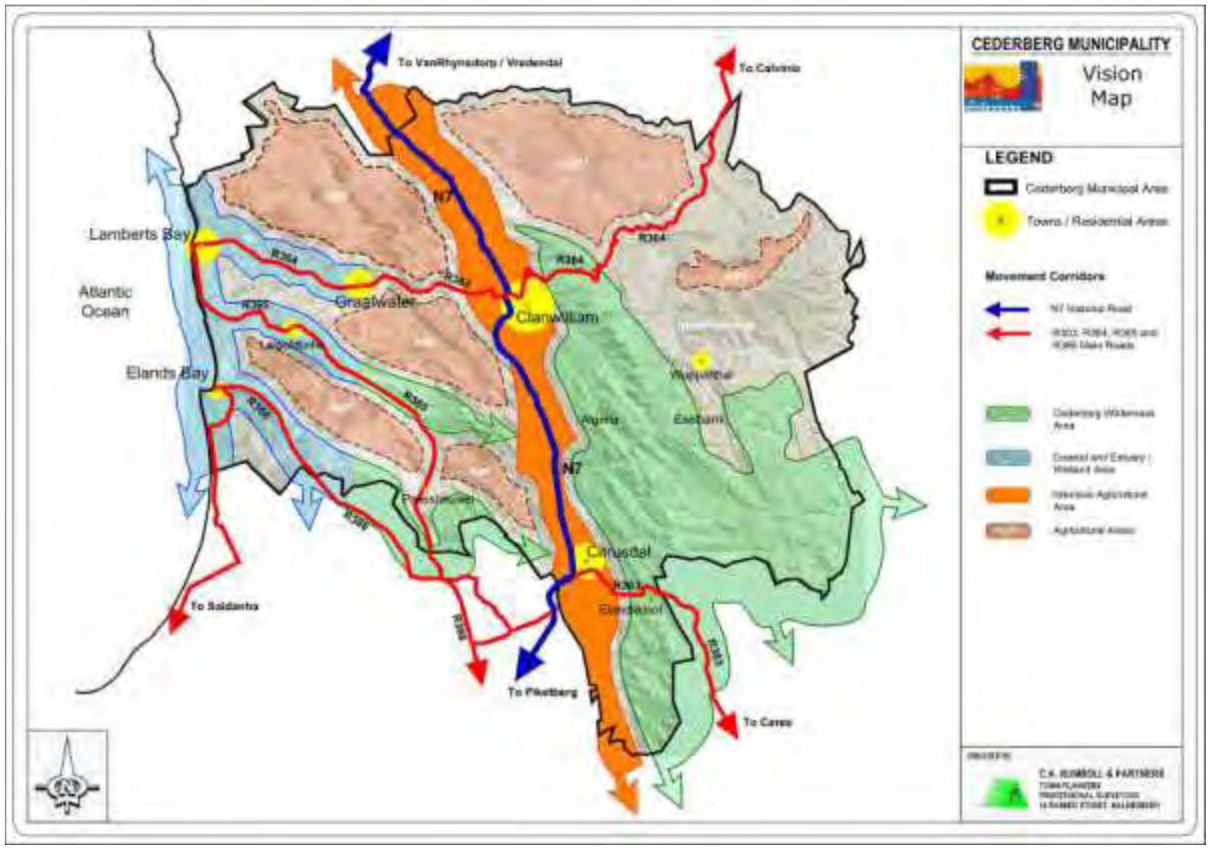
Balancing development and conservation by protecting resources, applying human and nature centred planning methodology and growing opportunities to ensure convenience

and equal access, Cederberg Municipality aims to optimise the opportunities that are provided by its assets…"

It is evident from the above that the Cederberg Spatial Development Framework adopts a holistic approach to their region, aiming to improve liveability without undermining their natural resource base.

The Cederberg SDF (2017) assessed biodiversity as an informant to the municipality's spatial planning proposals for the municipal area, specifically rural areas. The SDF vision for the Cederberg Municipality is summarised spatially on a SDF Vision Map (see Figure A.1 below).

Figure A.1: Spatial vision map – Cederberg SDF (2017)



The land use management proposals of this Sandveld EMF for different biodiversity and agricultural areas will add a more detailed layer over the local SDF, as the SDF proposals are based on high level information rather that ground-truthed onsite informants.

Bergrivier SDF (2012)

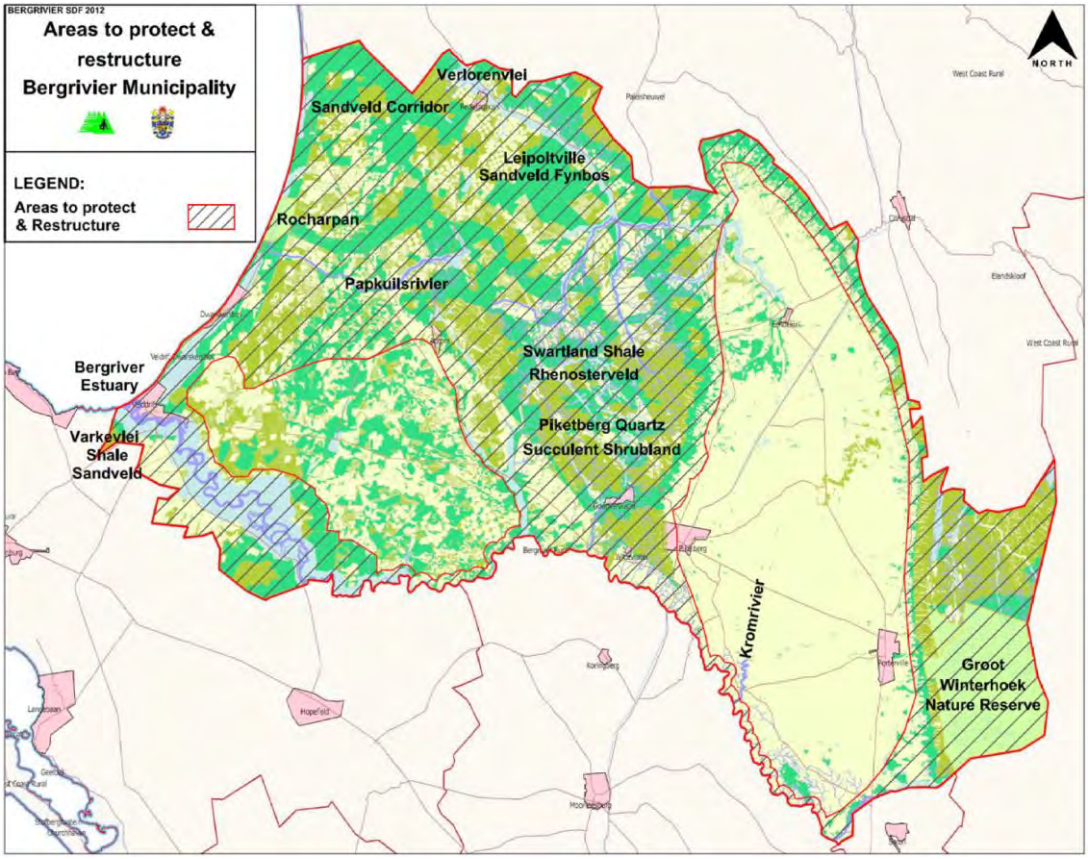
The Bergrivier SDF (2012) identified the following key issues in the region, which are regarded as concerns that can potentially impact the Sandveld study area and specifically the EMF study, namely:

- Illegal agricultural practices in Bergrivier region (Clearing of natural vegetation, Irrigation pivots, ploughing of natural areas, Intensive agricultural uses);
- Development and conservation of identified Corridor areas;

- Impacts of climate change on natural areas and on agricultural production;
- Conservation of Critical Endangered Areas according to identified CBA's;
- Protecting agricultural land (specifically cultivated land);
- Impact of ground water pollution on agricultural land;
- Fragmentation of agricultural land;
- Consideration of possible future population growth and spatial growth of towns;
- Renewable energy infrastructure development – identify appropriate areas to establish such infrastructure with minimal impact on natural environment;
- Protect and maintain agricultural productivity and the rural character of the area; and
- Hap-hazard development nodes in the rural agricultural areas are problematic in terms of services provision and impact on the natural and agricultural environment.

