Republic of Namibia
Ministry of Lands and Resettlement
Ministry of Environment and Tourism

Strategic Environmental Assessment (SEA) for the Karas Integrated Regional Land Use Plan (KIRLUP)

Final Report

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EXECUTIVE SUMMARY

This Strategic Environmental Assessment (SEA) looks at the suggestions and proposals of the Karas Integrated Regional Land Use Plan, with the objective to develop sustainable options, identify the potential of the region's natural resources and to achieve the land uses that best fit that potential. The parallel processes of Land Use Planning and SEA, led by the Ministry of Lands and Resettlement, and being piloted in Karas Region as a model for improved planning, can be seen as an assessment and identification of opportunities. In this light, this SEA concludes with some ideas that will help to achieve sustainable development in the region and contribute to achieving Namibia's Vision 2030 goals.

The SEA process involved the following parts:

- Information gathering (data collection and evaluation, site visits, expert discussions)
- Scoping, to identify the main issues and agree on the method of assessment. Meetings were held internally in Windhoek and invited stakeholder input in Keetmanshoop. The agreed method was to assess identified development proposals and trends against a number of criteria (e.g. their impact on biodiversity, livelihoods, sense of place, and others), to arrive at a conclusion of the most significant impacts and concerns.
- Baseline analysis and sector-by-sector assessment through Focus Group Discussions (FGDs). This process involved many technical decision-makers at relatively high level to achieve 'buy-in' from the relevant sectors, to receive well informed opinions and rational proposals, and to achieve integration between sectors.
- Collaboration with the LUP, through properly motivated adjustment and refining of the zoning proposals.
- Compilation of the SEA report

Additionally, the SEA identifies the region's natural strengths and most limiting factors. It considers what's coming in terms of climate change, and how people can make themselves less vulnerable to the present arid climate and the increasing variability that climate change is expected to bring. The main economic sectors and land uses are considered, at present and with an eye to the future. Issues of concern to the region's sustainable growth are highlighted as **RED FLAGS**.

The natural potentials in Karas are based on five main factors:

- Mineral riches, based mainly on the world's largest productive sedimentary diamond deposits, and on other mineral occurrences;
- Open landscapes and beautiful scenery, an asset of increasing value in a crowded world;
- Plentiful sunlight and localised strong winds, both potentially useful energy resources;
- The Orange River valley with its warm climate and perennial water that favours irrigation farming (but with efficient use of water, see limiting factors below)
- The Atlantic Ocean with its rich Benguela Current and a limitless supply of water for potential desalination.

The greatest limiting factors in Karas include:

- The arid climate and an overall shortage of water. Supply of water from the Orange River, although perennial, is limited and getting scarcer. Groundwater potential is low overall.
- Poor soils and rangeland productivity;
- A poor skills base, evident in high unemployment, little value addition and manufacturing, and severe urban poverty.

Climate change is expected to cause a significant decrease in primary productivity (= growth of fodder), brought on by lower rainfall, higher temperatures, increased variability of rains and higher rates of evaporation. The greatest impact will be on livestock farming, which will become even more marginal.

AGRICULTURE

Irrigation farming

Conditions in the very hot lower Orange River valley provide a competitive advantage for irrigated, export-quality, high-value crops such as table grapes and dates. Namibia presently achieves great economic benefit from the irrigation farms at Noordoewer and Aussenkehr, although the low price paid for water allows farmers to use wasteful methods such as centre-pivot sprinkler systems. Since Karas is the most water-deficient part of the country (taking high evaporation into account), irrigation methods should be much more water-efficient. Examples include drip irrigation, micro-sprays and underground irrigation (water delivered directly to the root zone).

The apparent abundance of water in the Orange River is misleading, since both the quantity and quality of water is declining. The wetland at the river mouth, which serves as a good indicator of the river's ecological health (especially in its lower reaches), is classified as internationally important and is listed on the Montreux Record as one that is degraded. Climate change is likely to make the water situation even more critical. Irrigation potential using Orange River water is vulnerable to these risks and to abstraction upstream. Carefully considered tariff systems should be used as a demand management strategy that incentivises farmers to use water-efficient irrigation methods and to concentrate on high value crops.

Orange River water quality is getting poorer from the return flows from irrigation farms (in SA and Namibia) which carry high loads of pesticides and leached fertilizers. This threatens the ecological integrity of the Orange River as an important linear oasis through the arid surroundings, particularly the mouth which is recognised as a wetland of international importance. Return flows of water could be significantly reduced using more efficient irrigation methods.

High-value crops are targeted at discerning overseas customers, so the quality has to be excellent to achieve the profits that are sought. Irrigation farming requires skilled farmers and high capital and running costs. These conditions mean that irrigation farming is not very effective at improving local livelihoods. The main benefit to local people is through their unskilled, seasonal labour. Namibia's draft Integrated Water Resources Management Plan (MAWF 2010a) states that shortcomings in the water sector are "a focus on developing new sources rather than managing existing ones better, and top-down sector approaches to water management result in uncoordinated development and management of the resource." The proposed Neckartal Dam is an example of this approach, and is predicted to achieve far less economic growth and benefit to local people in Karas Region than is being proposed. For eco-

nomic, social and environmental reasons, this SEA considers the Neckartal Dam to go against many principles of Vision 2030, NDP3 and IWRM, and to be unsustainable. This is raised as a **RED FLAG.**

The irrigation schemes at Noordoewer and Aussenkehr, including proposed expansions, are supported by this SEA, only if water-efficient irrigation methods are used. Monitoring of the amount of water consumed for irrigation along the Orange is very poor. Management of this critical resource should be much tighter.

Livestock farming

The greatest part of Karas Region is dedicated to farming with small stock, predominantly sheep. Although this is consistent with the MAWF's agro-ecological zoning, the habitat is marginal even for these hardy animals. Karakul are probably the best suited and most profitable domestic animals for this arid terrain. Goats make up about a fifth of all livestock in Karas. Slaughtering of goats and sheep is dictated by the Small Stock (6:1) Policy by which a farmer can only export 1 live animal (and get a good price for it in SA) for every 6 animals slaughtered in Namibia (where the profit is lower). Although the policy is supposed to create an incentive for local value addition and employment, it has almost no support from local farmers. Many are shifting over to cattle farming which is not affected by this regulation, and small stock numbers in the region are declining. Cattle make up less than 5% of the total livestock but their numbers are growing. They require more grass pasture and water than small stock and so are less suited to the arid shrubby habitat, and their growing numbers have a negative impact on rangeland health. The Small Stock Policy in its present form is noted as a **RED FLAG**. This SEA does not support the zonation for large stock farming (in north-eastern Karas) as proposed in the KIRLUP.

Climate change will make southern Namibia even less suitable for stock farming, with primary productivity (= carrying capacity) expected to decline significantly by 2080. Additionally, insect-borne diseases such as Rift Valley Fever are likely to become more prevalent in the south. Wildlife, especially springbok and gemsbok, are far better suited to arid conditions and many farmers are already diversifying to tourism and wildlife for economic reasons. Night culling of springbok for export to SA is a growing market. If managed and monitored properly, this trend is seen as positive for environmental health and is expected to grow steadily.

Indigenous plants and small-scale agriculture

Hoodia, the desert plant with supposed great pharmaceutical potential as an appetite suppressant, has not risen to commercial expectations and may decline in importance. Devils Claw is harvested in the north-eastern parts of Karas, and offers some commercial benefit. The marketing and promotion of these indigenous products for commercial gain is encouraged, as they diversify local livelihoods. Ad hoc harvesting of wild Hoodia and Devils Claw plants is illegal and is not supported by this SEA. Small-scale gardening projects for local food production are plentiful in the region. These are beneficial for local livelihoods and, individually and cumulatively, have very little environmental impact. However, groundwater supplies may, in some cases, limit the extent of these schemes.

CONSERVATION AND TOURISM

This sector has been growing steadily and holds the greatest potential for continued strong growth in Karas Region. The competitive advantage of the region relates to a number of key facts and resources:

- Fish River Canyon, the second largest canyon in the world;
- Nomination of the Greater !Gariep area (lower Orange River and surrounds) as a World Heritage Site;
- Established and growing populations of desert animals such as gemsbok, ostrich and springbok, and unique vegetation in the world's only plant biodiversity hotspot in an arid region;
- Varied recreational activities including 4x4 routes, river rafting, hiking, and camel or mule or horse treks, through spectacular landscapes;
- Historic relicts of diamond mining in the Sperrgebiet and outstanding coastal landscapes;
- Rich cultural and historic heritage of the Nama people and the German colonial period;
- Interesting geological features such as a meteorite crater, fossils, an extinct volcano;
- Good roads and telecommunications, and a growing number and diversity of accommodation establishments, which provide for most tourist necessities. Transit routes into southern Namibia from South Africa, linked with the Trans-Frontier Conservation Area, are well established.

Formal Protected Areas and areas under conservation management (including private game farms and communal conservancies) make up about 40% of the area of Karas. The reality of climate variability, making livestock farming less profitable, is likely to continue the shift towards farming with wildlife and tourism. In particular, land adjacent to protected areas is more profitable under conservation management than under conventional farming, and leads to a reduction in park-neighbour conflicts as land uses become more compatible. This SEA supports this shift for promoting conservation and the improved socio-economic benefits they can bring. As an over-arching guideline, the continuity of areas under conservation management should be increased, under the motto "Karas Network Natura".The Gondwana Canyon Park complex is seen as a model for turning protected areas and wildlife-landscape resources into economic engines.

Mining is a potential threat to this form of land use but it can and should be managed so that the impacts are considerably reduced. Unavoidable problems only occur if profitable mineral deposits occur in areas of high biodiversity or landscape value.

Other conflicts with conservation and tourism include the loss of aesthetic value from ugly infrastructures such as powerlines, telecommunication towers and roads. These can be planned and constructed so that they provide the necessary services without detracting from the value of scenic landscapes.

MINING

Mining operations are strong economic drivers, and increasingly they are responsible developers. They bring large investments which can be used to tackle significant national priorities such as desalination, skills development and infrastructure e.g. town, roads, solar energy. The mining sector in Karas is dominated by diamonds along the lower Orange River and the coastal strip up to Lüderitz, and by heavy metal deposits at Rosh Pinah and Skorpion. Other mineral occurrences with possible potential are copper at Haib, and uranium at Warmbad, Aus and Garub.

The main environmental threats from mining in the region are the heavy demand for water, and the risk of pollution. Landscape alterations on a large scale, that have occurred during coastal diamond mining operations, are relatively benign except for the visual impact. Rehabilitation of past mine dumps and

ponds along the coast will occur to a limited extent, but all modern earth-moving operations for diamonds are now rehabilitated as an ongoing 'mend while you mine' policy.

Significant pollution threats (contamination of soils and groundwater by heavy metals) have been detected at Rosh Pinah and are identified as a **RED FLAG**. The threat of long-term contamination needs to be properly addressed in the closure plans of this and all mines, so that there is not a legacy of pollution and health risks left by the mines.

Exclusive Prospecting Licences (EPLs) for minerals grant the holder access to any land, and almost the entire Karas Region is covered by EPLs. This is a potential problem in areas that are under farming or conservation management, through activities such as off-road driving, drilling and poaching and just the presence of people where wilderness value is the main land use. The Minerals Ancillary Rights Commission offers a dispute-resolution forum in the case of such conflicts.

An important principle for new mines is that they should not start up new settlements (e.g. for accommodating labour), but should rather invest in existing towns. This is to prevent the future occurrence of ghost towns after mine closure. As part of their social responsibility, mines should invest in training and capacity building programmes that will help to build skills for a diversified economy after closure. The legacy of the mine should continue in improved social and economic conditions, and sustained environmental health, after the mineral resources have been removed.

An idea to consider for the future of Rosh Pinah after closure of the mines is to use the town as a centre for solar power generation, research and development.

ENERGY

Energy developments in the region and in Namibia as a whole are strongly influenced by external factors, especially in South Africa. Local issues are subservient to the strategic decisions of the Southern African Power Pool.

The main manifestation of energy infrastructure in Karas Region is powerlines. Main transmission lines running from South Africa to feed the Namibian network run through Karas, and the network serves all towns and most settlements. The most important impacts of powerlines are aesthetic, as well as the dangers to birds such as large raptors and bustards which suffer mortalities from electrocutions and collisions. These impacts can be mitigated through careful routing of lines and specific bird-related measures.

Generation schemes are proposed along the Orange River and at Oranjemund. Strategically, the development of energy generation capacity using natural resources is supported. Preliminary work on the Lower Orange River Hydro-Electric Power Scheme (LOHEPS) has not identified any fatal flaws, and this project is likely to begin construction in 2012. No major conflicts are identified, but the project is vulnerable to continued adequate flows in the Orange, so that there remain risks of impacts on the wetland ecosystems. The proposed power station close to Oranjemund fuelled by Kudu gas is being started up again as a viable project now that gas price obstacles have been overcome. The most significant impact is the risk of oil pollution from the marine industrial operations. There is a relatively small land-use conflict with Namdeb, since the gas pipeline will exclude diamond mining operations from a specific area. The loss of this potential mining income has been agreed to by Namdeb.

As Namibia's sunniest region, and its coastal strip the windiest, Karas has great potential for renewable energy generation. A wind park is under consideration for Lüderitz. A few solar power generation projects are proposed in the region, but are still only in the very early stages of planning. There is possibly an argument for using the Rosh Pinah town, its infrastructure and mine facilities as a hub for solar power generation, research and development, which would help to maintain the life of the town after the closure of the Rosh Pinah and Skorpion mines. Electricity could be used to power desalination at the coast, providing water for Oranjemund and Rosh Pinah, and possible new mines.

Domestic energy needs in towns are largely supplied by electricity and paraffin, but there is heavy reliance by low income groups on wood. The alien invasive tree, *Prosopis*, is the main source, and it should not be removed unless it is severely harming environmental flows in water courses.

FISHING

The fisheries sector has been the economic backbone of Lüderitz, which serves as one of Namibia's two main ports. The harbour town provides services to the fishing industry and the processing factories which preserve and package fish products mainly for export to Europe. For roughly the last two decades there have been diminishing stocks of important species such as hake and rock lobster, and thus the fisheries sector is in steady decline.

Mariculture, the growing and harvesting of marine products such as seaweeds, abalone, oysters and rock lobster, are growing industries in Lüderitz Bay, and show economic potential. While their development is promoted, their vulnerability to occasional natural marine events such as red tides and low-oxygen water must be noted. Big pollution events have not occurred in Namibian waters; an oil-spill or equivalent accidental spill could be disastrous for this sector.

Marine diamond mining involves disturbance of the sea floor and smothering of biota, but this is localized and affects only about 5 km² per year, so the small scale of it and the natural ability to recover make this overall impact quite small. Again, the greatest risk stems from the possibility of pollution if a vessel capsizes.

Fresh-water fisheries (aquaculture) have some potential in Karas as a diversification of local livelihoods. No significant impacts or conflicts are predicted, while their development synergises with existing and planned infrastructures such as Naute and Neckartal Dams.

TOWNS AND INFRASTRUCTURE

Transport infrastructure such as roads, rail and port facilities are generally well developed in Karas and pose no significant environmental threats as known so far, and mitigation measures at the project level can adequately minimize environmental damage. Especially barrier effects to animal migration mostly due to road kills need to be assessed properly.

With most of its population living in urban settings, there is great pressure on government and local authorities to provide effective social services such as education and health facilities; water, waste and sanitation; and security and recreational outlets. In mining towns such as Oranjemund and Rosh Pinah, these are carried adequately and the towns contain enough employed people that the services can be

paid for. Other centres such as Keetmanshoop and Karasburg do not have the benefit of supporting industries and the high proportion of unemployed people in the towns means that little income is available from rates and taxes to pay for the services. Overall, poverty, accompanied by deterioration of social services and of the social fabric in Karas communities, is identified as a **RED FLAG.**

ASSESSMENT OF CUMULATIVE IMPACTS

The Orange River is understandably a focus area for development in the Region, but is reaching its limit in terms of availability of water for abstraction. Additionally, water quality is declining significantly. This report cites the considerable body of information which shows that the Orange River water resource is over-exploited and abused, and that its Ramsar wetland at the mouth is now placed on the Montreux Record as a degraded wetland. The cumulative impacts of irrigation schemes, water for towns and luxury developments such as golf courses, and mining, is highly significant and is likely to influence how these developments continue in future. Climate change will exacerbate these impacts. Future planning should not take for granted that ample water will always be available. Planners and developers also need to recognise the importance of environmental flow requirements so that the resource is kept in a healthy state and is able to support people's needs in future.

The Fish is the most important ephemeral river in the region, and has been described as Namibia's closest resemblance to a perennial river within its borders. Flows and environmental health downstream are going to be significantly impacted by the Neckartal Dam development, which will also cumulatively add to the pressures on the Orange River mouth since its flow contributions to the Orange will decline.

CONCLUSIONS AND SUSTAINABLE DEVELOPMENT SUGGESTIONS FOR KARAS REGION

Considering the key natural resources and the limiting factors of the Karas Region, the following suggestions are made to help Karas Region achieve sustainable economic development and contribute to Vision 2030.

Strengthen the role of Integrated Water Resources Management

The Orange-Fish River Basin Committee and its parent ministry, MAWF, should take the lead in promoting Integrated Water Resources Management in the region. NDP3 states a key activity in the water sector is to undertake a "pilot study on efficient irrigation methods to be used along the Lower Orange River". Water demand management, i.e. managing the amounts of water consumed through pricing or other incentives, should be urgently introduced. Demand management is also consistent with NDP3 which urges more value addition per unit of water consumed, and a strong role for functional basin management committees.

Since water is the most critical limiting factor in the region, it is appropriate that the management and monitoring systems around water use should be given a high priority. This places a great responsibility on MAWF and the newly formed Orange-Fish River Basin Committee, as well as on Local Authorities who are responsible for implementing water tariff systems.

Strengthen the wildlife and conservation sector

As an over-arching guideline, the continuity of areas under conservation management should be strengthened, under the motto "Karas Network Natura". This supports the existing trend to farm with wildlife as these animals are better suited to the arid conditions, and builds adaptation measures to cope with future climate change. Conservation and tourism are the economic future of agricultural land that is marginal. The protected areas and adjacent areas can be used as economic engines for growth in the tourism sector, by providing services to this industry and thereby improving rural livelihoods. It is recommended to implement the following measures:

- Promote wildlife populations by removing fencing to create larger contiguous management areas that facilitate movements in response to seasonal variations.
- Further facilitate wildlife movements by maintaining a corridor network that will allow animals to respond to seasonal variations and changing climates. The eastern edge of the Namib protected areas should be open with farming neighbours into the escarpment area. Open corridors should be maintained along the Orange and main ephemeral rivers,
- Cooperate with neighbouring states to implement trans-frontier conservation areas, as is being done between South Africa and Namibia. The Kgalagadi Transfrontier Conservation Area (shared between South Africa and Botswana) should be extended to include Namibia's southern Kalahari, where there are currently no protected areas.

Establish Karas as Namibia's solar power hub

As Namibia's sunniest region, its coastal strip the windiest, and the Ocean with almost infinite water, Karas has great potential for renewable energy generation and water provision. This SEA strongly supports the proposed wind park for Lüderitz and the scattered solar power generation projects. The argument goes further, to propose the idea of making Karas a hub for renewables. Specifically, Rosh Pinah with its infrastructure and mine facilities qualifies well to be transformed from a mining town to a centre for solar power generation, research and development. Even a production industry could be established in future. Electricity could be used to power desalination at the coast, providing water for Oranjemund and Rosh Pinah, Lüderitz and possibly Aus, as well as new mines and for tourism facilities. Sea salt production could be considered as well. It is recommended to start with a feasibility study, considering technical, economic and environmental feasibility of this proposal, as well as economic and social benefits.

Build the skills base

With a poor skills base, the region will continue to struggle to really move forward. It is therefore essential to implement effective education and training programmes. As partners in this drive, major economic drivers, such as the mines, large irrigation schemes, and large-scale tourism developments like Desert Star, should include support to schools and vocational training as part of their corporate social responsibility programmes. On-the-job training and experience and apprenticeships are invaluable. Irrigation centres such as Green Schemes and Aussenkehr should run well organised training in irrigation farming. Livestock farming training (e.g. in the karakul sector) is offered and should be expanded. Hospitality training should be offered through tourism enterprises. Technological training is offered through NIMT and Cosdef, and should be expanded. All these initiatives are worthwhile and essential investments in the future prosperity of the region.

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List of abbreviations

a	annum
BAWESG	Bird and Wind Energy Specialist Group
CBS	Central Bureau of Statistics, NPC
Cosdef	Community Skills Development Foundation
CSIR	Council for Scientific and Industrial Research (South Africa)
CSP	Concentrated Solar Power
DEES	Directorate of Extension and Engineering Services, MAWF
DEA&T	Department of Environmental Affairs and Tourism
DRFN	Desert Research Foundation of Namibia
DWA	Department of Water Affairs, MAWF
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EPL	Exclusive Prospecting Licence
EPZ	Economic Processing Zone
FGD	Focus Group Discussion
GFRCC	Greater Fish River Canyon Complex
GOPA	Gesellschaft für Organisation, Planung und Ausbildung mbH (GOPA Consultants)
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
h	hour
ha	hectare
HAN	Hospitality Association of Namibia
IRLUP	Integrated Regional Land Use Plan
IWRM	Integrated Water Resources Management
KIRLUP	Karas Integrated Regional Land Use Plan
km	kilometer
kV	kiloVolt
kWh	kiloWatt hour
LOHEPS	Lower Orange River Hydro-Electric Power Scheme
LUP	Land Use Plan
m	metre
ML	Mining Licence
Mm^3	million cubic metres
mm	millimetre
MAWF	Ministry of Agriculture, Water and Forestry
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
MLR	Ministry of Lands and Resettlement
MME	Ministry of Mines and Energy
MPA	Marine Protected Area
MRLGHRD	Ministry of Regional and Local Government and Housing and Rural Development
N	North
Nacoma	Namibian Coastal Management project

NAU	Namibia Agricultural Union
NDP	National Development Plan
NIMT	Namibia Institute for Mining and Technology
NNFU	Namibia National Farmers Union
NPC	National Planning Commission
OECD	Organisation for Economic Co-operation and Development
Orasecom	Orange-Senqu River Commission
P+U	Planung + Umwelt
PLUP	Participatory Land Use Planning
RoN	Republic of Namibia
SAPP	Southern African Power Pool
SNAFU	Southern Namibia Agricultural Farmers Union
S	South
spp	species
Namdeb	Namibia Diamond Corporation
NNF	Namibia Nature Foundation
NTB	Namibia Tourism Board
NWR	Namibia Wildlife Resorts
OFRBC	Orange-Fish River Basin Committee
Roshcor	Rosh Pinah Corporation
SEA	Strategic Environmental Assessment
SPAN	Supporting the Protected Areas Network project
SAIEA	Southern African Institute for Environmental Assessment
SKEP	Succulent Karoo Ecosystems Programme
SPC	Stubenrauch Planning Consultants
STFA	Southern Tourism Forum Area
TAC	Total Allowable Catch
TFCA	Transfrontier Conservation Area
Unam	University of Namibia

1 INTRODUCTION

The Ministry of Lands and Resettlement (MLR) is mandated to coordinate the preparation of Integrated Regional Land Use Plans (IRLUPs) in Namibia. The integration of Strategic Environmental Assessment (SEA) into the planning and approval process in accordance with the Environmental Management Act No. 7 of 2007 is one of the innovations in Integrated Regional Land Use Planning in Namibia. Since there are no experiences and concepts at this stage on how to conduct a SEA of the IRLUP in Namibia, the design and assessment of an optimal SEA process is part of the project on "Modelling IRLUP through the Karas Region," and is the subject presented in this report.

1.1 Strategic Environmental Assessment

Strategic Environmental Assessment (SEA) is an instrument to examine the environmental risks and benefits of policies, plans and programs at various levels (national, regional and local) as described in chapter 1.2. SEA is emerging in both developed and developing countries and first experiences of implementation are made. These can be summarised as objectives and characteristics and will be described below. These objectives and characteristics apply to SEA in general. For implementation they will be adjusted to national and regional characteristics.

Objectives of SEA

There are three essential objectives that can be ensured by carrying out a Strategic Environmental Assessment:

- Promotion of sustainable development
- Provision for a high level of protection of the environment
- Integration of environmental considerations into plans and programmes
- Participation through information and consultation of all interested and affected parties

Characteristics of SEA

The major characteristics of SEA are:

- environmental approval process
- instrument for decision-making
- addresses environmental effects of strategic proposals
- includes plans and programme decisions
- undertaken when alternatives are still open
- applies EIA aims and principles
- flexible, diversified process

Process management approach of SEA

A major approach of SEA is the application of process management techniques to organise and guide interaction and communication between all actors throughout the planning and assessment process.

1.2 SEA and EIA

SEA and Environmental Impact Assessment (EIA) are both instruments for the protection of the environment. However, there are important differences. One major difference is the time of performance within the decision making hierarchy.

1.2.1 Lessons learnt from the EIA approach

Environmental Impact Assessment (EIA) is an appropriate tool for evaluating impacts on the decision making level for project implementation. However, it has been recognised as being a "toothless lion" for reaching the overall goals of precautionary protection of the environment and sustainable development. The lessons learnt from the EIA approach can be summarised as follows:

- EIA is often performed too late. Mostly the assessment refers to projects (end-of-the-pipe technique).
- Decisions concerning location of the project and type of project have been made. EIA has no or limited chance to improve the project's environmental soundness.
- In the planning procedure of particular departments no system alternatives are taken into account.
- Policy making and financial decisions on a high political level have great and far-reaching influence on the environment and were not subject to an environmental assessment.

Conclusion: In order to ensure sustainable development and to achieve the main goal of prevention of environmental harm, a more strategic instrument for environmental assessment is needed.

1.2.2 SEA and EIA within the decision making hierarchy

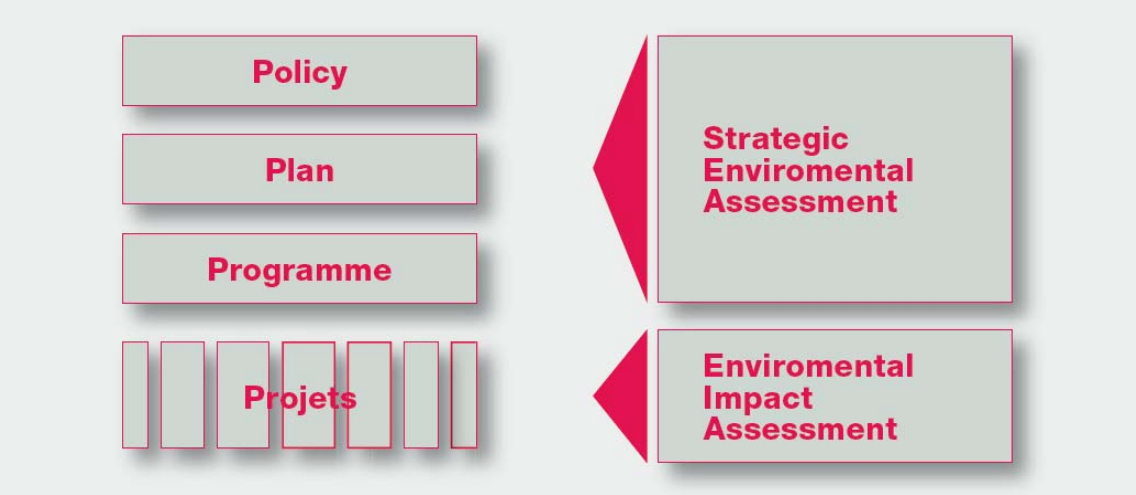
"There is a hierarchy of levels in decision making comprising projects, programmes, plans and policies (OECD 2006; Figure 1.1). Logically, policies shape the subsequent plans, programmes and projects that put those policies into practice. Policies are at the top of the decision-making hierarchy. As one moves down the hierarchy from policies to projects, the nature of decision-making changes, as does the nature of environmental assessment needed. Policy-level assessment tends to deal with more flexible proposals and a wider range of scenarios. Project-level assessment usually has well defined and prescribed specifications. Policies, plans and programmes are more "strategic" as they determine the general direction or approach to be followed towards broad goals. SEA is applied to these more strategic levels. Environmental Impact Assessment (EIA) is used on projects that put PPPs into tangible effect" (OECD 2006). Figure 2.1 shows how components of the Namibian planning procedures relate to each other.

Within the above described hierarchy is the question of efficiency of and synergy between the different levels of environmental assessment. Three components are key:

- **Tiering**, that means addressing issues and impacts at appropriate decision-making levels (e.g. from regional to project levels). Tiering is widely used as a way of concentrating on the issues specific to the action being evaluated, and streamlining "lower-tier" documents. The level of detail of an SEA therefore should be proportional to that of the strategic action, here the land use planning. For instance, the SEA for the Karas Integrated Land Use Plan will be more broad-brush than an SEA for a town planning scheme of Keetmanshoop or the EIA for Neckartal Dam.

- **Linkage of SEA and EIA** where appropríate (e.g. close collaboration between SEA for a regional land use plan and the EIA of a large scale sectoral project)
- **Multiple data use**. Depending on the availability of data that meet the quality needs for the assessment being worked on, it is imperative that these data are used rather than starting new surveys and elaboration. For this SEA, many data could be drawn from the Atlas of Namibia (Mendelsohn *et al.* 2002).

Figure 1.1: SEA and EIA within the decision making hierarchy



Source: OECD (2006)

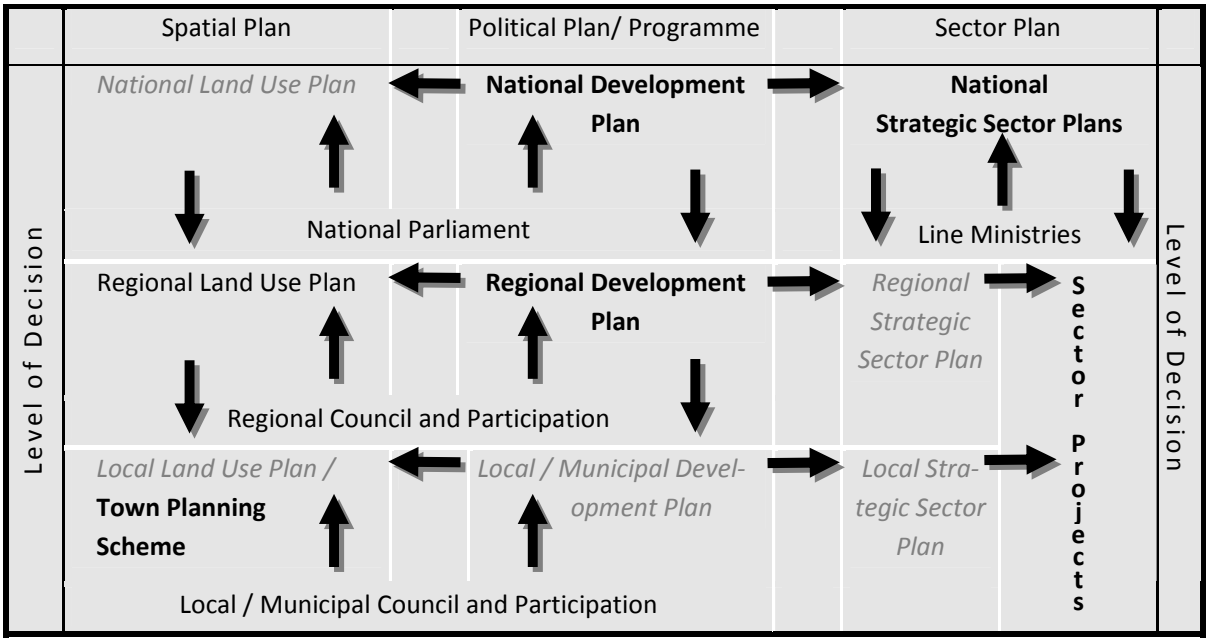
2 KARAS INTEGRATED REGIONAL LAND USE PLAN

The Karas Integrated Regional Land Use Plan (KIRLUP) has been commissioned by the Ministry of Lands and Resettlement (MLR), as the custodian of land and land related issues (MLR, 2007). One of the main objectives of the KIRLUP, as set out by the MLR, is to correct previous deficiencies in land use planning in Namibia. Previous land use plans were "stand alone" exercises and varied in content, scale, and layout. They were mainly an inventory and presentation of available data, with few proposals for future scenarios. There was also ineffective stakeholder participation (bottom up), local stakeholder involvement and lack of coordination between the various Ministries. As a result, previous land use plans have not been implemented or considered in decision making. Against this background, the Karas Integrated Regional Land Use Plan will address current land uses, conflicts and possible synergies between land uses as well as new and proposed land uses (SPC 2010).

2.1 Dependencies within the planning hierarchy

"Despite the efforts of the Namibian Government to achieve and implement the goals set out by the decentralisation law and policy, sectoral and top-down planning on regional and local levels is still common practice. This commonly leads to situations where regional development initiatives are not harmonized amongst the national, regional and local administrative levels. This also results in the failure of the National Development Plans (NDP) to recognize the needs of communities and initiatives at the grass root level in planning and budget allocation. The Ministry of Lands and Resettlement, within its mandate to facilitate utilization of land and as custodian of Namibian land, is the main actor and coordinator in the planning and administration of land falling within the rural areas of Namibia" (SPC 2010). Figure 2.1 shows the dependencies within the Namibian planning procedures. Sector projects in particular are often not assigned to the appropriate decentralised decision making levels.

Figure 2.1: Relationships within the Namibian planning hierarchy



Bold: Plan type exists and is legally binding; Light: Plan type exists but is not legally binding

Italics: Plan type doesn't exist

2.2 Outline of the proposed land uses in the Karas IRLUP

The following land uses are proposed by the Karas IRLUP and are cited from SPC (2010), Chapter 5:

(1) Protected Areas Zone
(2) Agriculture Zone
(3) Tourism and Wildlife Zone
(4) Urban Area Zone
(6) Fishing Zone

2.2.1 Protected Areas Zone

The Protected Area Zone stretches from the Namib Naukluft Park south towards the Orange River, including the Sperrgebiet National Park, the /Ai-/Ais Hot Springs Park, the Gondwana Canyon Park, the Greater Fish River Canyon Complex (GFRCC), Naute Dam and all four existing communal conservancy areas in the Region.

The Protected Area Zone can further be subdivided into 4 areas:

A) Proclaimed National Parks and Game Parks

This zone is the most restrictive, and all activities within this zone must adhere to MET's regulations and legislations and to the respective Management and Development Plans for the various areas. This area includes the Sperrgebiet National Park, Namib Naukluft Park, the /Ai-/Ais Hot Springs Game Park, the Island and Marine Protected Area, and the Naute Game Park.

B) Private land under conservation management

The Greater Fish River Canyon Complex aims at bringing together a group of farms surrounding the Fish River Canyon to ensure better management and sustainability for the area. This complex together with the /Ai-/Ais Hot Springs Park and the proposed land consolidation strategy of MET will eventually create one conservation area stretching from the Namib Naukluft Park, south to the Sperrgebiet and east to the Canyon Complex. This will make it one of the biggest co-managed conservation areas in Namibia. Farms surrounding this conservation area should be encouraged to become part of this conservation area and diversify into game farming and tourism.

C) Conservancies

There are currently four registered conservancies in the Karas Region and one emerging conservancy (#Kharis). The conservancies in the Karas Region are generally not well organized and mostly depend on subsistence farming. It is recommended that proper management plans should be developed for these conservancies to strengthen their role and economic basis. Linkages between existing protected systems and the conservancies should be strengthened so as to include the communal communities into the conservancy sector.

D) TFCA

The Transfrontier Conservation Area makes up almost half of the Karas Region. Several Tourism Development Areas are identified in the TFCA with specific focus on /Ai-/Ais, Sperrgebiet, cultural development sites in the Bethanie and Warmbad Cultural Area, and the Orange River.

2.2.2 Agriculture Zone

The agricultural zone comprises areas used for farming with livestock and indigenous products, and covers a large part the Karas Region. It includes both commercial, communal and government farms.

Livestock farming

Land use in this zone focuses on small stock – goats and sheep – as well as cattle. A subset of this zone, in the north-eastern part of Karas, shows where large stock – cattle – can be farmed (although the SEA is not in agreement with this suggestion; refer to ch. 6.1.2 for details). Small stock farming can take place in all areas except those that are protected. Farming practices should be guided by carrying capacities as set out by the Ministry of Agriculture, Water and Forestry, and it is recommended that new research on carrying capacity is done to take into account the rangeland changes that have occurred over the years. This research should also include possible climate change predictions for the region and adapt the carrying capacity accordingly. This zone is not restricted to domestic livestock, as diversification into game farming and tourism should be promoted. In areas such as Aus where conservation, tourism and livestock farming are combined, proper rangeland management should be done to ensure that these areas are protected and managed accordingly.