Following the afore-mentioned identification of local area issues, the SDF includes a plan indicating the areas requiring protection, management and restructuring (refer Figure A.2 below).

Figure A.2: Areas to protect & restructure – Bergrivier SDF (2012)



The Bergrivier SDF's primary focus is on urban development and guidelines for future urban development. The above-mentioned plan and issues point out what the typical area of concern in the area are, which are consistent with the issues investigated in this EMF study in more detail, i.e. agricultural use, biodiversity conservation, impacts of climate change, ground water, etc.

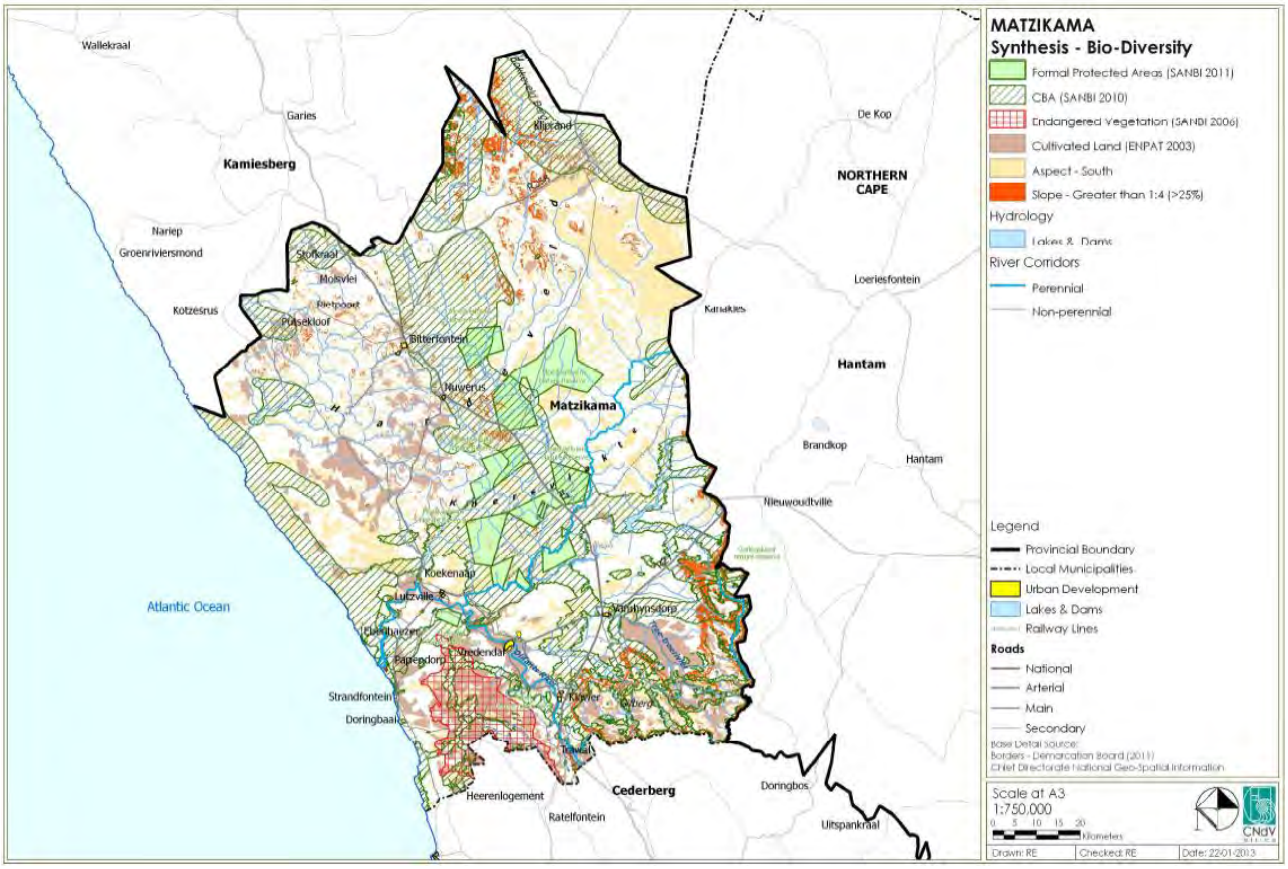
Matzikama SDF (2014)

The Matzikama SDF (2014) identifies and indicates certain distinct natural systems being present in the municipal study area, of which one is specifically relevant to the Sandveld study area, namely:

- In the south west of the municipality, between the coastal corridor and the Olifants River corridor is a triangular wedge of Sand plain fynbos mainly under dryland farming. This has resulted in this area and vegetation group being accorded endangered status by SANBI.

Figure A.3 indicates the area designated as endangered status marked in red grid.

Figure A.3: Biodiversity assessment – Matzikama SDF (2014)



The priority strategies identified by the Matzikama SDF (2014) for the above-mentioned study area, are as follows:

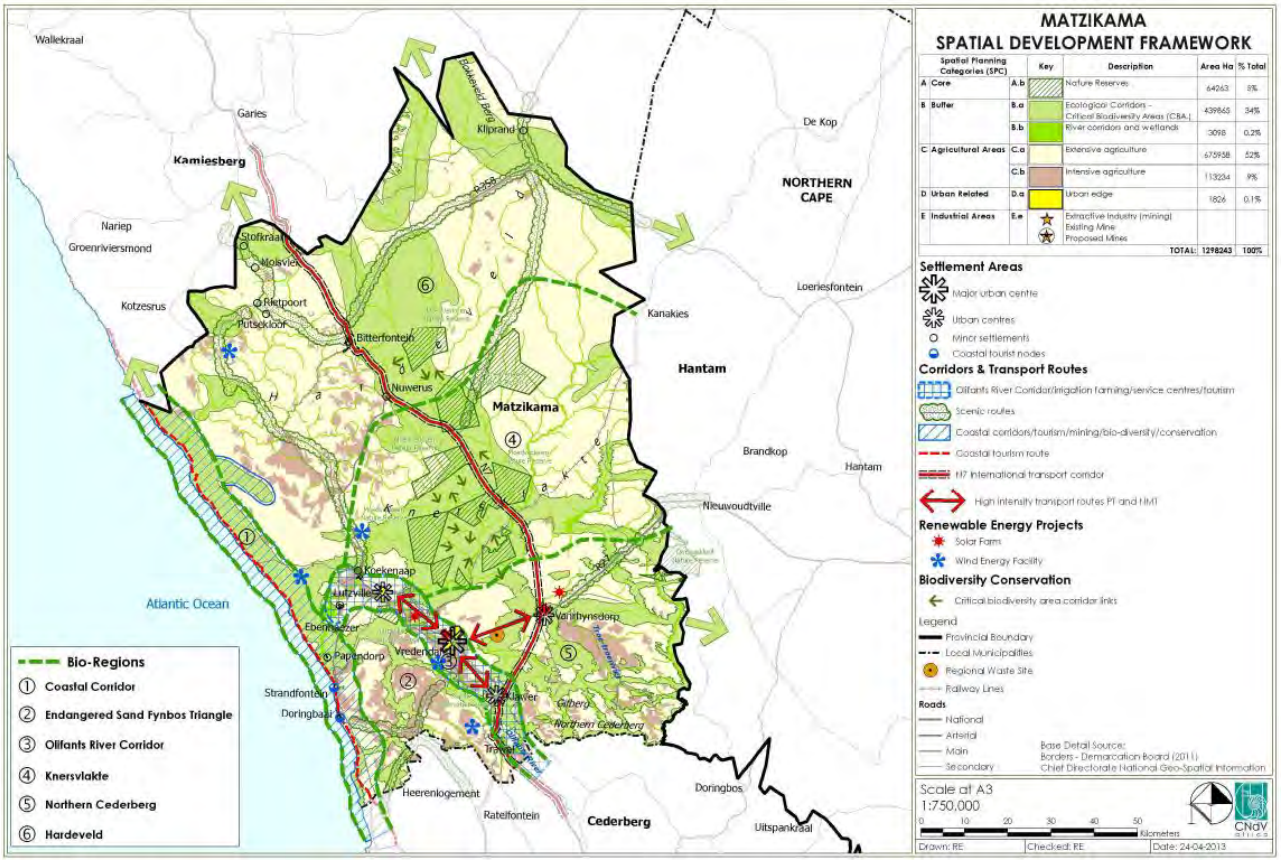
- Promote consolidation of Sand Fynbos remnants and their protection though stewardship areas and conservancies;
- Establish an overall conservancy institution to represent interests of land owners and promote bio-diversity conservation; and
- Protect existing, potential or fallow agricultural land from conversion to other uses.

Other Bio-Regions within the Matzikama Municipality includes the Olifantsriver Corridor, the Coastal Corridor, Cederberg, Hardeveld and the Knersvlakte respectively. Each of these areas has its own challenges in terms of environmental conservation and agricultural

sustainability. The challenge often relates to a conflict between retaining natural fallow land for conservation purposes as opposed to the extension of agricultural activities. Mining is also a widespread land use throughout the Matzikama Municipality, which requires careful consideration in natural and biodiversity sensitive areas.

The Matzikama SDF (2014) includes a comprehensive framework plan, which indicates spatial planning categories, development corridors, as well as biodiversity corridors (refer Figure A.4).

Figure A.4: Spatial proposals – Matzikama SDF (2014)



Other laws that may apply to new agricultural developments in the Sandveld[131]

The National Environmental Management: Protected Areas Act 57 of 2003 (NEMPAA) NEMPAA supplements NEMA and NEMBA with:

- Expanded definitions of the components of biodiversity and environmental goods and services respectively;
- Specific assessment and environmental reporting measures relating to various categories of protected areas and coastal management entities; and

[131][131] See Appendix C for a summary of development activities that may require legal approvals which could be reviewed in terms of the Sandveld EMF

- Additional mechanisms (such as Protected Environments) for balancing and guiding development in relation to biodiversity and, more broadly defined, environmental considerations.
- Section 9 of the NEMPAA defines protected areas, namely:
  - Special nature reserves, national parks, nature reserves (including wilderness areas) and protected environments;
  - World Heritage Sites;
  - Marine protected areas;
  - Specially protected forest reserves, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act 84 of 1998 (see below); and
  - Mountain Catchment Areas declared in terms of the Mountain Catchment Areas Act 63 of 1970.

The National Water Act 36 of 1998 (NWA)

The NWA addresses the sustainable use, protection and management of water resources from an integrated, catchment-based perspective. It assigns absolute primacy of access to water as a basic human and ecological right and establishes comprehensive system of regulation and resource governance. The NWA provides for mandatory licencing or general authorisation of specified water uses.

It states that water resources must be protected, used, developed, conserved, managed and controlled in ways which promote equitable access to water, redress past racial discrimination and protect aquatic ecosystems.

<u>Protection of water resources</u>

The protection of water resources entails:

- A classification system for water resources (the minimum baseline condition for all water is resources 'largely modified' or 'D'; ecological conditions may require that a higher category be set, i.e. 'C' to 'A');
- Classification of water resources and resource quality objectives; and
- Determining the Reserve with respect to basic human needs and the water required to protect aquatic ecosystems.

<u>Determination of the ecological reserve</u>

- The reserve refers to both the quantity and quality of the water in the resource, and varies depending on the class of the resource. It is binding in the same way as the class and the resource quality objectives.
- If a resource has not yet been classified by the Minister, a preliminary determination of the reserve may be made before use of water may be authorised.
- The potential impact of development on the ecological reserve – both in terms of quality and quantity of water affected – must be addressed in environmental assessment.

Regulation of water use and permissible water use

- A water use must be licensed unless it constitutes a permissible water use.
- Section 21 of the NWA defines water uses that must be licensed, including taking and storing water, impeding, diverting and altering flows, altering the characteristics of a watercourse, and discharging waste or effluent into a water resource.
- Permissible water uses:
  - are defined by Schedule 1 of the Act (reasonable domestic use, etc)
  - constitute existing lawful uses, permitted by a law since repealed by the NWA, to that extent that the use is compatible with, or permitted by, the NWA and/or the Department of Water Affairs
  - may be permitted in terms of a general authorisation (e.g. for wetland rehabilitation by organs of state, disposal of wastewater, undertaking river maintenance or abstracting groundwater)
- A water use licence may be dispensed with if a permission issued by another Act meets the purposes of the NWA
- Water uses approved by licence or permitted by general authorisation must be registered with the Department of Water Affairs or a catchment management agency, if applicable.

The Conservation of Agricultural Resources Act 43 of 1983 (CARA)

CARA predates NEMA by some 15 years and is currently subject to comprehensive revision with other agriculture-related legislation, regulates the sustainable use of agricultural resources (soil, water and vegetation).

Its objectives include the maintenance of the production potential of land by combating erosion and weakening or destruction of water resources. CARA is enforced through regulations that *inter alia* control:

- The cultivation of virgin land (i.e. soil that has not been cultivated for 10 years);
- The regulation and control of run-off water;
- The utilisation of vleis, watercourses and water sources;
- The use and protection of veld that has burnt; and
- The control of weeds and invader plants.

Refer to Appendix D: Developments on farms that may need legal approvals for farming-related activities that may require one or other legal approval. The list is not complete and project proponents are strongly advised to obtain professional assistance in determining their environmental and legal responsibilities.

Appendix B: GIS mapping

The following section provides a short overview on the source data and methodology employed for the generation of maps included in this document:

Map 1.1: The Sandveld EMF study domain

Dataset	Date	Custodian
Coastline, Roads & Towns	2007	NGI[132]
Rivers	2010	DWS[133]
Relief	2014	Generated for EMF Study
Moravian Church Land at Wupperthal	2014	SG[134]
20 m Contours (Not shown, but used for DEM and relief generation)	2014	NGI

Methodology:

Standard map compilation by GIS data overlays. Shaded relief generated from digital elevation model, as compiled from 20 m Contours.