Irrigation farming:

This will be mainly focused on areas located next to the Orange River, the Naute Dam and Neckartal Dam. Sustainable use of water is recommended – ie water-efficient irrigation techniques, and it is also recommended that proper environmental management takes place to prevent pollution. Irrigation schemes should be subject to control and monitoring of water usage and pollution to minimize negative impacts and conflicts with other water users.

2.2.3 Tourism and wildlife Zone

The tourism and wildlife zone is a buffer zone around the existing protected areas, and includes natural and scenic attractions such as the Quiver Tree Forest (Keetmanshoop), Brukkaros and the Orange River. Land uses in this zone will focus primarily on tourism accommodation establishments, conservation and game farming. Towns such as Lüderitz, Aus, Oranjemund and Rosh Pinah will become key nodes in terms of tourism development. Tourism development plans should be compiled for these areas to ensure that developments complement each other and adequate marketing strategies are aligned.

Another area identified for tourism potential is around Aroab, as the border post links the area with the Kgalagadi Transfrontier Park heightening the potential for tourism development in this area. The tourism and wildlife potential around the Groot and Klein Karas Mountains is also significant.

The communal conservancies also have great potential for niche-market tourism, focusing on cultural sites, history and geological attractions. Most of these conservancies already have or are busy with construction of camping sites. These should be thoroughly integrated with the Tourism Development Plans mentioned above.

The potential for tourist development next to the Orange River should not be underestimated. However, close consultation with MET and MAWF should take place to ensure sensitive areas (due to biodiversity) and water issues are considered. (The proposed Desert Star South Project in the south-east is a case in point, with intended heavy water abstractions for two golf courses.) Game reserves and tourist accommodation establishments should be encouraged in this zone.

The potential for tourism and wildlife around the proposed Neckartal Dam and around the Naute Game Park should also be investigated. The Naute Game Park is closed to the public, but 600 ha of land, the Southern Tourist Forum Area (STFA), was deproclaimed from the park in 1996 and donated to the Municipality of Keetmanshoop. No development has taken place on this piece of land, even though it has a 10 km water frontage, making this an excellent area for tourism development. It is recommended that a study should be done for the STFA identifying the potentials and business opportunities.

2.2.4 Fishing Zone

This zone will obviously be mostly confined to the coastal region of the Karas Region, while aquaculture and some mariculture projects occur at inland sites. Both marine and inland fishing activities have possible synergies with tourism and conservation, and even with mining through use of mined areas for fishponds. Such collaborations and synergies should be encouraged.

2.2.5 Urban Zone

The urban zone contains all the town, villages and settlement areas in the region as well as the proposed upgrading of settlements and the proposed Desert Star South city. Land uses in this zone will be urban functions such as services, business, educational facilities, offices, regional offices, banks etc. New proclamations such as Oranjemund and the Desert Star city will have to diversify to ensure sustained economic viability.

Institutional infrastructure need to be developed at Keetmanshoop, as this town will become increasingly important if projects such as the Neckartal Dam are implemented. The extension of the Naute Irrigation Scheme and possible future development at the Southern Tourism Forum Area at Naute will also contribute significantly to the growth of Keetmanshoop.

2.2.6 Conclusions on the KIRLUP zoning

The zoning recommendations made in the Land Use Planning process have largely incorporated the views of the SEA, so there is overall agreement on the zones. Points which have been adjusted during the planning process include the following:

- Removal of a Mining Zone, since mining can not be confined to or prohibited from any zone;
- Removal of an Infrastructure Zone, for the same reason;
- Refinement of the boundaries of the Tourism and Wildlife Zone, to match the areas of environmental sensitivity identified by the SEA.

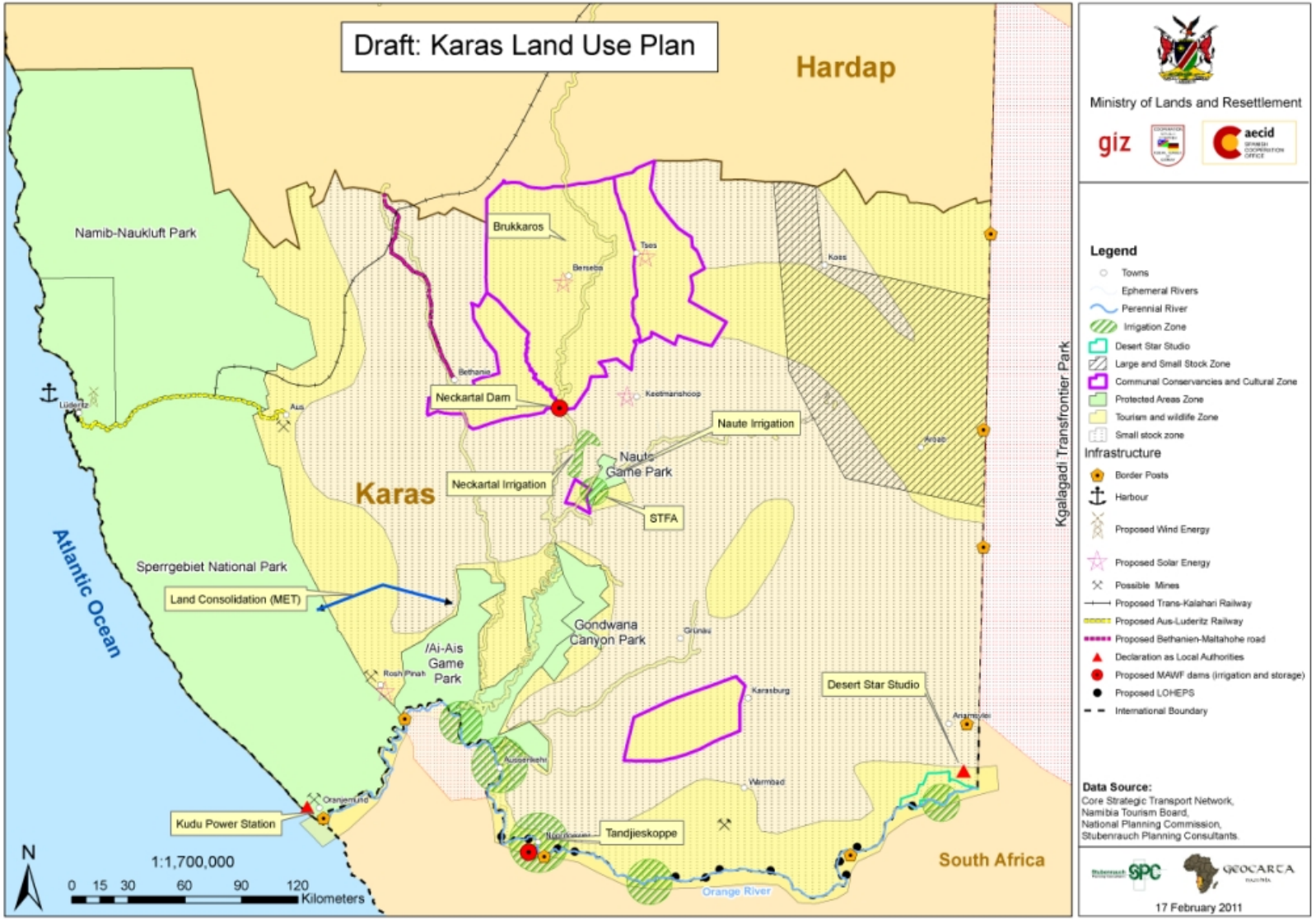
The SEA disagrees with the Large and Small Stock Zone in north-eastern Karas, on the grounds that large-stock farming is environmentally damaging over time in all of Karas, and should not be promoted. In those areas where livestock farming occurs, it should be done with small stock only.

The SEA also strongly disagrees with implementation of the Neckartal Dam development, and gives its reasons in the discussion on the Irrigation sector. The reality is that this development is probably going ahead so the zoning for the dam and its irrigation lands cannot be avoided.

The zoning as proposed is largely similar to the current land-use activities. Important factors to consider to bring present and future land use activities in line with the sustainability recommendations of this SEA include:

- The availability of water, in view of future Orange River water limitations and water quality constraints;
- The improved economic returns that much land in Karas can achieve under tourism and wildlife, as compared to the status quo of stock farming, especially in areas adjacent to protected areas, conservancies and private game farms;
- The opportunity offered by sun and wind resources to develop centres for renewable energy generation;
- The need to plan economic developments that will not exacerbate existing poverty levels, as this is a common consequence through the influx of hopeful work-seekers.

Figure 3: Draft Karas Land Use Plan (January 2011)



3 FRAMEWORK AND METHODOLOGY OF THE SEA

3.1 Legal framework

In Namibia environmental assessment is mandatory for a number of activities. Section 27 of the Environmental Management Act (EMA) of 2007 says that activities listed in Part VII (environmental assessment) may not be undertaken without an environmental clearance certificate. Although assessment for plans and programmes on a strategic level is not specifically mentioned, the Act mandates the responsible minister to make regulations about the constitution of the activities listed in Section 27. The Ministry of Environment and Tourism has therefore drafted Regulations on Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), but they have not been officially gazetted yet.

SEA requirement in the draft Environmental Assessment Regulations (2010)

Part 4 No. 10 (1) of the Environmental Assessment Regulations (2010) says that "Environmental assessment is required for plans, policies and programmes, subject to preparation or adoption through a legislative, regulatory or administrative procedure -
(a) which are prepared for mining, agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, local and **regional planning or land use**;..."

Definitions

Assessment in the EMA (Part I Sec. 1) is defined as "the process of identifying, predicting and evaluating -

(a) the significant effects of activities on the environment;
(b) the risks and consequences of activities and their alternatives and options for mitigation with a view to minimise the effects of activities on the environment and to maximise the benefits and to promote compliance with the principles set out in section 3 [such as:]
   - renewable resources must be used on a sustainable basis for the benefit of present and future generations;
   - community involvement in natural resources management and the sharing of benefits arising from the use of the resources, must be promoted and facilitated;
   - the participation of all interested and affected parties must be promoted and decisions must take into account the interest, needs and values of interested and affected parties;
   - equitable access to environmental resources must be promoted and the functional integrity of ecological systems must be taken into account to ensure the sustainability of the systems and to prevent harmful effects;
   - assessments must be undertaken for activities which may have significant effects on the environment or the use of natural resources;
   - sustainable development must be promoted in all aspects relating to the environment;
   - Namibia's cultural and natural heritage, including its biological diversity, must be protected and respected for the benefit of present and future generations;

- the option that provides the most benefit or causes the least damage to the environment as a whole, at a cost acceptable to society, in the long term as well as in the short term must be adopted to reduce the generation of waste and polluting substances at source;
- the reduction, re-use and recycling of waste must be promoted;
- a person who causes damage to the environment must pay the costs associated with rehabilitation of damage to the environment and to human health caused by pollution, including costs for measures as are reasonably required to be implemented to prevent further environmental damage;
- where there is sufficient evidence which establishes that there are threats of serious or irreversible damage to the environment, lack of full scientific certainty may not be used as a reason for postponing cost-effective measures to prevent environmental degradation; and
- damage to the environment must be prevented and activities which cause such damage must be reduced, limited or controlled."

Part I Sec. 1 of the EMA defines environment as "the complex of natural and anthropogenic factors and elements that are mutually interrelated and affect the ecological equilibrium and the quality of life, including -

(a) the natural environment that is the land, water and air, all organic and inorganic material and all living organisms; and
(b) the human environment that is the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values."

Part I Sec. 1 of the EMA defines biological diversity as " the variability among living organisms from all sources, including amongst others, terrestrial and aquatic ecosystems and the ecological complexes of which they are part, and this includes diversity within species, between species and of ecosystems."

Part 1 No. 1 of the regulations defines cumulative impact as "…the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential effects eventuating from similar or diverse activities or undertakings in the area."

3.2 Methodology of the SEA

Within the overall IRLUP process for the Karas region, the SEA is a process-oriented instrument based on stakeholder participation and expert opinion. The SEA process has involved the following parts:

- Information gathering (data collection and evaluation, site visits, expert discussions)
- Scoping
- Baseline analysis and sector assessment through Focus group discussions (FGDs)
- Collaboration with the LUP
- Compilation of the SEA report

Within the SEA process, the major steps taken included:

- Definition of criteria to be used in the assessment
- Identification of the region's natural potentials (key resources) and most limiting factors

- Compilation of baseline information with a focus on sensitive areas
- Consideration of climate change projections
- Consideration of present and future sectoral activities and land uses
- Sector by sector assessment of conflicts, synergies and environmental impacts
- Identification of the most important cumulative impacts of the LUP
- Making recommendations for the region's sustainable development
- Making recommendations for future SEAs on the regional level

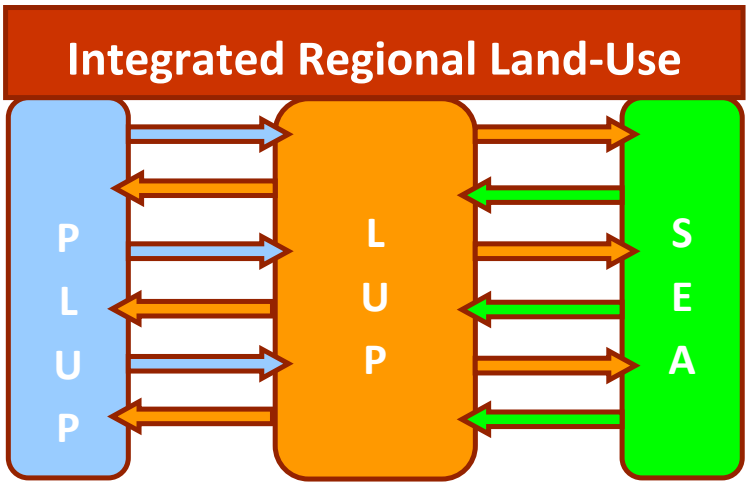
This SEA for the Karas IRLUP serves as a pilot SEA for future land use plans. To make it cost- and time-efficient it was first intended to focus on certain "key issues" only that were identified in the IRLUP process. It was agreed at the draft scoping meeting on July 2nd 2010 to extend the SEA to all the sectors considered by the land use plan itself and which may have impacts on the environment.

3.2.1 Relationship of SEA and IRLUP in the Karas Region

The relationship between SEA and IRLUP is based on four major issues:

1. The SEA is an important support in the IRLUP multi-column planning model (see Figure 3.1).
2. IRLUP and SEA are two separate instruments: The LUP is the planning instrument and the SEA is the assessment tool.
3. SEA gives advice for environmentally sound planning, therefore
4. Close collaboration between the two instruments is appropriate.

Figure 3.1: SEA in the multi-column model of the Karas IRLUP



LUP: Land use planning
PLUP: Participatory land use planning process
SEA: Strategic environmental assessment

3.2.2 Scoping

The relevant environmental authorities and other interested and affected parties need to be consulted when the scope and level of detail of an SEA is decided. Scoping is one of the most important tools in the SEA process. The main characteristics of scoping are:

- Establish the content of the SEA
- Establish the relevant methodology for the SEA
- Identify the need and depth of investigation, considering:
  - time-scale
  - availability of data
  - knowledge on cause-effect relationships

3.2.2.1 Establishing the content of the SEA

Scoping meetings in July and August 2010 proposed the following as the main components of the receiving environment:

- Human health
- Livelihoods and employment
- Cultural heritage and social cohesion
- Economic development
- Biodiversity and ecological functioning
- Rangeland health / Soils
- Water and hydrological functioning
- Air quality / Climate
- Landscape beauty / Sense of place
- Infrastructure

It was agreed that the SEA will assess the impact of each of the sectors on these components in Karas Region. Where appropriate, environmental objectives will be formulated so that the most desirable state of these components is identified.

Identification of main causes of possible environmental impacts

Driving causes that may impact on the environmental components were identified and grouped as follows:

- Land occupation
- Barrier effects
- Emissions and pollution
- Disturbance of landscapes
- Diseases / pests

Identification of environmental risks and potential for enhancement

The SEA will identify the environmental risks and the environmental enhancement that may arise from developments proposed in the LUP. Basic cause and effect relations between the identified sectors and

the environmental components are presented in Table 3.1, derived from preliminary scoping within the LUP-SEA team (2 July 2010).

Table 3.1: Basic cause and effect relations between sectors and environmental components

may cause impact on → Environmental Component / Land-Use Sector	Human beings	Animals, Plants, Biological Diversity[1]	Soils	Water	Climate/ Air	Land-scape	Cultural Heritage
Game and Livestock Farming							
Irrigation Farming							
Mining							
Tourism							
Fishing							
Transport							
Conservation[2]							
Energy							
Water supply							
Urban development							

The yellow marked cells indicate if the identified driving causes that could arise with any of the land use sectors may have impacts on the environmental components.

Cumulative risks and impacts

The following Table 3.2 summarises the impacts of each sector on other sectors to assess potential cumulative impacts.

[1] Comment during Scoping: Conservation status of indigenous plants (e.g. Devil's Claw, Hoodia) to be considered

[2] Comment during Scoping: Additional attention to be paid on project "Strengthening the Protected Area Network (SPAN)"

Table 3.2: Matrix for the assessment of cumulative effects

effect on →	Game and Live-stock	Irrigation Farming	Mining	Tourism	Fishing	Trans-port	Conser-vation	Energy	Water supply	Urban devel-opment
Game and Livestock		-	-	+ -	0	0	- +	0	-	+ -
Irrigation Farming	-		-	(-)	(-)	0	-	0	-	+ -
Mining	-	-		- +	-	- +	-	-	-	- +
Tourism	+ -	0	0		0	-	+ -	0	-	(-)
Fishing	0	(-)	-	- +		(-)	-	0	-	0
Transport	- +	- +	+	+ -	+		-	0	-	+ (-)
Conser vation	+ -	-	-	+ -	- +	-		-	- +	-
Energy	(-)	(-)	0	+ -	0	0	-		(+) (-)	+
Water supply	+ -	+ -	(-)	+ -	+	0	- +	-		+
Urban develop-	-	-	0	+ -	-	-	-	-	-	

Legend for Table 3.2

Sector Effects by Competitive Land-use		Cumulative Environmental Effects	
-	Negative		Cumulative environmental effects not clearly identifiable, however, impacts may increase, if competitive land-use leads to intensification of affected sector
(-)	Slightly negative		
+	Positive		Cumulative effects likely increase environmental impacts
+	Positive		Cumulative effects that can enhance synergies with positive effects on the environment
(+)	Slightly positive		Cumulative effects slightly may increase environmental impacts
+ -	Positive and negative positive predominates		See above
- +	Negative and positive negative predominates		See above
0	No relevant effect		No relevant cumulative environmental impacts to be expected
	No relevance between same sectors		No relevance

3.2.2.2 Scoping meetings and workshops

The Scoping Phase of the project started in June 2010 with discussions between P+U, SAIEA and GTZ. Progress and preliminary findings of the LUP process were presented by SPC in early July, to provide background information to all the project participants (Table 3.3).

The scoping exercise was continued in mid-August 2010 with the Stakeholders Scoping Workshop in Keetmanshoop. After opening statements by the Ministry of Lands and Resettlement and introductions to the LUP and the SEA by the consultants, all participants were asked to give their opinion about the content and the relevant methodology of the SEA and about the need and depth of investigation. The main part of the scoping meeting was the joint discussion about the potential environmental risks and the potential of enhancement that can arise with the future developments in the Karas region. It was jointly worked on sectoral matrices with potential impacts on one side and the receiving environmental components on the top (see Annex for scoping matrices). The Scoping Report finalized after this workshop summarized the scope of the study and gave an early indication of impacts, synergies and conflicts that would need assessment in the next phase.

Table 3.3 Meetings held during the Scoping Phase of the SEA.

Date	Topic and mode	Participating organisations
2 July 2010	Scoping meeting with donor and client, and presentation of progress in Karas LUP	GTZ MLR SPC GOPA P+U, SAIEA
12 August	Internal SEA discussion and preparation for Keetmanshoop Scoping meeting	MLR SPC P+U, SAIEA
16 August	Stakeholders Scoping Workshop, Keetmanshoop	MLR MET MAWF NAU Gondwana Canon Park OFRBC NNFU RoshCor Skorpion Zinc Lüderitz Municipality SPC, MLR, GOPA, P+U, SAIEA

The Scoping Phase reached agreement on how impacts to the receiving environment were to be categorized (Table 3.4). The components cover the impacts on the biophysical and the socio-economic environment. These components were suggested to the participants of the two scoping meetings, and agreed upon with the client as described in the Scoping Report.

Each component is given an overall rating to explain its main impact and give an indication of its significance.

Table 3.4 Standardised table for assessing the impact of sector activities and land uses on the various components of the receiving environment.

Component	Description	Overall rating
Biodiversity and ecological functioning	Describes how the activity/sector/proposal affects flora and fauna, and/or ecological processes. These criteria depend on maintenance of key habitats, protection of particularly rare, endangered and/or endemic species, and maintenance of processes such as water and food provision, allowing migratory movements and other behaviours that the species depend on.	Positive (+) or negative (-) or neutral (0) The significance of impacts is rated as low-medium (+ or -) high (+ + or - -) or very high (+ + + or - - -)
Rangeland health and soils	Describes how it affects the condition of soils and of the plants which provide grazing and browsing fodder for animals.	
Hydrological functioning	Describes how it affects surface and groundwater resources, their recharge, and dynamics such as frequency, capacity and timing of river flows.	
Air quality	Describes whether it makes any significant polluting emissions into the air.	
Landscape beauty / Sense of place	Describes how it affects the visual and aesthetic components of the area, which are an important component of the attraction of natural landscapes.	
Livelihoods, employment	Describes how it affects the standard of living and employment status of both local people and people further away in Namibia who are possibly affected by the activity.	
Human health	Describes whether it has any significant impacts on the health of people involved in the activity or who live in situations where they are affected by it.	
Cultural heritage / social cohesion	Describes whether it affects cultural or traditional values and practices, if it raises tensions between different groups, or causes family and other social ties to be disrupted.	
Infrastructure	Describes whether it has any significant impact on the wear and tear or need for replacement or upgrading of structures such as roads or powerlines.	
Economic development	Describes whether it makes a significant positive contribution to the economic situation both locally, to the region and nationally, or whether the activity or proposal has a negative effect (i.e. it is a 'waste of money').	

3.2.3 Information gathering and sharing discussions

The Baseline Analysis and Assessment Phases of the project were characterized by intensive gathering and analysis of information through Focus Group Discussions (Table 3.5). The inputs of specialists and relatively high decision makers was sought:

- to ensure that the LUP and SEA process was known to and achieved 'buy-in' from the relevant sectors and ministries,
- so that the LUP and SEA would benefit from well informed opinions and rational proposals,
- to achieve integration between the sectors.

Table 3.5 Focus Group Discussions and other meetings held to gather information and share it amongst stakeholders.

Date	Topic and mode	Participating organizations
30 August	Ecologically sensitive areas in Karas FGD	DRFN MET-SPAN NNF Biodata CC Coleen Mannheimer, botanical consultant SPC, SAIEA
9 September	Irrigation farming and water sector FGD	MAWF – DWA and OFRBC NamWater Dudley Biggs – water consultant DRFN Water Desk MLR, SPC, SAIEA
20 September	Energy sector FGD	NamPower DRFN Energy Desk MME MLR, SPC, SAIEA
27 September	Mining sector FGD	RoshCor Skorpion Zinc Mine MME – Geological Survey MLR, SPC, SAIEA
5 October	Fisheries sector FGD	Unam inland fisheries specialist MFMR MLR, SPC, SAIEA
12 October	Conservation and tourism sector FGD	MET – SKEP NWR HAN NTB MLR, SPC, SAIEA
26 October	Towns and infrastructure sector FGD	Urban Dynamics NamPort Namibia Roads Authority Keetmanshoop Municipality MLR, SPC, SAIEA
28 October	Preliminary findings of SEA – presentation to OFRB Stakeholders Forum	MAWF – DEES, DWA MET MRLGHRD
2 November	Livestock and game f arming FGD	NAU NNFU SNAFU Karakul Board Meat Board MLR, SPC, SAIEA
5 November	Mining discussion by telecon	Namdeb SAIEA

The main activities in each sector were discussed, and the significant impacts were identified. Participants at the Focus Group Discussions were asked to describe the proposed future developments in the sector, and to provide opinions on their environmental impacts. Concerns that had been raised during

the course of the project were put to the group for discussion. Participants were asked to identify possible conflicts or synergies with other planned or possible activities in the region, and information from other sectors was passed on (e.g. NamPower staff were not aware of the proposed Neckartal Dam, which could be a possible source for hydropower). Participants were also asked to suggest alternative developments and opportunities for the sector. During the FGD, issues of concern were noted as 'red flags', which included issues such as risks for the sector (e.g. serious limitations on the amount of water in the Orange River for future irrigation developments), and impacts which need to be considered thoroughly in future project-level EIAs. The agenda of the FGD on the energy sector is provided as an example in the Appendix.

Information sources suggested by the FGD participants were followed up wherever possible. The presentation to the Fish-Orange River Basin Stakeholders Forum (28 October, Table 3.5) was done on invitation by the Forum, and served as a useful platform to present the preliminary findings of the SEA.

3.2.4 Sector-by-sector assessment

Information gathered during the FGDs and from all available literature is summarized under the headings:

- National targets for the sector. These were gathered from Vision 2030 (RoN …), NDP3 (RoN 2008a, b and c), and policy documents published by government ministries.
- Present situation. Information here is summarized from the KIRLUP (SPC 2010) and from other literature sources. Environmental impacts of the major activities are assessed using the components identified in Section 3.2.2.1.
- Likely future developments. These reflect the 'key issues' identified in the KIRLUP (SPC 2010) and draw on information provided during the FGDs. Expected environmental impacts of proposed developments are assessed, again using the format described in Section 3.2.2.1.
- Cumulative impacts, risks and conflicts with other sectors. This summarises the main points of concern for the sector, and indicates those key issues and proposed developments which are not likely to be sustainable.
- Synergies, opportunities and suggestions for the sector. This summarises the ways in which major benefits can be achieved from the activities in the sector.

3.2.5 Reporting

A draft Land Used Plan was compiled by SPC and submitted for review and modifications on 1 October 2010, followed by a draft that has been final subject for preparation of the SEA report.

Information gathered during the Assessment Phase was compiled, and formed the basis of the Key Issues which were presented to SPC for incorporation in the LUP. The SEA is presented as a separate report, and its findings are included as far as possible in the LUP report by SPC.

4 ENVIRONMENTAL BASELINE OF THE REGION

This chapter describes the region's key natural resources and limiting factors, and is followed by a more detailed description of the natural and the human environment (Chapter 5).

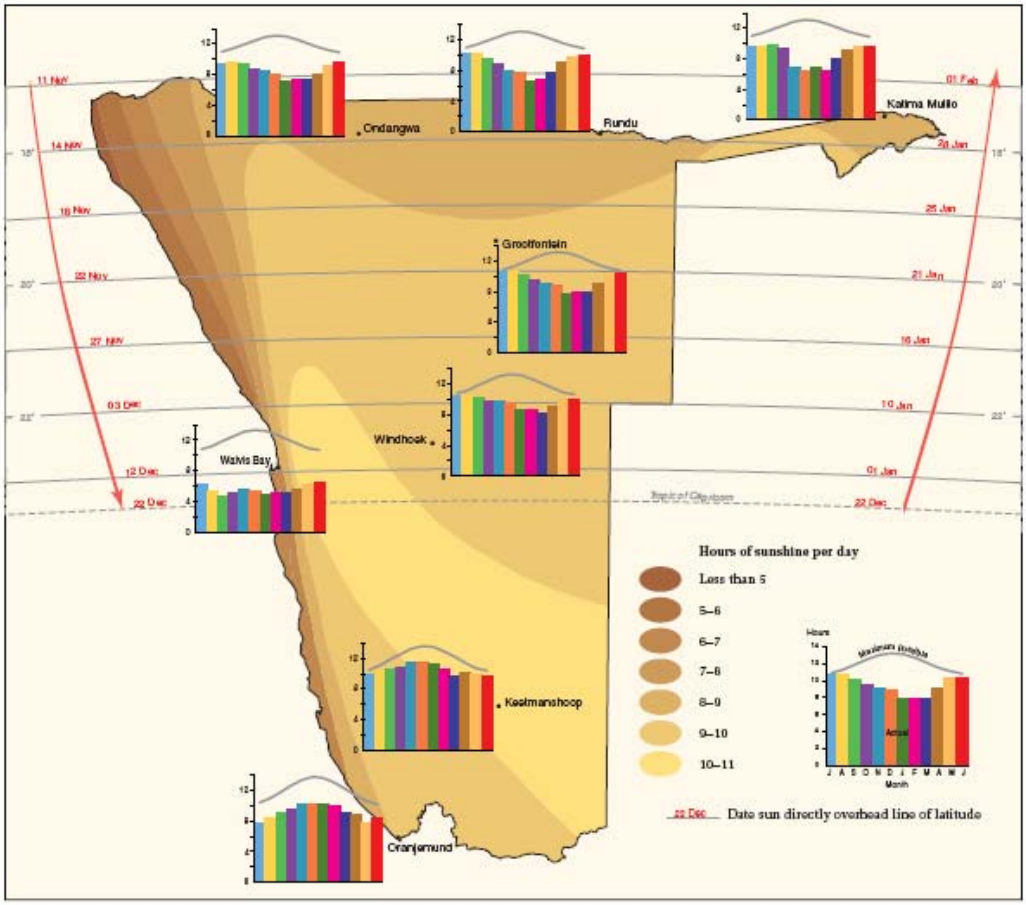
4.1 Key natural resources in Karas Region

Karas is often brushed off as 'the south', without giving this diverse region the credit it is due. The following six features offer very varied, rich and potentially productive resources, which form the basis for the competitive advantages which the region should exploit.

4.1.1 Sunlight

Karas receives high levels of radiation. Clear sunny days are a feature of the region, and average incoming solar radiation is about 6 kWh/m^2/day (Mendelsohn *et al.* 2002). This is very close to the maximum possible amount that can be received at this latitude (see the graph for Keetmanshoop in Figure 4.1). Only a thin strip along the coast receives an average of less than 9 hours sunlight per day.

Figure 4.1 Most of Karas Region receives close to the maximum possible amount of sunshine at that latitude. Map from Mendelsohn et al. 2002.



This natural resource gives great potential to the generation of solar electricity and solar water heating.

The east-west orientation of the Orange River allows maximum day-long penetration of sunlight into this deep valley (Irish 2008). Crops that can ripen quickly in the long days and intense heat, such as table grapes and dates, have a competitive edge over such products grown in other parts of the world.

4.1.2 Outstanding flora and fauna

Early explorers into southern Namibia described the presence of giraffe and rhinos, and even hippos in the Orange River (Brown 1991). While efforts are being made to reintroduce some of these species to the south (e.g. in Gondwana Park), there are strong populations of large desert-adapted animals such as gemsbok, springbok and ostrich in the region. Seals are abundant on the coast. Coastal wetland- and sea-birds congregate at the Orange River mouth and on the offshore islands. High levels of endemism occur in invertebrate and reptile groups, particularly along the escarpment, Huns Mountains and Fish River Canyon area (Irish 2008).

Plant life is exceptionally rich. The Succulent Karoo biome is internationally recognised as an important plant biodiversity hotspot, and is the only one found in an arid climate.

The combination of flora and fauna are a unique national heritage and a pressing national responsibility.

4.1.3 The ocean

The Atlantic Ocean in the west is a huge reservoir of water, offering the potential for desalination to produce potable water for this arid region.

The Benguela Upwelling System is well known for its high marine productivity. This has supported a strong fisheries industry, but over-exploitation of the stocks of especially rock lobster, hake and pilchard, combined with natural population fluctuations, limits the future potential of the fisheries sector (Mendelsohn *et al.* in prep.).

4.1.4 Wind

Global circulation patterns, in the form of the South Atlantic Anticyclone, produce the effect of a gigantic fan blowing onto Namibia's coast, and this drives upwelling in the Benguela current. The Lüderitz area is particularly windy, and Pomona just south of the town has the strongest average wind velocities in southern Africa, with constant daily winds in summer of 30 – 80 km/h (Pallett 1995).

This resource offers potential for generation of electricity.

4.1.5 Open landscapes and desert scenery

Karas Region is very thinly populated and offers beautiful wide open vistas and majestic landscapes. These in themselves are a great tourist attraction, especially for people coming from densely populated parts of the world.

4.1.6 Mineral riches

The Orange River and its offshore delta is the Earth's largest and richest sedimentary deposit of diamonds, of which over 70% are gem quality (Schneider 2008). They are a huge economic driver. Other promising mineral deposits in the region are base metals (lead, zinc, silver), copper and uranium.

4.2 Limiting factors in Karas Region

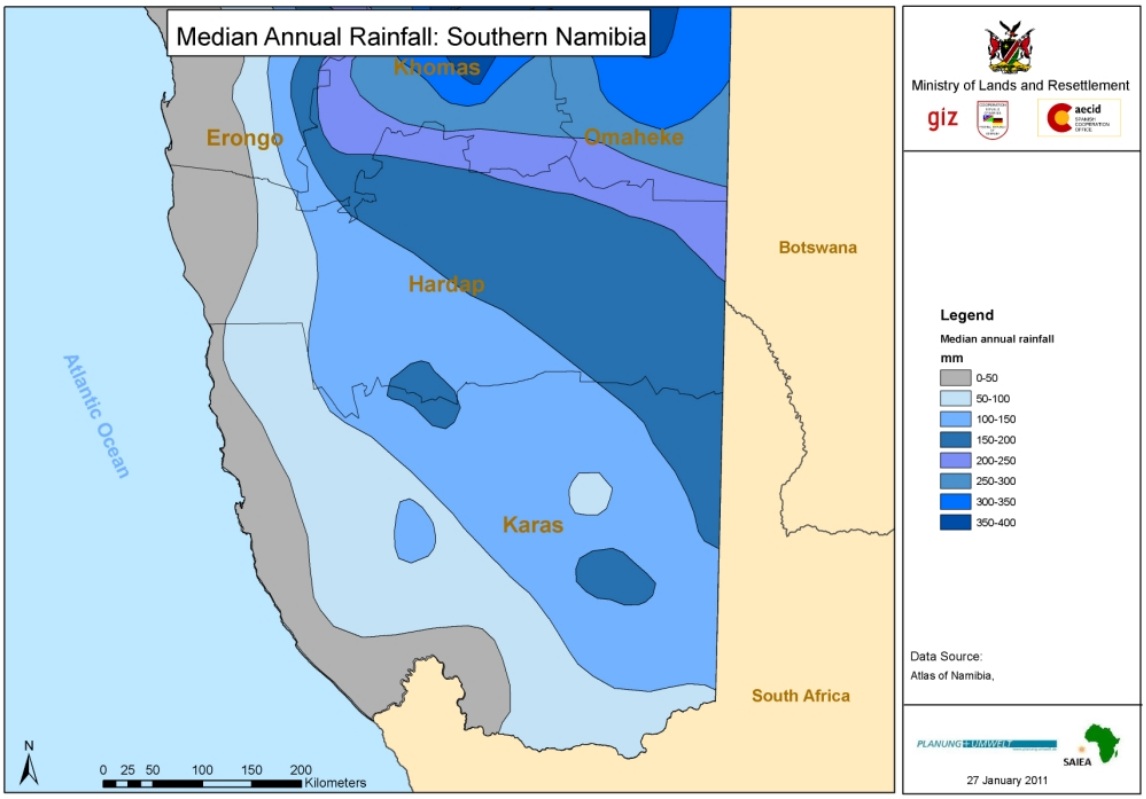
4.2.1 Water

Nowhere in Karas is annual median rainfall higher than 200 mm (Mendelsohn *et al.* 2002) (Figure 4.2). Most of the region is thus classified as arid (< 150 mm/a); only the north-eastern corner is semi-arid. Dry climates are characterised by very high variability. The coefficient of variation of rainfall is greater than 50% throughout the region, and reaches over 100% in parts (Mendelsohn *et al.* 2002). This statistic reflects the reliability of rainfall – the higher the CV, the less reliable will be the annual rainfall. Primary productivity (i.e. the growth of fodder for animals) is directly dependent on rainfall, and is equally unreliable (see 4.2.2 below).

All rivers are ephemeral, except the Orange with its extensive catchment in wetter South Africa and Lesotho. Total abstraction from the Orange River, for irrigation schemes, mines and towns, already produces a significant deficit in the mean annual runoff at the mouth, which classifies it as a Category D status (largely modified wetland with extensive losses of natural habitat and basic ecosystem functions) (Orasecom 2008).