Map 2.1: The catchments within the study area

Dataset	Date	Custodian
Catchments	1990	DWS[135]

Map 2.2: Groundwater resource potential in the study area.

Dataset	Date	Custodian
Aquifer Yield	2014	GEOSS
Aquifer Quality	2014	GEOSS

Map 2.3: **Water registrations as indicated on the Department of Water & Sanitation's** WARMS database

Dataset	Date	Custodian
WARMS Registrations	2013	DWS[136]

Map 2.4: Major ecosystems of the Sandveld study domain

Dataset	Date	Custodian
Fine Scale Planning Vegetation Maps Matzikama Municipality Cederberg Municipality Berg River Municipality	2010	SANBI[137]

[132] National Geospatial Information – A division of the Department of Rural Development and Land Reform
[133] Department of Water and Sanitation
[134] Surveyor General
[135] Department of Water and Sanitation
[136] Department of Water and Sanitation – Water Registration Management System
[137] South African National Biodiversity Institute

Methodology:

The Fine Scale Planning Integrated Vegetation maps (SANBI, 2010) of the Matzikama, Cederberg and Bergrivier Districts were used as source data, for the compilation of the Ecosystems Management Zones map. Each of the vegetation types where assigned to an ecosystem, according to the table below.

ECOSYSTEMS				
Coastal	**Lowland fynbos**	**Midland-upland fynbos**	**Renosterveld**	**Succulent Karoo**
Estuaries, sandy shores and strandveld	Sand fynbos	Sandstone and quartzite fynbos	Shale and 155ilcrete renosterveld	Succulent shrubland, vygieveld, gannabosveld
Cape Coastal Lagoons	Cape Inland Salt Pans	Bokkeveld Sandstone Fynbos	Cape Vemal Pools	Agter-Cederberg Shrubland
Cape Estuarine Saltmarshes	Cape Lowland Freshwater Wetlands Freshwater Lakes	Cederberg Sandstone Fynbos	Swartland Shale Renosterveld	Citrusdal Vygieveld
Cape Inland Salt Pans	Hopefield Sand Fynbos	Graafwater Sandstone Fynbos	Swartland Silcrete Renosterveld	Doringrivier Quartzite Karoo
Cape Flats Dune Strandveld	Berg River Sand Fynbos*	Grootrivier Quartzite Fynbos	Vanryhnsdorp Shale Renosterveld	Kamiesberg Mountains Shrubland
Cape Seashore Vegetation	Leipoldtville Sand Fynbos	Kamiesberg Mountains Shrubland		Knersvlakte Dolomite Vygieveld
Lambert's Bay Strandveld	Namaqualand Sand Fynbos	Klawer Sandy Shrubland		Knersvlakte Shale Vygieveld
Langebaan Dune Strandveld		Northern Inland Shale Band Vegetation		Knersvlakte Quartz Vygieveld
Namaqualand Strandveld		Olifants Sandstone Fynbos		Namaqualand Riviere
Saldanha Flats Strandveld		Piketberg Sandstone Fynbos		Namaqualand Spinescent Grassland
		Swartruggens Quartzite Fynbos		Tanqua Karoo
		Winterhoek Sandstone Fynbos		Tanqua Wash Riviere
		Southern Afrotemperate Forest		Vanrhynsdorp Gannabosveld
				Klawer Sandy Shrubland
				Piketberg Quartz Succulent Shrubland
				Swartruggens Quartzite Karoo

Map 2.5: Protected areas and stewardship sites within the Sandveld study domain in relation to the Greater Cederberg Biodiversity Corridor

Feature	Dataset	Date	Custodian
GCBC	Greater Cederberg Biodiversity Corridor	2011	SANBI
Protected Areas	NPAES Formal Protected Areas NPAES Informal Protected Areas	2014	WCNCB

Feature	Dataset	Date	Custodian
	NEMPAA Protected Areas Stewardship Sites		

Methodology:

Standard map compilation by GIS data overlays.

Map 2.6: Ecosystem status of the vegetation types that occur in the Sandveld study domain

Dataset	Date	Custodian
Fine Scale Planning Vegetation Maps Matzikama Municipality Cederberg Municipality Berg River Municipality	2010	SANBI
Ecosystem Status Update	2014	WCNCB

Methodology:

The Fine Scale Planning Integrated Vegetation maps (SANBI, 2010) of the Matzikama, Cederberg and Bergrivier Districts were used as base data for the mapping of the vegetation types. The 2014 Ecosystem Status data were then used to update the conservation status of the individual ecosystems to allow for the compilation of an updated Ecosystem Status map of the study domain.

Map 2.7: Critical Biodiversity Areas and NFEPAs in the Sandveld study domain

Feature	Dataset	Date	Custodian
CBAs	Terrestrial CBAs Estuary CBAs River CBAs Wetland CBAs	2016	CapeNature
Wetlands	NFEPA	2011	CSIR[138]

Methodology:

Standard map compilation by GIS data overlays.

Map 2.8: Focal areas in the study domain identified by the National Protected Area Expansion Strategy (DEA, 2011)

Feature	Dataset	Date	Custodian
NPAES Focus Areas	National Protected Areas Expansion Strategy	2010	SANBI

[138] Council for Scientific and Industrial Research

Feature	Dataset	Date	Custodian
Protected Areas	NBA Protected Areas	2011	SANBI
Stewardship Areas	Stewardship Sites	2014	WCNCB

Methodology:

Standard map compilation by GIS data overlays.

Map 3.1: Current land uses in the Sandveld study domain

Feature	Dataset	Date	Custodian
Protected Areas	NBA Protected Areas	2011	SANBI
Stewardship Areas	Stewardship Sites	2014	WCNCB
Wetlands	NFEPA	2011	CSIR[139]
Perennial Rivers	wriall500	2010	DWS
Cultivated Land	Field Boundaries	2011	DAFF[140]
	Centre Pivot Circles digitised from Landsat[141] Imagery	Jan 2016	Generated for EMF Study
	Sandveld Crops	2013	DA:WC[142]
Urban Areas	Fine Scale Planning Project: Matzikama Municipality Cederberg Municipality Bergrivier Municipality	2010	SANBI

Methodology:

Standard map compilation by GIS data overlays.

Map 3.2: Desired land-uses for the Sandveld study domain

Feature	Dataset	Date	Custodian
Protected Areas	NBA Protected Areas	2011	SANBI
Stewardship Areas	Stewardship Sites	2014	WCNCB
CBAs	Terrestrial CBAs Estuary CBAs River CBAs Wetland CBAs	2016	CapeNature
Threatened Ecosystems	FSP Vegetation Maps + Ecosystem status update	2010-2014 2014	SANBI CapeNature
Ecological Support Areas	Ecological Support Areas	2016	SANBI
Wetlands (outside CBAs / ESAs)	NFEPA Wetlands	2011	CSIR

[139] Council for Scientific and Industrial Research
[140] Department of Agriculture Fisheries and Forestry
[141] Landsat 8: http://glovis.usgs.gov/
[142] Provincial Department of Agriculture: Western Cape

Feature	Dataset	Date	Custodian
Slopes >20%	Slope analysis of 10m DEM compiled from 20 m Contours	2014	Generated for EMF study
Cultivated Land	Compiled as for Map 2.9	2011-2016	Generated for EMF study
Other Natural Areas 1	All CBAs (aquatic and terrestrial) + threatened (CR) ecosystems buffered by 30m	2014	Generated for EMF study
Other Natural Areas 2	Remainder of landscape not classified as any of the above categories	2014	Generated for EMF study

Methodology:

Each of the above identified features was assigned to a Land Use Class and spatial dataset as outlined in Table 3.5 and spatially depicted for the study area.