Groundwater potential over most of the region is classified as low, with only about 30% having moderate potential, and many boreholes being unsuitable for human consumption due to high concentrations of fluoride, nitrates and sulphates (Christelis and Struckmeier 2001).

Figure 4.2 Annual median rainfall in southern Namibia. The median gives a more accurate reflection of 'normal' rainfall than average. From Mendelsohn et al. 2002.



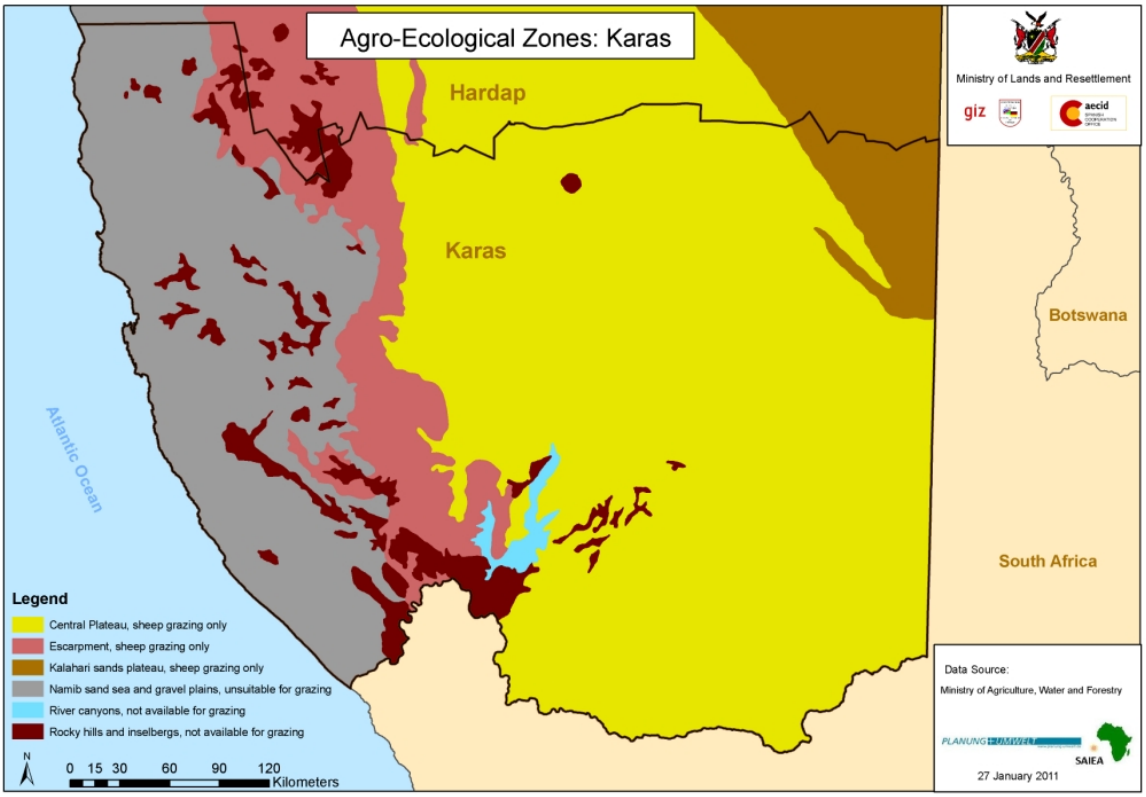
4.2.2 Soils and rangeland productivity

Much of the central and southern part of Karas is covered in thin, coarse-textured soils with low water-holding ability (Mendelsohn *et al.* 2002). Vegetation cover on these leptosols and regosols is generally sparse because the soils cannot provide most plants with adequate water or nutrients. At best, these soils can support low densities of livestock and wildlife.

Sandy soils in the far west – the Namib – are in a hyper-arid climate, which severely limits productivity. Those in the north-eastern parts of the region receive more rainfall but it drains through the soil rapidly, leaving little moisture for plants. Few nutrients are retained in the porous sand. These characteristics give the Kalahari sandy soils also low carrying capacities.

Namibia's agro-ecological zoning map (Figure 4.3.) shows that almost one third of the region is unsuitable or unavailable for livestock, and only small stock should be farmed on the remaining 70% of the region.

Figure 4.3 Agro-ecological zones as defined for the Karas Region by the Ministry of Agriculture, Water and Forestry.



The soils in Karas are very sensitive to inappropriate land use, e.g. overstocking leads to soil degradation. If rangelands are overgrazed, bare soils will increase runoff. This promotes sheet and gully erosion, resulting in damage to the land's productive capacity.

4.2.3 Skills

Of those people employed, only 6% completed tertiary education, and about 16% have completed junior or senior secondary school (NPC 2007). Skilled workers make up about one fifth of the total work force (see Section 5.1.1). These statistics point to a worrying lack of skills in the Karas population, which limits the potential for strong economic growth.

5 SOCIO-ECONOMIC AND BIO-PHYSICAL DESCRIPTION

This section provides greater detail on the environmental factors – both socio-economic and bio-physical – that are most relevant to strategic assessment of the Land Use Plan.

5.1 Population and social factors

In 2001, the latest population census done in Namibia, the country population was 1.8 million, of which Karas made up only about 4% (69,000 people) (CBS 2004, cited in Dierkes 2009). The projected growth gives a 2011 population estimate for Karas as 74,000 people, but subsequent private surveys reveal an urban population of just over 100,000 in Karas (Dierkes 2009).

The population in the Karas region is very unevenly spread: the large protected areas along the coast are uninhabited and the communal areas are thinly populated, with people concentrated in scattered rural settlements. Almost three quarters (72%) of the people in Karas live in an urban environment (Dierkes 2009). Close to 3 out of 5 persons (65%) were born in the region while 1 out of 5 persons (19%) were born in the northern regions.

The major language spoken in households in the Karas Region is Afrikaans (40%). Nama / Damara (26%) and Oshiwambo (23%) are the next major languages,

Aspects of the social situation in Karas Region which are of greatest relevance to this SEA are:

- employment and livelihoods (as a measure of the productivity of people),
- level of literacy and skills in the population (as a measure of their potential to be productive),
- poverty and the level to which people's basic needs are met (as a measure of how dependent the population is on government support for housing, health and food).

5.1.1 Employment and livelihoods

According to the 2004 Labour Force Survey (MLSW 2006, cited in Dierkes 2009), a person is considered to be employed when he or she has worked for at least one hour for pay, profit or family gain during the seven days preceding the census. This criterion is controversial: it is accused of over-estimating employment and painting a rosier picture than really exists. We use here the broad definition of unemployed to include those people who are employable but are not actively seeking work, which gives a higher figure than the strict definition that excludes those people who are not actively seeking work.

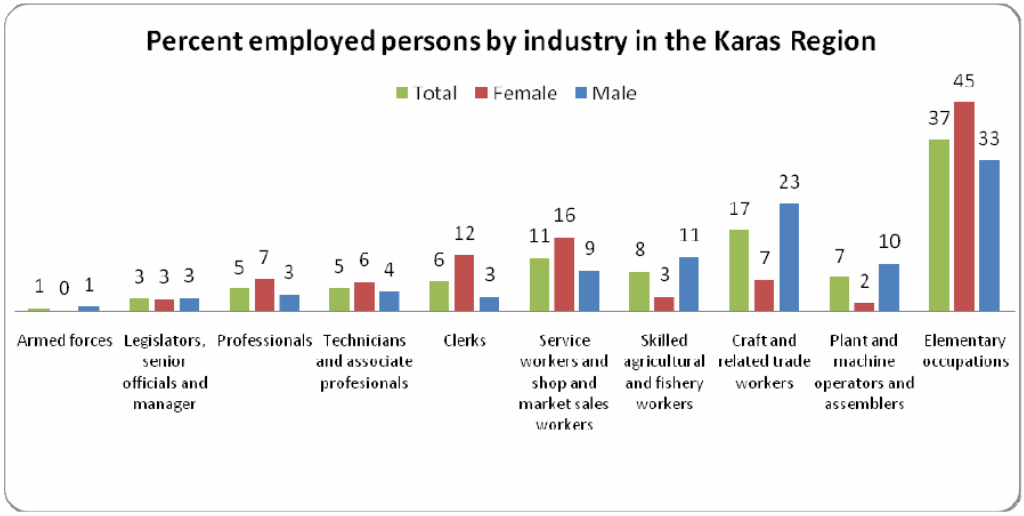
In 2004, the rate of unemployment in Namibia was 37%, and had risen from 34% in 2000 (MLSW 2006, cited in Dierkes 2009). Unemployment was much higher in rural than urban areas (45 vs 29%), and higher in women than men (43 vs 30%). It was reported to have reached 51% in 2009 (Republikein 2010). Unemployment in Karas Region in 2004 was lower than the national average, at 27%. Since the reported increase is likely to have occurred at the same rate in Karas, unemployment in the region probably now stands at about 40%.

Employment in Karas Region is dominated by men (two-thirds versus one-third for women) in almost all kinds of work. About 61% of all employed persons work in the private sector (mostly the mines and irrigation schemes), the government employs about 27%, and a small proportion work in other sectors.

The largest occupational group in the Karas Region (Figure 5.1) is 'elementary occupations' (= unskilled labourers), which make up 37% of all employed persons. Semi-skilled positions occupy about two-fifths of the workforce, and skilled workers make up another fifth.

Salaries and wages are the main source of income in the Karas Region at 69%, followed by pensions at 10% and farming at 7%. The average annual per capita income in the Karas region was N$ 11,123 in the 2004 NHIES (CBS 2004, cited in Dierkes 2009), similar to the Namibian average.

Figure 5.1 Categories of employed people in Karas (from Dierkes 2009).



5.1.2 Literacy and skills

Eight percent of the population in the Karas Region have never attended school (MHSS 2008, cited in Dierkes 2009), but the NDHS 2006-07 survey outlines that, in Karas in 2006, 97% of the primary school age population (6-12 years) was attending primary school, and 57% of the secondary school-age population (13-17 years) was attending secondary school. More male than female children (61 vs 52%) attend school. Compared to the national literacy rate of 81%, Karas compares favourably with 92%, with relatively higher literacy in females (94%).

While literacy (the ability to read and write with understanding) looks good, the picture is less impressive when it comes to completion of secondary education. This figure is only 14% in Karas.

According to the information above (Figure 5.1), semi-skilled and unskilled labourers make up almost 4/5ths of the labour force.

5.1.3 Poverty, health and housing

Health and disease

The infant mortality for the Karas Region at 47 infant deaths per 1,000 live births is one of the lowest of Namibia's regions. Female life expectancy at birth is 61 in the Karas Region, which is of the highest in

Namibia. Male life expectancy in Karas (54) is above the Namibian average of 48 years. These figures give a general indication of the fairly good state of health of the Karas population.

The 2008 National HIV Sentinel Survey measured an overall national HIV prevalence among pregnant women of 18% (Dierkes 2009). HIV prevalence is unevenly distributed and is centred around areas where people are mobile mining and tourist areas, commercial areas and border entry and exit points. This is thought to be the case in the mining towns of Oranjemund and Rosh Pinah, the port of Lüderitz and the agricultural areas at Aussenkehr, where rates are 18-20% compared to 13% averaged for the Keetmanshoop health district. Countrwide, HIV-related mortality grew steadily from 1988 to 2005 but declined in 2006 and 2007, most likely due to the rapid roll out of treatment in the country. However, it is projected that HIV mortality will begin to rise again after 2009 due to the increasing number of people on treatment as well as the increasing ages of those on treatment.

Housing, water supply, sanitation and waste

Detached and semidetached houses are occupied by almost two thirds (65%) of all households in Karas, while shacks make up about 14% of housing units. The percentage of shacks in urban areas is higher at 18%. About 16% of the households in rural areas occupy traditonal dwellings opposed to less than 1% in urban areas. On average 1.8 persons share one room in the Karas Region. A large proportion of the households in the Karas Region own their dwellings without any mortgage (42%), while the proportion of households residing in dwellings provided by the employer is relatively high (24%) compared to the Namibian average of 10%.

94% of all households in Karas have access to safe drinking water. The main source of safe water for most of the households (77%) is from piped water within the property. The same pattern applies for urban as well as for rural areas with the former having a higher proportion with regard to safe water (99% and 93% respectively).

Slightly more than a quarter of all households (26%) in the Karas Region have no toilet facilities. About 58% of the households use flush toilets while another 26% have no toilet facilities at all. 7% make use of the bucket/pail. There are notable differences between the urban and rural areas. 80% of the households in the urban areas use flush toilets while the corresponding rural percentage is 31.

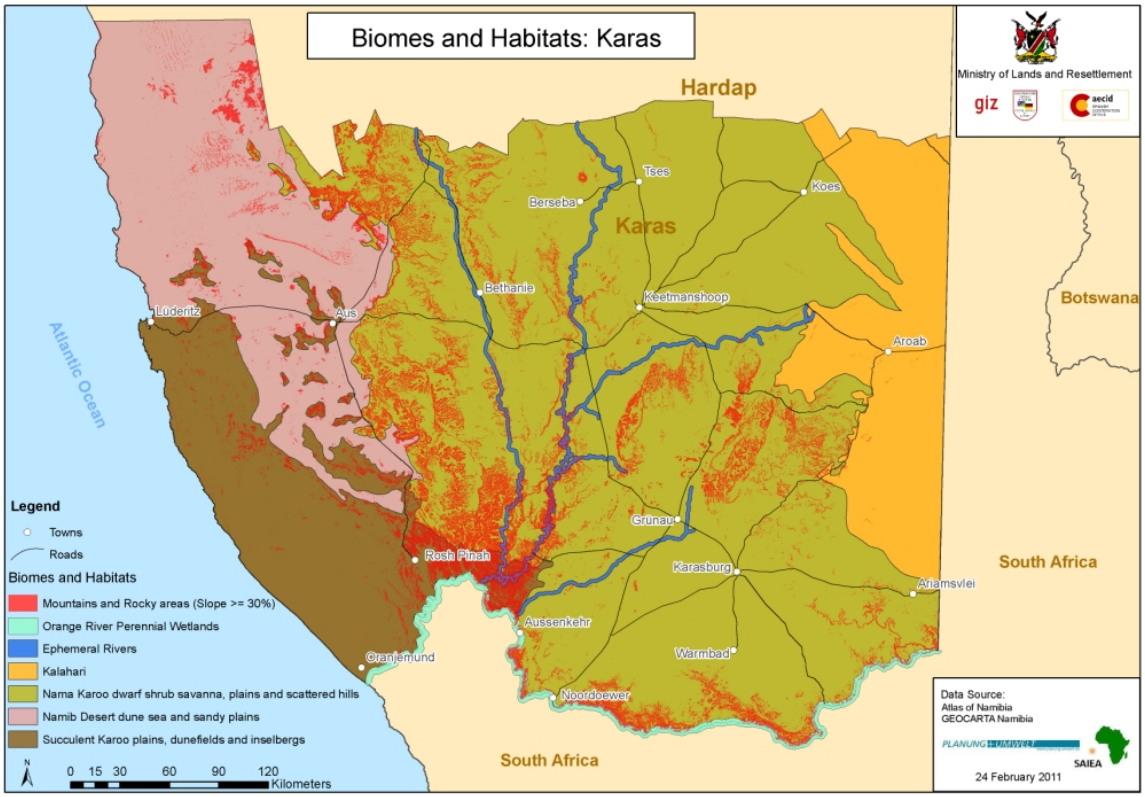
The most common means of disposing garbage in the Karas Region is by regular collection, with 57% of the households having this service. This is more predominant in the urban (85%) than in the rural areas (25%). The rubbish pit is fairly common in the rural areas with 27 % of the households utilizing it. Incineration (17%) and roadside dumping (19%) are also common features in the rural areas.

5.2 Biodiversity

5.2.1 Biomes and habitats

Broad biomes and habitat categories are mapped in Figure 5.2.

Figure 5.2: Biomes and main habitats in Karas Region.



5.2.1.1 Succulent Karoo plains, dunefields and inselbergs

The western edge of the region is hyper-arid and is part of the Namib Desert. The most southerly section, from the Orange River to roughly the latitude of Lüderitz, comprises the Succulent Karoo biome. This area, which includes the entire Sperrgebiet, has varied terrain with generally sandy plains, small dune fields, scattered inselbergs and mountain ranges (e.g. Klinghardt, Aurus, Obib Mountains), and areas of coastal hummocks. What distinguishes the habitat from the central Namib is the abundant vegetation, dominated by succulents (plants with fleshy leaves or stems), with great diversity of species and a high proportion that are endemic to this biome. For example, the Sperrgebiet carries nearly 25% of the plant species known to occur in Namibia. The predominantly winter rainfall is meagre (40 – 90 mm). This habitat is open and windswept, and in certain places the topography and the alignment of the coast relative to the dominant southerly winds funnel the wind in corridors where wind and sand transport are particularly strong. The gravel plains in the fog zone support lichen fields, where lichens carpet the ground and grow profusely on low plants and any relief which catches fog precipitation.

The Succulent Karoo biome is recognized as a globally important biodiversity hotspot, and is the only one in an arid region (Myers *et al.* 2000, Burke & Mannheimer 2004). It is also identified as an Important Plant Area (Hofmeyer 2004). The plant life is prolific by virtue of the winter rainfall and fog, and areas of higher relief such as inselbergs and the Orange River valley flanks (at the western side) are particularly densely vegetated. Almost all the inselbergs and mountains in the Succulent Karoo biome are known to receive relatively higher levels of precipitation, giving them a more diverse range of flora.

5.2.1.2 Namib Desert dune sea and sandy plains

The largest area of sand accumulation and dunes in the Namib occurs between Lüderitz and Walvis Bay. Areas closer to the coast have predominantly barchan (moon-shaped) and transverse dunes, while deeper inland they are sculpted into parallel, north-south oriented longitudinal dunes separated by interdune valleys. Those parts of dunes which experience rapid sand movement are barren of plant cover, while more stable and consolidated sands support scattered hummocks of grass and succulent shrubs. Areas with relatively little sand supply generally form open sandy plains with a thin covering of short grass. This area receives an average of less than 40 mm rain per year.

5.2.1.3 Nama Karoo dwarf shrub savanna, plains and scattered hills

This area extends across much of southern Namibia, and is dominated by shrubs and grasses. Trees are absent except along watercourses. The area forms a large part of the Nama-Karoo biome in Namibia (Irish 2008), and receives an average of 40 – 100 mm rainfall. Typical of this area are low bushes and shrubs, dominated by 'driedoring' (*Rhigozum trichtomum)*.

5.2.1.4 Kalahari savanna

The eastern side of Karas Region sees elements of the Kalahari Desert, forming part of the Savanna biome in Namibia (Irish 2008). The northeastern corner is classified as Southern Kalahari, where fairly consolidated red sand dunes support a generous cover of grasses and scattered acacia trees. This area is dotted with small to medium sized pans, which are the only places where surface water accumulates naturally. Annual average rainfall in this area is from about 100 to 200 mm. The presence of fairly common trees introduces a wider variety of niches and hence slightly raised levels of biodiversity compared to the Nama Karoo.

The southeastern area comprises a transition zone between the southern Kalahari and the dwarf shrubland of central Karas Region. Here the *driedoring* (*Rhigozum trichtomum*) dominates the landscape, occurring in the areas between dunes and riverbeds. Perennial grasses dominate in areas of undisturbed veld and on the dune crests. In the southern parts, various Acacia species occur, forming open tree savanna.

5.2.1.5 Woodland and floodplains along the perennial Orange River, and the Ramsar wetland at the mouth

The Orange River is the only perennial river in Karas Region. The river has carved a fairly deep and wide valley through the arid landscape of southwestern Africa, in places forming dramatic scenery with pools

and rapids contrasted against the rugged topography of the mountainous flanks of the valley. While flows are much more regulated and much smaller in volume than before due to heavy use of the waters in South Africa and Lesotho (Orasecom 2008), the lower stretch of the river is still vitally important as a linear oasis. Riverine vegetation on the alluvium banks comprises a thin line of woodland (dominated by *Rhus pendulina* and *Tamarix usneoide*s), shrubs and reeds (Burke 2006). Flat areas of the river course are open mud and sand flats, in places covered by short grass, and with occasional dense stands of *Phragmites* reeds. At the river mouth is an important area of saltmarsh. The whole length of the river course along Namibia's border is classified as Very High Conservation Importance (DEA&T 2004, Hofmeyer 2004).

The river mouth is recognised as an internationally important wetland for migratory birds and has Ramsar status. It is the only large estuarine nursery area on Africa's south-western coast, supporting significant populations of estuarine and marine invertebrate and fish species (Turpie *et al.* 2002), and is ranked as the 7th most important coastal wetland system in South Africa in terms of conservation importance. The river mouth makes a potentially important contribution to the Benguela Current Large Marine Ecosystem (Clarke *et al.* 2010).

The negative ecological impacts of a wide array of industrial, mining and agricultural developments in the basin are seen in the lower Orange River (Orasecom 2008). These include high levels of abstraction from the river and its tributaries, high salinity water running back into the river from irrigated lands, polluted effluents from industries, over-fishing and clearing of river-bank vegetation (reeds and wood). The Orange River mouth is presently classified as a Category D wetland (i.e. one which is largely modified with extensive losses of natural habitat and basic ecosystem functions), and on a negative trajectory of change (Orasecom 2008). The state of the wetland has caused it to be placed on the Montreux Record, a list of Ramsar sites around the world that are in a degraded state.

5.2.1.6 Ephemeral rivers

Most of the drainage in Karas Region is directed towards the Fish River which flows southwards to join the Orange, and other smaller tributaries which flow directly into the Orange. All these rivers are ephemeral, being dry for most of the year and experiencing surface flows only for a few days or weeks each year. Standing pools of surface water and underground water in alluvial aquifers supports vegetation so that these drainage lines form important linear oases, with trees and shrubs growing in the riverbeds. Aquatic life in the aptly named Fish River is evidence of strong underground flows which feed surface pools and support not only fish but even water-loving mammals like otters (Irish 2008, MAWF 2010).

The Koichab River is a fossil system that flows westwards towards the Atlantic but is blocked by the sand sea. It manifests as a number of inconspicuous drainage lines with the main one marked by the presence of camelthorn (*Acacia erioloba*) and *Salvadora* bushes.

5.2.1.7 Mountains and rocky areas

Karas Region supports a few areas of rugged relief and high topography, viz ranges and inselbergs within the Sperrgebiet mentioned above, the Groot Karas range, the Huns Mountains, the Tiras Mountains and

the flanks of the Orange River valley. The escarpment, made up in parts by the western edge of the Tiras Mountains, the Rooirand and the Huib-Hoch Plateau, is also rugged, mountainous terrain.

This habitat deserves mention since the interplay between higher altitude (bringing coolness and, close to the coast, fog precipitation) and aspect (slopes with differing amounts of sunshine/ shade/ fog) produce a mosaic of microhabitats and niches that support greater biodiversity than the surrounding plains. The raised conservation value and sensitivity of mountains is recognised in Section 5.4.

5.2.1.8 Sandy coast

The southern part of the Karas coastline comprises fairly uniform sandy shores, large parts of which have been mined for diamonds. While most of the coast is rocky north of about Chameis, this pattern is interrupted by frequent bays, Elizabeth Bay being the largest, and these have also been a target for diamond mining.

5.2.1.9 Rocky coast and offshore islands

Most of the coastline is characterised by rocky terrain, with cliffs and sea arches, including the highest in southern Africa, the 54 m high Bogenfels arch. Within a few kilometers of the shore are several islands, some only very small, which form important habitats for breeding seabirds.

5.2.2 Plants and animals of conservation concern

Table 5.1 Summarised overview of those species or groups of species which occur in Karas Region and are recognised as conservation priorities due to endemism or rarity. Information from Pallett (1995). Griffin (2005), Irish (2008),

Group or species	Biome or habitat preference	Endemism and conservation status
Lichens	Succulent Karoo coastal plains and inselbergs	Many spp endemic to Sperrgebiet
Plants	High concentration of endemics in Succulent Karoo biome	Approx. 250 spp endemic to Namibia
Arachnids (spiders + scorpions)		18 spp endemic to Namibia
Insects		156 spp endemic to Namibia
Fish	Orange River	1 sp endemic to the lower Orange and classified as Vulnerable
Amphibians	Coastal hummocks	1 sp – desert rain frog - confined to N Cape and Sperrgebiet coastline
Tortoises and terrapins		Nama padloper endemic to southern Namibia and Endangered.
Lizards		19 spp endemic to Namibia, including dwarf chameleon and two kinds of girdled lizards restricted to Karas Region.

Group or species	Biome or habitat preference	Endemism and conservation status
Snakes		5 spp endemic to Namibia, including dwarf adder and desert mountain adder restricted to Karas Regio. Southern African python is Vulnerable.
Birds	Offshore islands important for coastal seabirds. Raptor populations dependent on protected areas and vulnerable to anti-predator measures on farmlands.	9 spp endemic to Namibia Of 7 Red Data spp, 3 are coastal seabirds: bank cormorant, African penguin, Cape gannet. The remainder are raptors.
Mammals	The Red Data spp occur on farmlands and protected areas. Otters require open pools in Fish River.	10 spp (mostly rodents and bats) endemic to Namibia, 3 of them to southern Namibia. 3 spp Vulnerable – cheetah, small-spotted cat, pangolin. African clawless otter along Orange and Fish Rivers.

In Karas Region, the highest concentrations of species that are endemic to Namibia occur in the Sperrgebiet, escarpment area and southern parts.

5.3 Processes that support ecological functioning and environmental flows

Ecosystems in the Karas Region are mainly supported by the scarce resource, water. This great dependence on one resource makes the ecological processes and environmental flows extremely sensitive and developments affecting them require great caution.

5.3.1 Water provision along perennial and ephemeral rivers, in pans and springs

Obviously any water sources are vitally important in the desert. Perennial rivers serve as permanent water resource for human beings and the natural environment. Riverine vegetation on the alluvium banks comprises a thin line of woodland, shrubs and reeds. Flat areas of the river course are open mud and sand flats, in places covered by short grass, and with occasional dense stands of reeds. At the river mouth is an important area of saltmarsh. Ephemeral rivers hold underground water reserves which nourishes vegetation, so that the water courses are linear oases. It is important that short-lived surface flows are not interrupted or diminished, so that upstream-downstream continuity is maintained and groundwater reserves are recharged. Natural springs support desert life, and they depend on groundwater reserves being sustained so that the seepages continue. Similarly, all pans become a focus of desert life during the rainy season, and they should not be disturbed.

5.3.2 East-west movements of wildlife

Gemsbok, ostrich and springbok populations in the Namib tend to move eastwards when food becomes scarce, and deeper westwards into the desert proper when conditions there are favourable. Fences

along the eastern edge of the Namib protected areas restrict such movements. These animals need freedom of movement to be able to maintain and expand their populations.

5.3.3 Fog precipitation along the coast and along Orange River valley

Fog is a recognised water source for Namib desert plants and animals. Areas within about 50 km of the coast receive regular fogs, but penetration inland is much further along the valley of the Orange River. Fog brings moisture and also moderates the temperature extremes that are experienced on clear days.

5.3.4 Dependence of rangelands on rainfall for primary productivity

Where soil quality is generally low, any growth of grasses and browse depends heavily on rain.

5.4 Environmentally sensitive areas

The above considerations provide the justification for identifying certain areas (Figure 5.2 and Table 5.2) as having high environmental sensitivity.

The main principles that motivate these areas are:

- All wetlands are critically important lifelines in the arid terrain – perennial and ephemeral rivers, springs and pans;
- Formal protected areas;
- Areas recognised as Important Bird Areas and/or Important Plant Areas;
- All mountain ranges and inselbergs and the escarpment.

In terms of overall coverage of the protected area network, the south of the country, especially the south-east (Nama Karoo and Orange River valley) is the most poorly represented.

Figure 5.3 Environmentally sensitive areas in Karas Region.

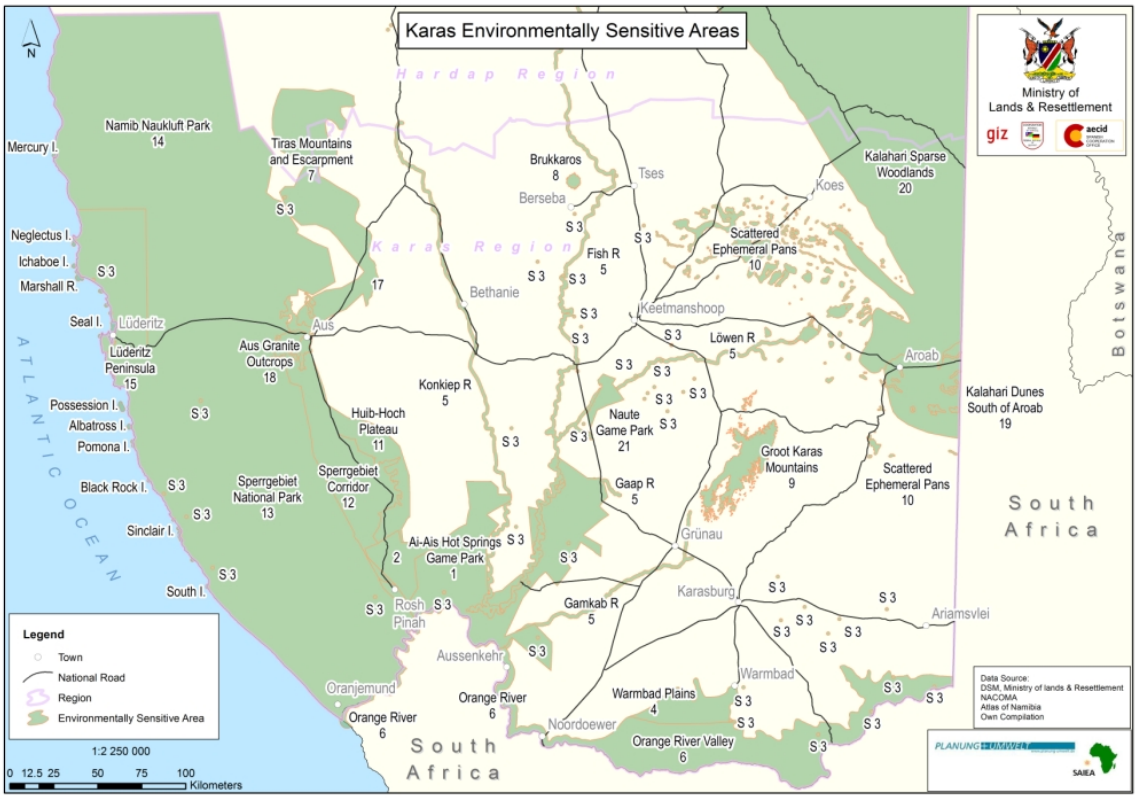


Table 5.2 Environmentally sensitive areas in Karas. Numbers refer to the numbered areas in Figure 5.3

Number in Fig 5.2	Name of area	Justification	Vulnerability to a particular activity
1	/Ai-/Ais Hot Springs Game Park and surrounds as part of the Greater Fish River Canyon Complex	• High landscape beauty and sense of place, gives high tourism value • Archaeological value – Apollo 11 Cave • Biodiversity – Succulent Karoo hot-spot in the western part, and recognised as an Important Plant Area • Springs, not only at Ai-Ais but also others in the Park	
2	Area between /Ai-/Ais Hot Springs Game Park and Rosh Pinah, incl farms Namuskluft, Zebrafontein, Witputs, Trekpoort, Spitzkop	• High biodiversity and endemism, especially in plants (e.g. *Aloe pillansii*) and invertebrates. • Fog corridor up Fish River valley	Possible pollutants from nearby Rosh Pinah and Skorpion Mines

Number in Fig 5.2	Name of area	Justification	Vulnerability to a particular activity
3	All natural springs (S) Hot springs more important than other (normal temperature) springs	• Vital water sources in arid environment. Support aquatic species which are rare e.g.frog *Rana fuscigula*. • Hot springs likely to support invertebrates associated only with hot water springs.	High tourism value achieved at /Ai-/Ais but great potential for recreational + tourism development at other springs, so long as carefully managed. Pollution and effluents could easily degrade the biodiversity and the tourism value.
4	Warmbad plains	• Recognised as an Important Plant Area.	Mining
5	All main ephemeral river courses, notably Fish, Konkiep, Gamchab, Lowen, Holoog/Gaap	• Vital role as linear oases. • Trees are rare in Karas, most are concentrated along riverbeds. • Much biodiversity associated and critically supported by the pools and plants along riverbeds (e.g. even otters!) • Consolidated silt banks of Fish R and Garub, host to *Neoluederitzia* endemic shrub.	Flow dynamics, quantities of surface and ground water, water quality all vulnerable to development of dams and irrigation schemes. Abstraction from river courses and sewage discharges into them, e.g. from tourism establishments, towns.
6	Entire length of Orange River along Namibia's southern border, and the main tributary valleys flowing into it	• Linear oasis through arid surroundings, and Ramsar site at Orange River mouth • Endemic species associated with aquatic habitat e.g. fish, otters, Red Data spp. • Great landscape beauty • Eastern section recognised as an Important Plant Area, due to diversity and endemism, especially succulents. Eastern outliers of some winter rainfall species. • Under review for nomination as a World Heritage Site, in combination with other features in the Greater !Gariep transfrontier area (DEA&T 2004) • Vital water source for any human developments	• Northern bank is the official border with SA. • Abstraction and effluent flows into river from mines, tourism and agricultural establishments. • Proposed dam near Vioolsdrif. • Infrastructure encroachment, especially at the mouth. • Alien vegetation e.g. *Prosopis, Nicotiana*.
7	Tiras Mtns and escarpment	• Biodiversity - endemic plants and reptiles. Recognised as an Important Plant Area.	

Number in Fig 5.2	Name of area	Justification	Vulnerability to a particular activity
8	Brukkaros Mtn	• Biodiversity - plant refugium for some winter rainfall (Succulent Karoo) relict species. Recognised as an Important Plant Area.	
9	Groot Karas Mtns	• Biodiversity - endemic plants and reptiles. Recognised as an Important Plant Area.	
10	All ephemeral pans	• Important water sources for animals living in arid terrain • Much biodiversity associated and critically supported by the pools and plants in pans	• Ploughing up to encourage grass growth
11	Huib-Hoch Plateau	• Recognised as an Important Plant Area.	
12	Sperrgebiet corridor	• Important wildlife corridor between Sperrgebiet and Huib-Hoch Plateau, facilitates E-W movements • Recognised as an Important Plant Area. • Beautiful landscapes associated with escarpment, high tourism potential.	
13	Sperrgebiet – entire area	• Succulent Karoo endemism and biodiversity hot spot, and its recognition as an Important Plant Area. Biological value of whole area is very high due to high concentration of near-endemic, endemic and protected plant and animal species.	• Mining and uncontrolled tourism e.g. poorly managed concessions
14	Namib-Naukluft Park	• Many endemic plant species, especially on inselbergs. E.g. *Jensenobotrya* exists only at Spencer Bay	• Uncontrolled tourism e.g. poorly managed concessions
15	Luderitz peninsula	• Wetland birds, plant endemics	
16	All offshore islands	• Southern African endemic birds and Red Data species. Endemic invertebrates specialized for surviving on guano.	
18	Aus area, particularly granite outcrops	• High plant diversity and endemicity • Invertebrate pollinator endemic species • Stronghold for Nama padloper (endemic tortoise) and Barlow's lark (endemic bird)	• Uncontrolled tourism
19	Kalahari dunes S of Aroab	• Invertebrate endemic species	
20	Kalahari sparse woodlands on eastern dunes	• Vegetation type with no formal Protected Area conservation status	

5.5 Climate change projections for Karas Region

The following information on climate change and its impacts is drawn from Turpie *et al.* (2010). It is predicted with a high degree of certainty that Namibia (and the rest of southern Africa) can expect an increase in temperature and evapotranspiration at all localities, with the maximum increase (2 - 6°C) in the interior. Warming is likely to be less along the coast than along the escarpment and inland regions (though the levels of uncertainty are high regarding currents, winds, sea temperatures and fog). Most global circulation models and the median of these models project that Namibia will become drier, rainfall variability is likely to increase and extreme events such as droughts and floods are likely to become more frequent and intense. Soil moisture levels are projected to decline, with the cumulative impacts of higher temperature, lower rainfall, higher run-off, lower humidity, higher evaporation and lower plant cover probably creating a compounding impact on soil moisture and on primary production that is greater than the sum of their individual contributions.

It is expected that the southern regions of Namibia will experience about a 10% decrease in rainfall by 2050, dropping further to 20% by 2080.