Map 3.3: Areas of potential conflict between current and desired land-use-objectives in the Sandveld study domain

Methodology:

For the purpose of compilation of this map, it was assumed that all cultivated fields (dryland and centre pivots) that overlap with CBAs (aquatic and terrestrial) or Ecological Support Areas, or NFEPA wetlands or slopes steeper than 20%, are potentially in conflict with environmental objectives. However, during the public participation process many land owners indicated that environmental authorisation was obtained for a significant portion of these areas, but the verification of such authorisations falls beyond the scope of this study. The result of the spatial analysis as depicted in the map therefore indicates all land where cultivation overlaps with areas considered to be environmentally sensitive, but does not necessarily imply an unauthorised activity.

Appendix C: Ecological guidelines for Farm-Level Management Plans

The EMF will be implemented by means of Farm-Level Management Plans based on identified land use categories, each of which has specific objectives to achieve a balanced interaction between farming and the natural environment, as outlined below.

Table C.1: Management objectives for each biodiversity category

Biodiversity category	SPC	Biodiversity Management objectives (Maree and Vromans, 2010; Esler *et al.*, 2014).
Statutory protected areas	Core 1	Maintain as natural land.
Critical Biodiversity Areas		Rehabilitate degraded areas to a natural or near-natural state. Manage against further degradation and for no further habitat loss
Ecological Support Areas	Core 2	Maintain at least in a near-natural state to ensure that these components of ecosystems remain functional (some loss of habitat can be tolerated). See management objectives for Buffer 1.
Other Natural Vegetation (intact, adjacent to CBAs)	Buffer 1	Must serve as undeveloped buffers between CBAs and cultivated areas. These areas may be developed provided that: They are depicted on FLMPs; Optimal buffer widths have been determined by a biodiversity specialist; Fragmentation is discouraged; Veld is burnt in blocks larger than 300 ha; Managed burns on smaller farms are not less than 100 ha, and blocks of less than 50 ha are burnt in one go; and Alien plants are removed.
Other Natural Vegetation (in transformed, agricultural matrix)	Buffer 2	Areas favoured for land-uses other than biodiversity conservation. This land may be developed, provided that: It is depicted on FLMPs; Development is consistent with sustainable agricultural practices as defined by the best practice guidelines for the potato and rooibos sectors; and Prior to any transformation, patches less than 50 ha should be burnt in one go and kept free of alien invasive species.
Cultivation 1	Centre pivots	Manage in support of sustainable agricultural production with regard to soil conservation and maintenance of soil health, control of run-off and contaminants, protection of water resources
Cultivation 2	Dryland fields	

Farm planning will entail detailed assessments and recommendations with regard to the identification of the different land-use categories, to the extent that they may be represented on individual farms. Land will also be mapped, according to the category which applies to it.

The FEPA implementation manual (Driver *et al.*, 2011) includes management guidelines for the different types of FEPA that are linked to ecological objectives for rivers and wetlands. The management units and objectives that are addressed by the FEPA guidelines are outlined in the table below.

Table C.2: Management units and objectives addressed by FEPA guidelines

FEPA type	Overall management objectives	Land-use implications
Wetland FEPAs and wetland clusters	Flow and inundation regime must keep wetland FEPAs in a good (A or B category) condition. If wetlands not in an A or B condition, they must be managed to the best attainable ecological category (i.e. C or better).	Practices that lead to the deterioration of wetland FEPAs are not acceptable. Practices that would impede rehabilitation of a wetland FEPA are also not acceptable.
River FEPAs	River FEPAs that are currently in a good condition (A or B ecological category) should remain so.	Practices that lead to deterioration in the current condition of a river FEPA are not acceptable
Sub-quaternary catchments associated with river FEPAs and upstream management areas	Management of land-use practices in the associated sub-quaternary catchment upstream management areas must aim to retain river FEPAs in their current condition. Cumulative impacts must be managed in the catchment and upstream areas.	Land use practices in the associated catchment must be managed. Practices that result in the deterioration in the current ecological condition of a river FEPA are not acceptable. Cumulative impacts need to be managed. Some streams and wetlands may be impacted, but only if this does not lead to deterioration in condition of the downstream river FEPA.

General guidelines for farm management: Potatoes and rooibos

The biodiversity best practice guidelines for potatoes and rooibos provide a set of region specific management objectives and procedures to lead land owners and farm managers towards sustainable practices with the lowest impact on the environment and natural resources.

The following are key points from the guidelines, with direct relevance to the Sandveld EMF:

- The compilation of a base map to ensure proper development planning, with due cognisance of the environmental constraints to farming opportunities;
- Guidelines for land clearing that take CBAs and ESAs into consideration, and also conforms to legal requirements in terms of CARA and NEMA;
- The sustainable use of groundwater resources and the proper registration of and application for legal abstraction;
- The implementation of buffer zones between cultivated fields and water bodies, streams or natural vegetation, to minimise impact potential;
- Guidelines to minimise the risk of groundwater contamination from nutrient, fuel or other potential agri-chemical pollution sources;
- Controlled farm traffic to minimise farm roads and tracks within natural vegetation;
- The planned and systematic removal of alien invasive plants;
- Veld fire management strategy and control measures;
- The maintenance and preservation of wetlands, rivers and river banks;
- The conservation of natural vegetation corridors and the prevention of habitat fragmentation;
- Game management guidelines, inclusive of friendly practices to allow freedom of movement of harmless game species, the management of problem animals and the control of feral fauna;
- Waste management guidelines to ensure responsible disposal of refuse and other waste products; and
- Compilation of an environmental management plan to ensure responsible development of farming enterprises.

Apart from the wide scale adoption of environmentally friendly best practices as listed above, the priority areas for optimising farming practices in terms of the objectives of the

EMF, relates to only two main themes namely (i) a reduction in the expansion rate of the agricultural footprint and (ii) the sustainable use of the groundwater resources.

Although the expansion rate of the agricultural footprint is partly linked to economic growth and market demand, there is also some suggestion that production on virgin land offers significant yield benefit for both main crops, potatoes and rooibos. The phenomenon is probably related to soil health which deteriorates with continuous cropping. Crop rotation is therefore essential to maintain soil health. A limited water supply often limits the incorporation of other crops in the rotation cycle of irrigated crops, mainly potatoes. The largest part of a potato crop rotation system is therefore largely unproductive fallow land. The duration of the cropping cycles, as prescribed by the potato seed certification scheme has as its main goal the production of the best quality seed potato tubers. The specific prescribed duration of the cropping cycle, e.g. one in five years, is related to the generation of the seed tubers, but results in a footprint of 5 hectares for every single hectare under production. A reduction in this prescription will therefore reduce the effective footprint and may lead to a reduction in the rate of expansion of the agricultural footprint. The viability of such a reduction in the prescription is, however, unknown and is recommended as a research priority. Similar observations in the reduction in rooibos yields on old fields have been noted and should also be a research priority for that industry.