Terrestrial areas that are particularly vulnerable to climate change include the western escarpment (which separates the arid desert from the semi-arid savannas), and the south-western Succulent Karoo – both important centres of endemism. The Orange River is heavily regulated and future flows are likely to be determined primarily by the socio-economic needs of South Africa. Climate change predictions will bring higher evaporative losses which are likely to compound the reduced flows in the system that are expected.

Namibia's farming systems are on the arid margins of viability. The impacts of climate change are expected to be severe. This in turn will have significant impact on the livelihoods of rural households as well as on the economy of farming-related businesses. In terms of commercial crop irrigation, it is expected that:-

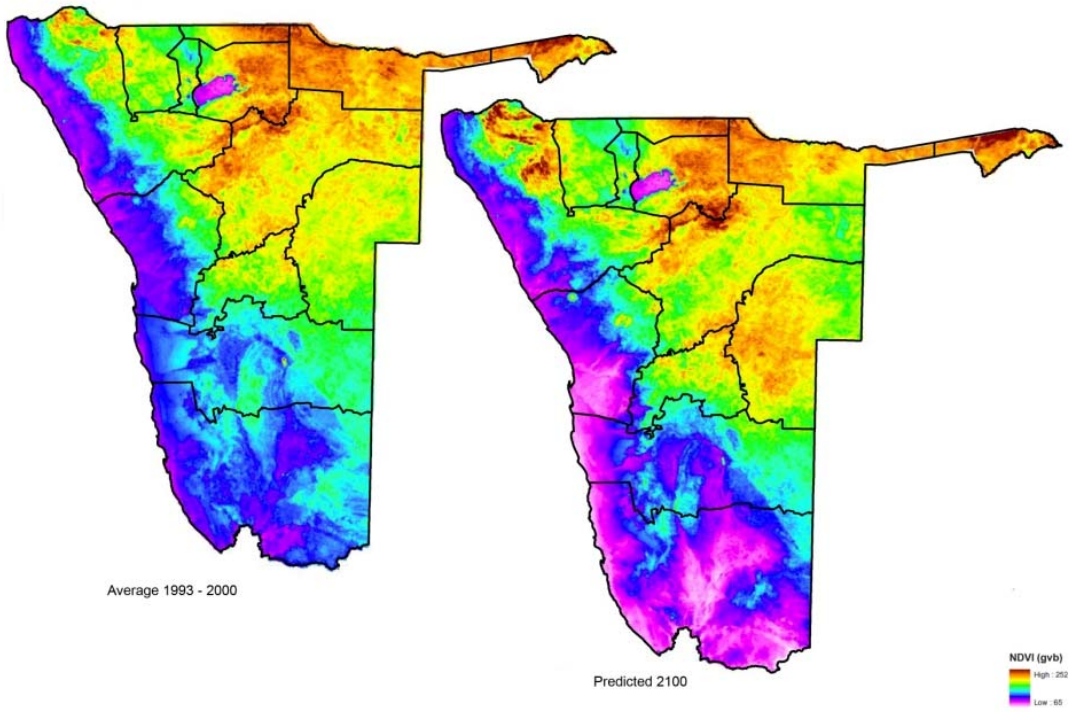
- Inter-annual variability of net irrigation water requirements will increase;
- Virtually all irrigated lands will require at least 10% more water applications per annum. Irrigated land in Lesotho may require up to 30% more irrigation applications per year – impacting considerably on the downstream end of the Orange river;
- The leaching of pesticides and fertilizers from irrigated land will cause an increase in water pollution – threatening freshwater ecosystems and human health;

In terms of livestock farming, Namibia's long-term carrying capacity is already exceeded in many places. The productive area for large stock in Namibia will shrink towards the east and north and cattle will decline significantly and probably be replaced by small stock and more profitably by wildlife and tourism in many areas. The productive area for small stock in Namibia will retreat from the west and expand towards the north and east into former cattle farming areas. Despite an overall increase in productive range the numbers of small stock are predicted to decline (countrywide) by 16% and 25% by 2050 and 2080 respectively. Impacts on wildlife are expected to be less severe than on agricultural production. This is likely to encourage further shifts in land use from agriculture to wildlife.

Total primary productivity is predicted to decrease by 4.5%, but is not expected to be equal across the country. Summer rainfall areas are expected to increase by as much as 30%. In contrast, winter and

winter/summer ecotone rainfall areas in the south are expected to decrease by as much as 40% particularly in the Central/southern Namib, Succulent Karoo and Nama Karoo (Figure 5.4).

Figure 5.4 Primary productivity measured prior to 2000 and predicted for the year 2100. Normalised Difference Vegetation Index (NDVI) measures vegetation growth, therefore high values (red and brown) indicate high primary productivity. Note that much of Karas Region in 2100 is purple and white, ie extremely low fodder production. Source Turpie et al. 2010.



Climate change projections for Namibia's marine environment are also sobering. Slackening off of south-westerly winds and decreased frequency and strength of upwelling could cause a decline in the primary productivity of the Benguela Current Large Marine Ecosystem (Turpie et al 2010). Climatic factors could trigger periodic extreme anomalous events, including red tides, sulphur eruptions, periods of deep water anoxia and episodic Benguela Ninos, all of which are capable of dramatically affecting primary production and availability of fish stocks.

Adaptation options that are relevant to Karas Region include:

- Promote wildlife by removing fencing to create larger contiguous management areas that meet viable population size requirements and facilitate movements in response to seasonal variations.
- Facilitate species movements through building a landscape-level biodiversity corridor network that will allow biodiversity to respond to seasonal variations and changing climates. A west – east southern Namib – Kalahari corridor is proposed.
- Cooperate with neighbouring states in implementing landscape-level corridors to align conservation management efforts across political boundaries.
- Adopt integrated river basin management fully, especially to safeguard wetland ecosystems.

6 ENVIRONMENTAL ASSESSMENT OF MAIN SECTORS AND LAND USES

6.1 Agriculture

6.1.1 Irrigated agriculture

6.1.1.1 National targets for this sector

Vision 2030 (Freshwater and associated resources): Where we want to be

- Water allocated and used efficiently
- Irrigation of only high value and strategic crops on suitable soils
- Clean, unpolluted water
- Productive and healthy natural wetlands with rich biodiversity
- Optimal and strategic economic development options

The development targets stated in NDP3 (RoN 2008b, p112), in the Key Result Area: Productive utilization of natural resources and environmental sustainability, Sub-sector 4 (Water) include:

- Increasing the contribution of water to GDP;
- Increasing the average value added per m^3 of water used;
- Establishing functional basin management committees;
- Increasing the irrigation water supply;
- Increasing availability of water, national water supply and potable water supply for people and livestock
- Construction of the Noordoewer Dam is specified as a key activity in NDP3 (RoN 2008c).

In the draft Integrated Water Resources Management Plan (MAWF 2010), the demand for irrigation water (country-wide) is predicted to rise from 135 Mm^3/a in 2008 to 497 in 2030, an almost 4-fold increase. Although this prediction was made, approximately 80% of the irrigable land surrounding Naute Dam is unused (Table 6.1) and Hardap Dam water and land is also under-utilised (Hager 2009). A suggested reason is that the set of practical and management skills required for irrigation farming is not readily found among Namibian farmers, who are more involved in livestock farming (Mendelsohn 2006). The skills base for expanding irrigation in Namibia is very limited.

How will this increased demand for water be met? Proposals and activities currently underway listed in the draft IWRM Plan, that are relevant to Karas Region, include the following:

- Use of purified sewage effluent for irrigation of parks, golf courses and sports grounds, and reclamation of water from wastewater effluents;
- Recycling of water used in industrial and mining processes;
- Water banking in aquifers (purposely pumping water into aquifers where the water is not lost to evaporation);

- Artificial recharge enhancement of aquifers (as practiced at Omdel Dam);
- Mixing of potable water with brackish water to improve quality;
- Water demand management through conservation of water by reducing unit consumption and wastage, mostly achieved through pricing incentives.

The draft IWRM Plan states (MAWF 2010a, p5) that shortcoming in the management of the country's water resources are "a focus on developing new sources rather than managing existing ones better, and top-down sector approaches to water management result in uncoordinated development and management of the resource". The proposed Neckartal Dam is an example of both of these shortcomings (see Section 6.1.1.3).

6.1.1.2 Present situation

The existing irrigation activities are summarized in Table 6.1.

Table 6.1 Existing and proposed irrigation schemes in Karas Region. Information from the KIRLUP (SPC 2010) and MAWF (2010b)

	Noordoewer	**Aussenkehr**	**Naute**	**Komsberg, Stolzenfels, Haakiesdoorn, Ramansdrift, Silwerstroom, Khaais**	**Noordoewer / Tandjieskoppe (proposed)**	**Neckartal Dam (proposed)**
Area available		1,000 ha, includes 300 ha that belongs to Gov.	800 ha (Koch 2010 pers. comm.)		Noordoewer: 960 ha proposed (12 x 80 ha plots) + 344 ha	5,000 ha altogether, 3,900 ha avail for irrigatn
Area presently used	286 ha	240 ha used by 20 small scale farmers. 700 ha used by 5 private companies.	132 ha altogether, of which 80 ha for dates; 40 ha grapes; 10 ha pomegranates			
Water consumption		16,000 m^3/ha/y = Total 16 Mm^3/y	2.2 Mm^3 used in 2007/08.	Komsberg - DWA permit for 13Mm^3/a (not confirmed yet)	12.7 Mm^3/y proposed	
			Only about half the irrig potential is realized (NRC 2002), and it is declining.			

	Noordoewer	Aussenkehr	Naute	Komsberg, Stolzenfels, Haakiesdoorn, Ramansdrift, Silwerstroom, Khaais	Noordoewer / Tandjieskoppe (proposed)	Neckartal Dam (proposed)
Labour[3]		20 small-scale farmers. 5 companies - ~18,000 p in peak season.	Coordinated by NDC. Perm staff = 79p Seasonal staff grapes 20-240, dates 140-180.		12 med-scale farmers 273 small-scale farmers 4,800 people altogether	Farm sizes 50-100 ha 2,600 perm staff 10,000 sea-sonal staff
Main crops	Vegetables – esp toma-toes, also sweet melon, grapes, pumpkins	Small-scale farmers – grapes, dates, vegetables Companies – grapes, dates, melons, toma-toes.	Dates, grapes, pomegranates.		Grapes 520 ha Dates 390 ha Veg 50 ha	Lucerne 2,400 ha Dates 1,000 ha Grapes 500 ha (Vegetables, wheat, maize)
Market and value	Mostly to Cape Town	Grapes and dates exported to SA + Europe, Arab countries	Most to Europe, some to SA. Profit = N$ 5.25 mill pa		Grapes + dates to be exported to Europe, Arab states, SA. Veg to local (Nam) markets	
Issues			Seasonal staff not accommo-dated at Naute.		Costs to de-velop scheme higher than anticipated, might not go ahead.	
Planned expan-sions			Additional 200 ha planned – 180 ha dates, 20 grapes			

It is a clear intention of government to improve the value added per unit of water consumed, but irrigation at present adds less than N$1, compared to the national average of N$57 (RoN 2008b). Irrigation, especially using overhead sprinklers and flood irrigation methods, is therefore a very poor activity for adding value to Namibia's scarce water resources.

Nevertheless, there is a similarly strong government intention to improve food security (as stated in the National Agriculture Policy of 1995), and the Orange River valley benefits from water availability and a very warm climate that can be put to great competitive advantage. Intensive irrigated production of table grapes and dates are proof of this. Such schemes are strong economic drivers, as witnessed by the influx of seasonal workers at Aussenkehr, and potentially make a significant contribution to the development of Karas Region and Namibia as a whole.

[3] Mendelsohn (2006) cites an average approximation of 2 employees per hectare of intensive production

Table 6.2 Strategic assessment of existing Karas Region irrigation schemes (Naute Dam, Noordoewer, Aussenkehr).

Component	Overall rating	Description
Biodiversity and ecological functioning	-	▪ Cumulative impact of abstraction from the Orange River threatens the ecological functioning of the lower stretches and particularly the mouth (Orasecom 2008). The mouth is a Ramsar Wetland of International Importance and an Important Bird Area. ▪ Seasonal workers who stay on during the off-season have major impact on fish and wood resources of Orange River. ▪ Pesticides and salt that are washed out of the soils are toxic to plants and animals
Rangeland health and soils	-	▪ Salination is a major problem within arid climates. It has negative impacts on the fertility of soils.
Water and hydrological functioning	-	▪ Incremental cumulative impact of pesticides and fertilisers that are washed out and the abstraction from the lower Orange River, threatening wetland functioning at the mouth Ramsar site (MAWF 2005, Orasecom 2008). ▪ Pesticides, fertilisers and salt that are washed out of the soil are toxic to ground- and surface water.
Air quality	0	
Landscape beauty / Sense of place	~ 0	▪ Although irrigation farming changes the land use from natural scenery, it has a rural ambience and does not strongly degrade landscape beauty. Irrigated land occupies a relatively small area in the Karas Region.
Livelihoods, employment	+	▪ Employment of permanent and seasonal workers is a significant positive impact to livelihoods of local people and many from northern Namibia ▪ Positive impact through labour (2,600 permanent, 10,000 seasonal workers) to irrigation farming activities.
Human health	0 to -	▪ Drinking water abstracted directly from the polluted Orange for use in informal settlements, and unsanitary conditions, create local health hazards.
Cultural heritage / social cohesion	-	▪ Small negative impact from influx of seasonal workers, who are seen by local Nama people as taking away 'their' work opportunities. ▪ Child labour has been reported at Aussenkehr
Infrastructure	+ -	▪ Small positive impact (roads, power supply) to the local area of the schemes. ▪ Informality of settlements such as Aussenkehr mean that social services such as schools and clinics are difficult for government to provide.
Economic development	+ to 0	▪ Positive impact to southern Namibia through employment, but low value crops carry opportunity costs.

6.1.1.3 Likely future developments

Neckartal Dam

Refer to Key Issue 5.1.1 in the KIRLUP (SPC 2010).

Table 6.3 Strategic assessment of the proposed Neckartal Dam.

Component	Overall rating	Description
Biodiversity and ecological functioning	Fatal flaw - -	▪ Extinction of site-endemic *Gladiolus* plant (MAWF 2010b). ▪ Significant possible downstream impacts to lower Fish River ecology due to barrier effect on surface and sub-surface water flows (MAWF 2010c). Impacts could include loss of aquatic animals (e.g. fish and otter populations) due to less frequent flows and longer periods without water in pools, reed proliferation, algal blooms, loss of riparian vegetation.
Rangeland health and soils	-	▪ Salination of soils due to irrigation can have negative impacts on fertility
Water and hydrological functioning	- -	▪ Significant downstream impacts to lower Fish River flows and the contribution to lower Orange River flows (MAWF 2010c) ▪ High evaporation losses, likely to increase with climate change
Air quality	0	▪
Landscape beauty / Sense of place	~ - 0	▪ Temporary impact e.g. quarrying, earth-moving and heavy machinery during construction. ▪ Local enrichment in landscape diversity through addition of a permanent water feature, but change of natural scenery.
Livelihoods, employment	+	▪ Employment of 1,000 people during construction. ▪ Potential positive impact through labour (2,600 permanent, 10,000 seasonal workers) to irrigation farming activities. However, these numbers might not be achieved.
Human health	0	
Cultural heritage / social cohesion	- - -	▪ Major negative impact expected in Keetmanshoop due to influx of work seekers, not likely to be mitigated by intention to preferentially employ local people.
Infrastructure	+ - -	▪ Small positive impact (roads, power supply) to the local area of the dam. ▪ Major negative impact due to strain on Keetmanshoop social services such as schools, clinics, security. Will significantly increase numbers of people affected by poverty in the town (MAWF 2010b).
Economic development	~+ - -	▪ Limited positive impact to southern Namibia through employment and provision of services to dam construction. ▪ Economic benefits predicted from food security unlikely to materialize to the extent that is proposed, due to skills shortage and

Component	Overall rating	Description
		high capital costs of efficient irrigation farming.
	- -	▪ Irrigation developments fail to improve the value addition from water (RoN 2008b)
	-	▪ Other high-priority water needs in Namibia will be jeopardized by major Government expenditure on this project.
	-	▪ Risk of negative cost-benefit ratio due to evaporation loss

There are major concerns about the Neckartal development:

- The proposed area and benefits of irrigation farming are not likely to be realized.
- It will be a major capital expense (N$3,000 million, likely to be more hidden costs) by government, but is likely to fail to achieve the NDP3 or Vision 2030 goals that are used as its justification.
- The environmental assessment process for this major development has been inadequate e.g. the lack of an Environmental Flows Study, and under-estimation of the negative social impacts on Keetmanshoop. This undermines the possibility of the development from minimizing environmental harm, and from reaching its full economic potential.

This SEA does not support the Neckartal Dam development as its economic benefits are marginal and the capital expenditure enormous. We predict that it is unlikely to achieve the social upliftment that is intended in the region, and its negative environmental impacts are significant. This proposed development is identified as a **RED FLAG**.

Noordoewer, Tandjieskoppe and Naute Irrigation Schemes

Refer to Key Issues 5.1.2 and 5.1.3 in the KIRLUP (SPC 2010).

Two sites are proposed for irrigation schemes close to Noordoewer, bringing 960 ha of land next to the Orange River under irrigation. These are GreenScheme developments, driven by the MAWF. An irrigation scheme proposed for Sendelingsdrif has identified 360 ha of irrigable land, with a crop mix of dates (70%) and grapes (30%) (MAWF 2005). Proposed expansion of the Naute Dam Irrigation Scheme intends to increase production of table grapes and dates

The cumulative impacts of these projects add to those described in Table 6.2. Overall, this SEA supports the developments as they make productive use of the favourable climate and water supply in the Orange River Valley and the existing Naute Dam. Irrigation methods should be water-efficient, and the products grown should be high-value crops to derive maximum value addition for the water used.

6.1.1.4 Cumulative impacts, risks and conflicts with other sectors

The quantity of water from the Orange River is limited and decreasing, due to growing abstraction in upstream and neighbouring parts of the basin. Regardless of considerations about environmental health, this limits the total potential for irrigation along the lower Orange. According to a study in 2004, it is predicted that "the existing Orange river system will be fully utilised by 2020" (DWAF 2004).

Declining water quality due to return flows from irrigation schemes (Earle *et al.* 2005, Orasecom 2008). E.g. water abstracted from Orange River for Rosh Pinah town has high incidence of blue-green algae (Saayman 2010, pers. comm.)