In addition to the preservation of soil health, all farming practices should be in support of higher production efficiency. These include making use of only good quality seed and plant material; adjusting plant nutrition to measured soil fertility; continuous monitoring of plant health linked to timely disease control; and optimisation of irrigation scheduling through soil moisture measurement, climate monitoring and efficient irrigation systems.

The sustainable use of the groundwater resource also relies on higher water use efficiencies linked to the general practices as listed above, but also relies strongly on (i) the monitoring of the resource itself (i.e. measuring groundwater levels and quality as well as the temporal changes) and (ii) longer term regional planning and monitoring in support of sustainable abstraction rates underpinned by water use licencing.

The farm planning process

Farm planning needs to be approached systematically in order to ensure consistency with the Sandveld EMF. It entails six inter-related components:

- Setting goals and objectives for managing the farm as an agri-ecological unit;
- Designing a management strategy;
- Identifying enabling measures;
- Drawing up an implementation plan
- Making provision for monitoring and performance review; and
- Adapting farm practices, and refining the farm management plan, on the basis of the performance review.

The table below sets the farm planning process out in more detail.

Table C.3: The farm planning process

GOALS	The Sandveld EMF aims to Promote productive farming in harmony the natural environmental systems and resources that underpin sustainable agriculture; Promote co-operative environmental governance; and Streamline regulatory procedures relating agricultural expansion.
LAND-USE CATEGORIES	Areas that must be managed in support of specific biodiversity outcomes (Core 1 and 2) Areas of remaining indigenous vegetation that may be available for cultivation (Buffer 1 and Buffer 2) Areas that are utilised for intensive agricultural production (Cultivation 1 and Cultivation 2)
MANAGEMENT OBJECTIVES FOR EACH LAND-USE CATEGORY	These are the overarching objectives that define the kind of outcomes that are desired for the affected ecosystems and farms. The management objectives provide guidance as to the desirability of farming-related activities with respect to land-use category.
Areas that must be managed in support of specific biodiversity outcomes	
Core 1 - CBAs	Maintain undisturbed habitat in a natural condition; or Actively restore degraded habitat to a natural or at least near-natural condition, and manage it accordingly
Core 2 - Mapped ecological support areas, remnants of Endangered vegetation	Manage/restore to maintain: Environmental and ecological processes in support of aquatic CBAs; and/or Ecological corridors that link CBAs across the landscape
Areas of remaining indigenous vegetation that may be available for cultivation	
Buffer 1 - Non-threated vegetation in 'other natural areas' that abut CBAs	Must serve as undeveloped buffers between CBAs and cultivated areas.
Buffer 2 - Non-threated vegetation in 'other natural areas' with cultivated matrix	Must be managed for sustainable development of current land uses in the area
Areas that are utilised for intensive agricultural production	
Cultivation 1 - May only be used for irrigated agriculture	Manage in support of sustainable agricultural production w.r.t. soil conservation and maintenance of soil health, control of run-off and contaminants, protection of water resources, etc.
Cultivation 2 - Dryland production. May be compatible with farm buildings and additional dwellings	

MANAGEMENT STRATEGY	This is the strategy that needs to be developed and implemented to achieve the management objectives. This strategy will be tied in with defined management 'targets' (i.e. desired and measurable outcomes') that are to be achieved by means of specific actions or projects. Its other components are: Enabling measures An implementation plan Provisions for monitoring and performance review Provision for adaptation of the strategy and its components.
ENABLING MEASURES	These define the preconditions for implementation of the management strategy, by means of an implementation plan. A crucial first step is to map farms according to the LandCare method Enabling measures would include establishing an effective system of co-operative governance that provides for stakeholder involvement in planning, and co-ordinates resources and capacity for implementing management actions or projects. They may also entail identifying options for formalising the system of agri-environmental management by means of statutory instruments such as biodiversity management plans and agreements (NEMBA), Farm-Level Management Plans (CARA) or water use (NWA) and/or maintenance management (NEMA) plans.
IMPLEMENTATION PLAN	This is an 'action plan' which identifies specific actions, projects and implementing agencies to undertake a step-by-step process aimed at implementing the management strategy.
MONITORING AND PERFORMANCE REVIEW	This is an integral component of any system of objectives'-led adaptive management. It assists in tracking performance w.r.t. the achievement of targets (measurable outcomes) that are linked to each management objective, per focal area. Key elements include identifying indicators, and monitoring methods and intervals. The allocation of responsibility for monitoring needs to be determined in consultation with stakeholders, in accordance with the principles of co-operative, ecosystem-based management. Monitoring results need to be reported, and management performance reviewed accordingly.
ADAPTATION AND REVISION	Provision must be made for translating the findings of the monitoring programme, and their review, into changes to the management system and actions/projects that would, where necessary or relevant, assist in achieving the respective management objectives.

Guidelines for managing indigenous vegetation, wetlands and rivers on farms

The guidelines below indicate some of the key actions that potentially would be necessary to achieve the ecological management objectives for those parts of the farm that fall within the Core 2, and Buffer 1 and Buffer 2 land-use categories. They should be refined during farm planning.

They are organised according to the major ecosystems in which farming takes place within the domain of the Sandveld EMF. Unless indicated otherwise, these guidelines are based on:

- The Fynbos Forum Ecosystem Guidelines for Environmental Assessment in the Western Cape (De Villiers *et al.*, 2005)
  - Strandveld — Nick Helme
  - Lowland fynbos — Nick Helme
  - Midland/mountain fynbos — Nick Helme, Pat Holmes and Tony Rebelo
  - Succulent Karoo — Nick Helme
- Fynbos: Ecology and Management (Esler *et al.*, 2014)
  - Managing natural vegetation fragments in agricultural and urban environments
- Freshwater guidelines for the Sandveld fine-scale planning domain (Job *et al.*, 2008)
  - Non-isolated floodplain wetlands
  - Non-isolated valley bottom wetlands
  - Non-isolated seeps
  - Isolated and non-isolated depressional wetlands
- NFEPA atlas (Nel *et al.*, 2011) and implementation guidelines (Snaddon, 2010; Driver *et al.*, 2011).
  - Wetland and estuary FEPAs
  - River FEPAs (including flagship free-flowing rivers).

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Appendix D: Developments on farms that may need legal approvals

EXAMPLES OF DEVELOPMENT ON FARMS THAT MAY NEED ONE OR MORE LEGAL APPROVALS WHICH COULD BE REVIEWED I.T.O. THE SANDVELD EMF

Note that (a) this list is not exhaustive and (b) projects may involve several activities, regulated by different laws. It is therefore essential to **'unpack' the development into its component activities and aspects in order to check likely legal implications.**[143]

Table D.1: Activities/Development on farms that may need one or more legal approvals

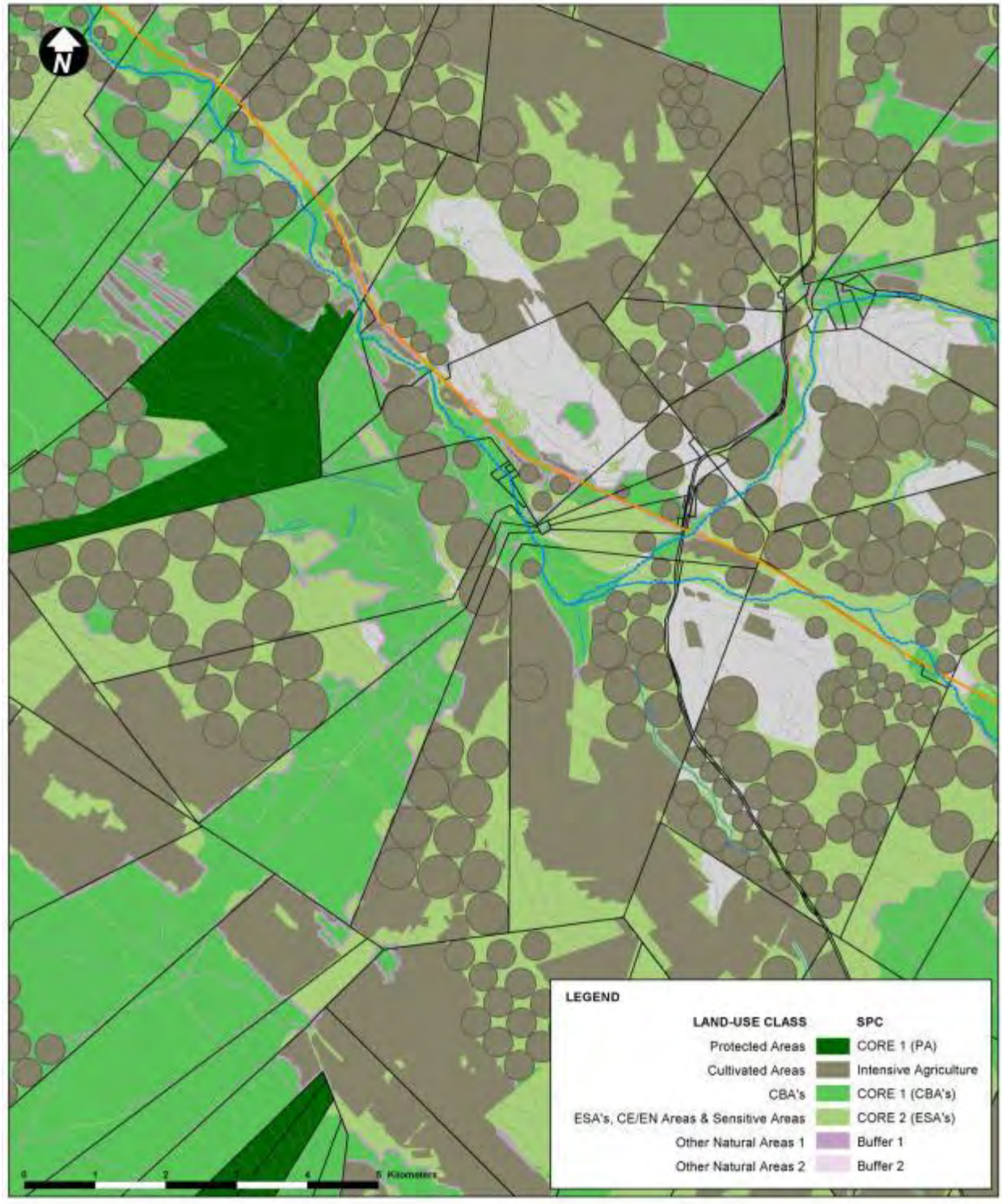
Activity	NEMA	NEMBA/ NEMPAA	CARA	NWA	NHRA	NWA	NVFFA	SALA	SPLUMA & other planning laws	Provincial conservation ordinances
Cultivation of 'virgin land'	✓		✓			✓				
Clearing of natural/ indigenous vegetation	✓		✓							
Alteration of drainage, extraction of surface water	✓			✓						
Abstraction of groundwater				✓						
Construction and expansion of dams, reservoirs, impoundments	✓		✓	✓		✓				
Construction of bridges, slipways, jetties	✓			✓						
Anti-erosion measures	✓		✓	✓						
Clearance of flood channels and river banks	✓		✓	✓						
Disturbance/ destruction of wetlands, floodplains, estuaries	✓		✓	✓						
Concentration of livestock (e.g. poultry, ostriches, pigs, cattle etc.)	✓									

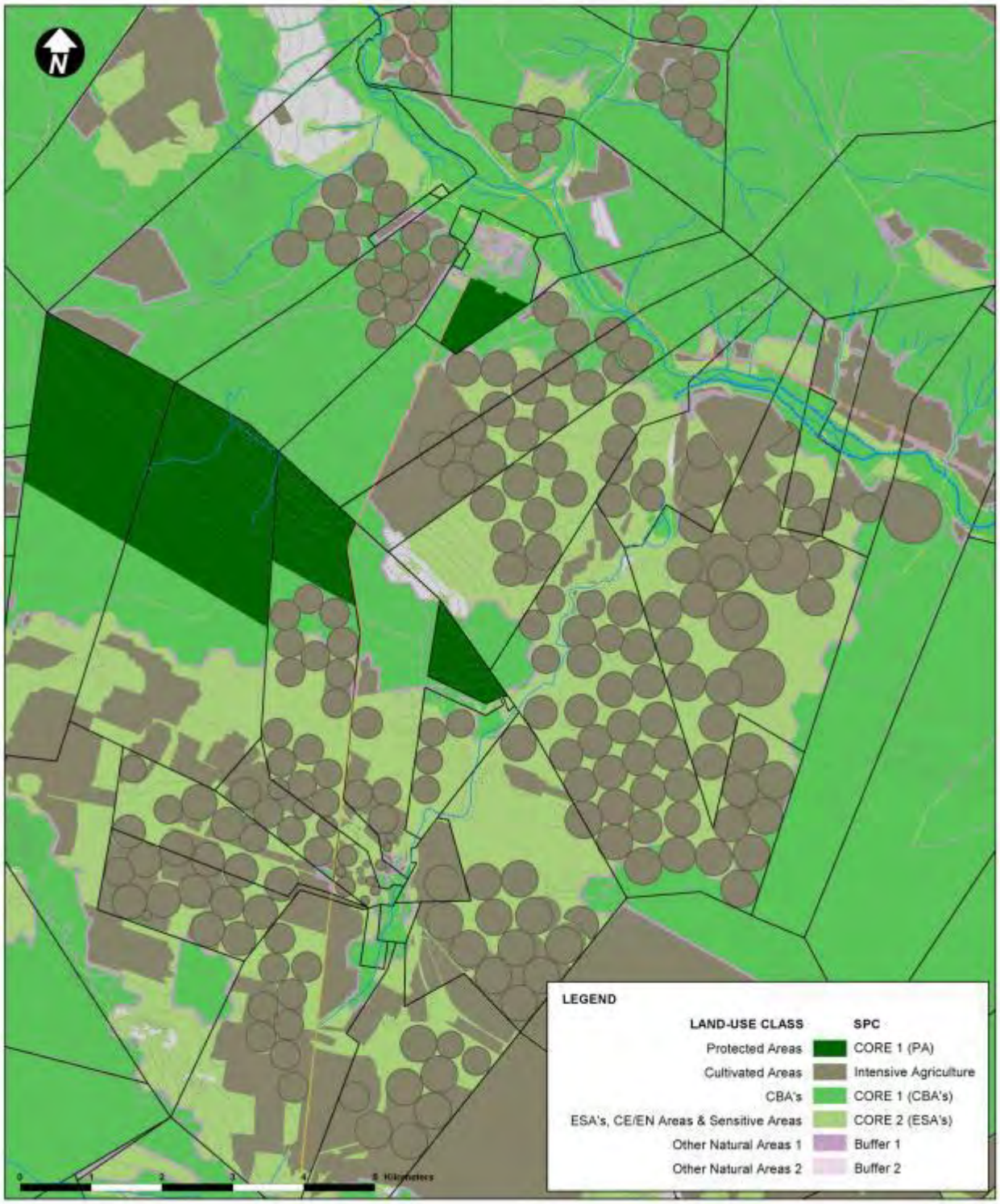
[143] **NEMA** = National Environmental Management Act 107 of 1998; **NEMBA** = National Environmental Management: Biodiversity Act 10 of 2004; **NEMPAA** = National Environmental Management: Protected Areas Act 57 of 2003; **CARA** = Conservation of Agricultural Resources Act 43 of 1998; **NWA** = National Water Act 36 of 1998; **NHRA** = National Heritage Resources Act 25 of 1999; **NVFFA** = National Veld and Forest Fire Act 101 of 1998; **SALA** = Subdivision of Agricultural Lands Act 70 of 1970; **SPLUMA** = Spatial Planning and Land Use Management Act 16 of 2013; **NFA** = National Forests Act 84 of 1998.

Activity	NEMA	NEMBA/ NEMPAA	CARA	NWA	NHRA	NWA	NVFFA	SALA	SPLUMA & other planning laws	Provincial conservation ordinances
Treatment and discharge/ disposal of waste water144	✓			✓						
Sewage disposal	✓			✓					✓	
Solid or hazardous waste disposal				✓						
Firebreaks and controlled burns			✓				✓			
Activity affecting threatened or protected species of plant and/ or animal		✓								✓
Control of invasive alien plants		✓	✓	✓						
Sub-division of agricultural land						✓		✓	✓	

[144] Waste-related activities may require authorisation under the **NEM: Waste Act** 59 of 2008. This must be clarified with your provincial environmental department.

Appendix E: Sample maps illustrating land use categories at farm level




N
LEGEND
LAND-USE CLASS
SPC
Protected Areas
CORE 1 (PA)
Cultivated Areas
Intensive Agriculture
CBA's
CORE 1 (CBA's)
ESA's, CE/EN Areas & Sensitive Areas
CORE 2 (ESA's)
Other Natural Areas 1
Buffer 1
Other Natural Areas 2
Buffer 2
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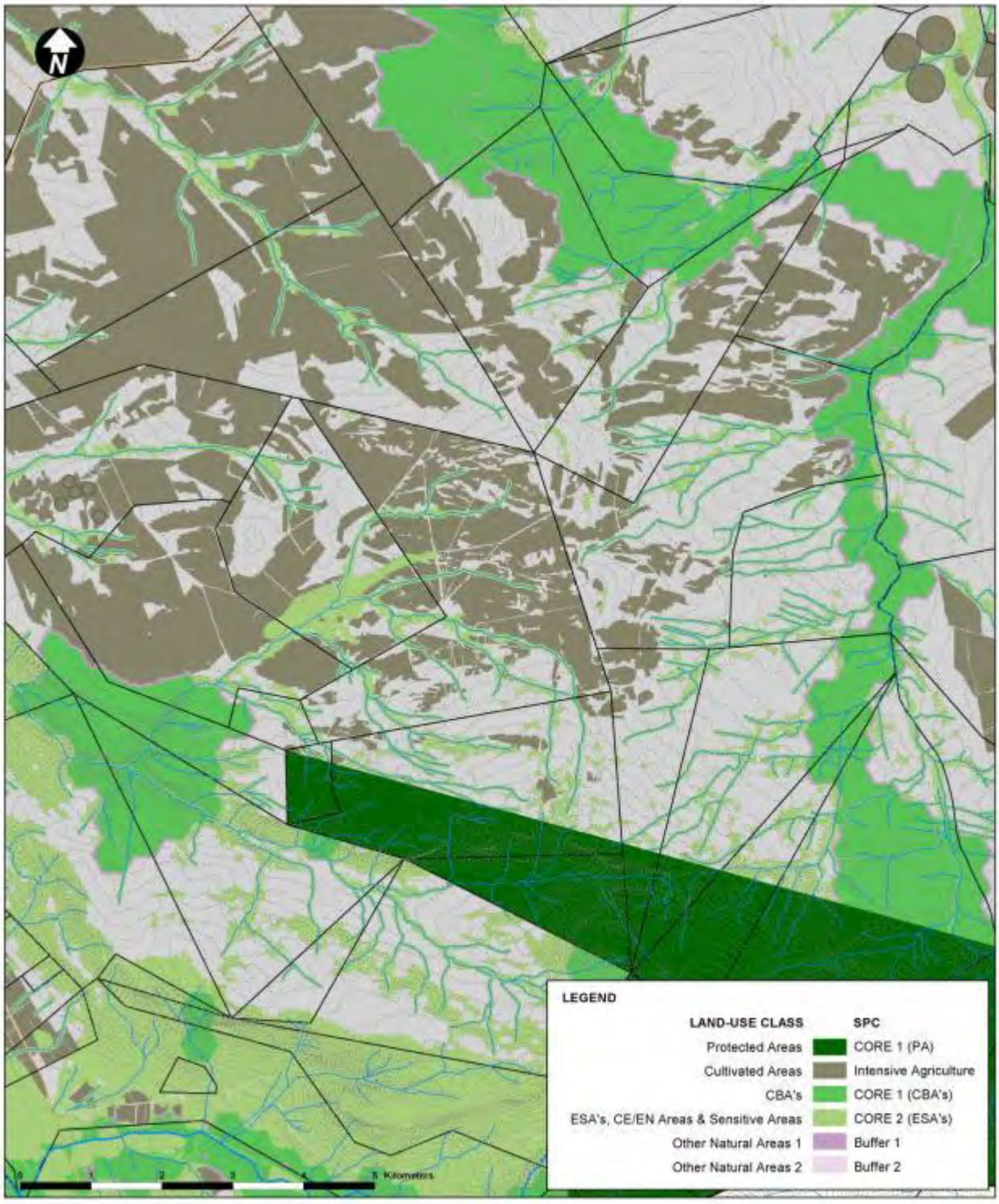
1
2
3
4
5 Kilometers


N
LEGEND
LAND-USE CLASS
SPC
Protected Areas
CORE 1 (PA)
Cultivated Areas
Intensive Agriculture
CBA's
CORE 1 (CBA's)
ESA's, CE/EN Areas & Sensitive Areas
CORE 2 (ESA's)
Other Natural Areas 1
Buffer 1
Other Natural Areas 2
Buffer 2
0
1
2
3
4
5 Kilometers

Western Cape Government Department of Environmental Affairs and Development Planning
Leeusig Building, 2nd Floor, 1 Dorp Street, Cape Town, 8001
Private Bag X9086, Cape Town, 8000
Tel: +27 21 483 4247/4114 **Fax:** +27 21 483 3625
Website: www.westerncape.gov.za/eadp

Email: Liza.Petersen@westerncape.gov.za
John.Wilson@westerncape.gov.za

Western Cape Government