The international border between South Africa and Namibia is still on the north bank high water mark. "The delineation of the border has major implications for the use of the waters of the Orange River as the current border effectively deprives Namibia of independent access to the water. … Although South Africa has repeatedly stressed that it will not object to the use of Orange River water by Namibia and although bilateral cooperation between the two countries is good, a solution to the border disagreement would be beneficial for joint basin management in the future" (Earle *et al.* 2005).

Demand for Orange River water for various uses - irrigation farming, mines, towns – is cumulatively decreasing the runoff of the Orange and could put the Ramsar wetland site at the mouth at risk.

The proposed Neckartal Dam development is in conflict with numerous directives in Vision 2030, NDP3 and the Integrated Water Resources Master Plan by MAWF (2010). The development possibly conflicts with tourism activities and proposals for the lower Fish River, particularly through the Fish River Canyon. The Sendelingsdrif irrigation project identifies a possible conflict in land use with the Trans-Frontier Conservation Area initiative (MAWF 2005).

The proposed LOHEPS at Noordoewer (Lower Orange River Hydro Electricity Power Scheme, refer to ch. 6.4.3.2 for details) will not interfere with the proposed Noordoewer expanded irrigation developments.

6.1.1.5 Synergies, opportunities and suggestions for the sector

All irrigation should be done using only high-efficiency drip and micro-spray technologies. The arid climate, particularly the high evaporation rate, demands that water should be used efficiently. More efficient methods of irrigating would in turn also reduce the amount of pesticide- and fertilizer-contaminated water flowing back into the river. Water demand management, i.e. managing the amounts of water consumed through pricing or other incentives, should be urgently introduced. The Orange-Fish River Basin Committee in MAWF should take the lead in promoting demand management for improved IWRM (MAWF 2010a). NDP3 states a key activity in the water sector (p43) is to undertake a "pilot study on efficient irrigation methods to be used along the Lower Orange River". This directive is also consistent with NDP3 which urges more value addition per unit of water consumer, and a strong role for functional basin management committees.

There is great potential for tourism development around water-based recreation and waterfront properties. The Southern Tourism Forum Area (STFA) at Naute Dam has not been utilized. Tourism developments are not being considered for Neckartal Dam as well.

If the Neckartal Dam will be implemented although not supported by this SEA, it should be considered the possibility to generate hydro-electric power. This suggestion, made during the EIA feedback process, is apparently being taken up.

Dam development brings opportunities for aquaculture on fish farms.

6.1.2 Livestock and game farming

6.1.2.1 National targets for this sector

Vision 2030 (Land and agricultural production): Where we want to be

- Declining rates of land degradation
- Unpolluted soils and agricultural water run-off
- Optimal land-use and livelihood options
- Improved economic development options

Strategies identified in Vision 2030 include (amongst others) the following:

- Create economically and ecologically rational land-use plans to ensure that land is used optimally and not just for direct-use activities like agriculture;
- Encourage local value-adding through domestic processing of meat products;
- Recognise the interdependence between agriculture and other issues, particularly water management and biodiversity conservation.

The development strategies stated in NDP3 (RoN 2008b, p100), in the Key Result Area: Productive utilization of natural resources and environmental sustainability, Sub-sector 1 (Agriculture) include:

- Increase the productivity of livestock in communal and resettlement areas;
- Promote good rangeland management practices through awareness campaigns and encourage rapid de-stocking and marketing of livestock to reduce pressure on rangelands;
- Promote meat exports

6.1.2.2 Present situation

The greatest part of Karas Region is dedicated to farming with small stock, predominantly sheep. Although this is consistent with the MAWF's agro-ecological zoning (Figure 4.3), the habitat is marginal even for these hardy animals. Numbers of sheep in the region are on the decline, largely due to the Small Stock Scheme of 2004 (Hager 2009), but the karakul industry is recovering after its major slump from the 1970s to early 2000s, and karakul are on the increase due to the improved pelt prices that can be achieved. Karakul are probably the best suited and most profitable domestic animals for this arid terrain (Mendelsohn 2006).

High-production mutton farming is concentrated on dorpers, but Damara and Nama sheep are also well adapted to the harsh conditions and are less aggressive on pastures than dorper sheep (Hager 2009). They are not farmed in very large numbers in the region (less than 300,000 in Karas and Hardap combined).

Goats make up about a fifth of all livestock in Karas. Boer goats are hardy, have a high reproductive rate, strong resistance to parasites and provide lean, tender meat. They also prefer to browse on woody plants. There is a strong market for export of goats to South Africa.

Slaughtering of both goats and sheep is dictated by the Small Stock (6:1) Scheme by which a farmer can only export 1 live animal for every 6 animals slaughtered in Namibia. The scheme is considered by the farmers unions to be a hindrance because farmers can achieve a better price for their carcasses in SA and, for many, the SA abattoirs are physically closer. Although the scheme is supposed to create an incentive for local value addition and employment, it has almost no support from local farmers (pers. comm. FGD livestock sector). Many are shifting over to cattle farming which is not affected by this regulation.

Cattle make up less than 5% of the total livestock but their numbers are growing. Cattle farming is concentrated in the higher rainfall, north-eastern section of the region, but is growing in other areas as well due to the above-mentioned reason. Cattle require more grass pasture and water than small stock and so are less suited to the arid shrubby habitat, and their growing numbers have a negative impact on rangeland health.

It is acknowledged that farming in southern Namibia is a risky business (Mendelsohn *et. al* 2002), and there is concern that rangelands are becoming less productive due to overstocking and poor rangeland management. Condition of pasture was recorded in 1993 to be worsening in many areas (Moorsom *et. al* 1993). While goats feed on a wider variety of forage, including browse, rangeland experts have commented that, in switching from sheep to goats, small-scale farmers may reduce their risk in the short run, but that the pasture might suffer in the long term (Moorson *et al.* 1993). Invasive growth of *driedoring* bushes has led to a loss of agricultural productivity in large parts of Karas (Mendelsohn 2006), and a shift from sweet to sour grasses (dominated by *Schmidtia kalaharensis*) with lower palatability is noticeable.

Livestock farming depends on a reliable water supply, and in Karas this is almost entirely from groundwater resources. Karas Region has overall low groundwater potential (Christelis and Struckmeier 2001).

Table 6.4. Strategic assessment of livestock farming in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	0 to -	Depending on rangeland management, ecological health of rangelands may be maintained or, if they are overgrazed, they will support lower biodiversity.
Rangeland health and soils	0 to -	Depending on their management, rangelands and soils may maintain their productivity or become degraded through overstocking followed by sheet and gully erosion. Problems such as *driedoring* infestation and increasing dominance of less palatable grasses are signs of overgrazing that are widespread in farming areas in Karas. Large stock farming is more damaging to rangeland health in the

Component	Overall rating	Description
		south than small stock, and MAWF's agro-ecological zoning project prescribes that the area is suitable for sheep farming only.
Water and hydro-logical functioning	0 to -	If rangelands are overgrazed, bare soils will increase runoff. This promotes sheet and gully erosion, resulting in increasing turbidity and silt load of rivers.
Air quality	0	
Landscape beauty / Sense of place	+ to 0 to -	Depends on rangeland management. Rural scene with grass cover and livestock is positive, but erosion and desertification have a negative impact on landscape beauty.
Livelihoods, em-ployment	+	Livestock in communal areas are important for self-sufficiency. Farm labour and commercial marketing of livestock on freehold land have a positive impact on livelihoods.
Human health	+	Food
Cultural heritage / social cohesion	+	Farming communities tend to have strong cultural values and family support structures.
Infrastructure	0	
Economic develop-ment	+ to -	Livestock (through marketing and home slaughtering) contributes significantly to the Karas economic situation. But economic per-formance is marginal, as the farming activities are vulnerable to droughts and declining rangeland productivity.

6.1.2.3 Likely future developments

No major future interventions in the livestock sector are known or expected. Because this form of land use is the most familiar to most southern farmers, it is expected to continue in the foreseeable future. The trend to farm with cattle depends on whether the Small Stock Scheme continues in its present fash-ion, but changes are being called for by the farmers unions and are due to be considered. The other trend, to farming more with wildlife and tourism activities, is also likely to grow as climate variability continues.

6.1.2.4 Cumulative impacts, risks and conflicts with other sectors

Livestock farming in southern Namibia is vulnerable to droughts and groundwater depletion. Declining rangeland productivity is reflected in soil degradation, widespread *driedoring* encroachment and less palatable pastures. Increasing climate variability will make livestock farming even more marginal. This SEA does not agree with the KIRLUP's delineation of a Large Stock Zone in the north-eastern corner, as none of Karas Region is suitable to be sustainably farmed with cattle (MAWF 2009).

Failure of the Small Stock Scheme to achieve the goal of increasing value adding and local employment is a major concern. The scheme is making farmers slaughter less small stock, and persuading them to

switch to large stock, which accelerates land degradation. The Small Stock Policy in its present form is noted as a **RED FLAG,** as it is directly contributing to accelerated land degradation in southern Namibia.

Climate change will make southern Namibia even less suitable for stock farming, with primary productivity (= carrying capacity) expected to decline significantly. Additionally, insect-borne diseases such as Rift Valley Fever are likely to become more prevalent in the south. Wildlife, especially springbok and gemsbok, are far better suited to arid conditions and many farmers are already diversifying to tourism and wildlife for economic reasons. Night culling of springbok for export to SA is a growing market. If managed and monitored properly, this trend is seen as positive for environmental health and is expected to grow steadily.

There are no major conflicts with other sectors. However, mining EPLs grant access to any land, and farmers feel vulnerable to the priority given to geological prospecting activities and its impacts.

6.1.2.5 Synergies, opportunities and suggestions for the sector

There is great potential for farmers to diversity into wildlife and tourism activities. Land adjacent to protected areas is more profitable under wildlife and tourism than under conventional farming. It also results in lower human-wildlife conflict since the land uses are more compatible. The "Parks Vision" (MET 2005) is to expand, manage and develop the park network of Namibia to protect the biodiversity and landscapes of the country. This includes improving the connectivity of the parks system through establishing new conservancies. Farmers on communal, resettlement and freehold farms should use this as leverage for diversifying into the wildlife and tourism sector, especially in those areas identified in the Land Use Plan as holding potential in this sector.

Grasses need adequate recovery periods between grazing to prevent overgrazing. Therefore sustainable rangeland management is recommended, as it ensures that livestock numbers do not exceed the amount of food available and that there is sufficient reserve supply to cope with drought conditions. Expansion of open land (by removing fencing barriers) improves the possibility of livestock and game to migrate with food availability. Development of cooperative farming units is suggested to address this approach.

6.1.3 Small-scale farming and indigenous products

The Vision 2030 targets for this sector are the same as those listed in the previous section, concerning land and agricultural production.

NDP3 (RoN 2008a, p39) states that the Namibian people want commercialization of indigenous plants and promotion of income generation from this resource, and that the government intends to support production and marketing in this line. It urges investors to investigate the potential in this sector, and to ensure that a portion of the benefits remain at the local level. Devil's claw and Hoodia, which both occur naturally in Karas Region, are specified with targets for production (RoN 2008b, p99).

Although there is strong motivation for development of these resources, the international Hoodia market is not yet strongly established and is very vulnerable. Similarly the Devil's Claw market is still only

very small (Mendelsohn 2006). These sectors hold some potential but the total value is limited. These products hold the greatest economic impact at the local level, where subsistence livelihoods can be greatly improved, but they are very vulnerable to and have no control over international markets. If these products are commercially exploited, then harvesting practices must be sustainable. Ad hoc harvesting of wild Hoodia and Devils Claw plants is illegal and is not supported by this SEA.

Small-scale vegetable farming is also a valuable contributor to local livelihoods and has insignificant impacts on water and soil resources because of the small size of the enterprises.

6.2 Conservation and tourism

6.2.1 National targets for this sector

Vision 2030 (Wildlife and tourism as well as Biodiversity): Where we want to be

- Extended and well managed parks and nature reserves, to include biodiversity hotspots and trans-boundary areas
- CBNRM extended into all viable rural areas to improve livelihoods
- Protection of Namibia's unique tourism product, focusing on low impact, high quality nature-centred tourism
- Tourism and wildlife increasingly contributing to economic growth for sustainable development of Namibia
- Diminished rates of biodiversity loss
- Equitable access to and appropriate tenure over all natural resources through CBNRM initiatives
- Strong partnerships and significant sharing of skills and opportunities between GRN, private sector and conservancy stakeholders
- Vibrant, productive rural areas

In the Wildlife sub-sector and Tourism sub-sector of NDP3 (RoN 2008b, p124), strategies relevant to Karas include:

- Promote sustainable utilization of wildlife in communal and commercial areas;
- Proclaim Protected Areas;
- Promote tourism as a viable vehicle for poverty reduction, rural development, biodiversity protection and overall economic growth;
- Coordinate the development of training and skills development programmes/materials that are particularly aimed at illiterate and semi-literate rural communities;
- Create new tourism investment opportunities focusing on proclaimed conservation areas and cultural heritage sites
- Intensify tourism promotion and marketing, market diversification and destinations management.

These strategies are drawn from, and are in agreement with, the MET's Strategic plan for the five-year period to 2012 (MET 2007). The government clearly recognises this sector as an economic engine with great potential for growth and poverty reduction. The SPAN (Supporting the Protected Areas Network) and SKEP projects (Succulent Karoo Ecosystem Programme) in MET contribute to realizing this potential in Karas Region.

6.2.2 Present situation

Approximately one quarter of Karas Region is formally protected for wildlife conservation, in the parks run by MET. Communal conservancies and private reserves add another 15%. The total area under wildlife management is over 50,000 km² (Table 6.5).

Table 6.5 Important features of protected areas in Karas Region. Information from NACSO (2010), NNF (2008).

Protected area	Main biome or veg type	Area (km²) in Karas Region	Number of tourists p.a.	Number of people resident	Main attractions
Sperrgebiet National Park (MET)	Mainly Succulent Karoo, some Desert biome in NW and NE	26,000	0 (awaiting allocation of concessions		▪ Diverse and abundant flora ▪ Wilderness and scenic landscapes ▪ Colonial history (esp diamond mining) ▪ Orange River mouth
Namib Naukluft Park (MET)	Desert		Small number, in 4x4 concessions up coast from Luderitz.		▪ Dunes
/Ai-/Ais Hot Springs Game Park (MET)	Nama Karoo and Succulent Karoo	4,420			▪ Fish River Canyon and surrounding scenic landscapes ▪ /Ai-/Ais hot springs
Naute Game Park (MET)	Nama Karoo	230			▪ Scenic landscapes surrounding dam
!Khob !Naub Conservancy	Nama Karoo	2,747		5,000	▪ Giant quiver trees ▪ Scenic landscapes
//Gamaseb Conservancy	Nama Karoo	1,748		5,000	▪ Gamaseb Mountain ▪ Missionary Station
!Gawachab Conservancy	Nama Karoo	132		500	▪ Adjacent to Naute Dam ▪ Old railway station
!Han/Awab Conservancy		1,923		780	▪ Konkiep River ▪ Nama culture ▪ Scenic landscapes

Protected area	Main biome or veg type	Area (km²) in Karas Region	Number of tourists p.a.	Number of people resident	Main attractions
Gondwana Canyon Park (private)	Mainly Nama Karoo, small area of Succulent Karoo in south	1,120			▪ Scenic landscapes ▪ Indigenous wildlife re-introductions
Namib Huib Plateau Park (private)					▪ Scenic landscapes

The Marine Protected Area comprises a coastal strip 400 km long from Meob Bay in Hardap Region to Chameis in Karas, that is about 30 km wide and includes 16 offshore islands. The entire area is 9,555 km², and includes the rock lobster sanctuary between Chameis and Prince of Wales Bay. This MPA will help to preserve the biological resources of the southern Benguela.

Sustainable tourism development involves promoting appropriate uses and activities that draw from and enhance landscape character, sense of place, community identity and site opportunities (NNF 2008). As such, tourism can enhance environmental quality at the same time as creating jobs, and provides longer-term development opportunities than other industries (e.g. mining) which have shorter project lifespans.

Tourism products in the region are diverse, including Lüderitz, the Namib-Naukluft Park, Fish River Canyon, the Orange River, the deserted coastline and forbidden diamond area of the Sperrgebiet. There is also a wide range of tourism products and experiences in northern Namaqualand on the south side of the Orange. The strategic plan for the Sperrgebiet National Park identifies the need to target different market segments with a range of tourism and recreational experiences and products that are appropriate to each segment and to the resources themselves (NNF 2008). For instance, in the Sperrgebiet there is a central wilderness core with low visitor numbers, surrounded by a range of low-intensity tourism experiences catering for greater numbers of people, where there is good access by public roads. This also agrees with the principle to locate tourism products on the periphery of protected areas.

Private game park helps to achieve the real value of the land

The Gondwana Canyon Park lies adjacent to the /Ai-/Ais Hot Springs Game Park, together making up part of the Greater Fish River Canyon Complex. Since 1995, the original farms which were marginally productive under large-scale, fenced, commercial small-stock production, have been transformed for wildlife- and landscape-based non-consumptive tourism (Gondwana Collection Namibia, 2010). Removal of internal fences and re-introduction of indigenous wildlife have helped the rangelands to recover from overgrazing and allowed game numbers to build up, including the return of various predators. An assortment of tourist facilities, with luxury chalets, simple cottages, a roadhouse and self-catering accommodation, attract a broad range of tourists. Over and above the normal holiday attractions there are also adventure activities such as hiking and mule trails. The hospitality business is run on eco-friendly principles (such as re-using wastewater to irrigate vegetable gardens which supply the restaurants) and helps to finance the nature conservation side of the operation.

Compared to other land uses in the vicinity (livestock farming on a commercial basis or for subsistence on communal land), tourism contributes by far the most to profits, community income, employment and economic growth (Barnes and Humavindu 2003). For instance, 153 people are employed in this Park, compared to about 30 on commercial farmland of the same size, and only 24 on communal land. Economic returns are far higher for tourism land use than for either of the other two 'conventional' uses of the land. Following this model, similar improvements in livelihoods and economic returns could be achieved in numerous places in southern Namibia, although this area has an already strong tourism bias due to its proximity to the Fish River Canyon.

Table 6.6. Strategic assessment of protected areas in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	+ + + 0	This is their main function, and they succeed in protecting the species and ecological processes in most of the biomes and vegetation types. The Southern Kalahari vegetation type is inadequate protected.
Rangeland health and soils	+	Because indigenous wildlife makes efficient use of scarce resources, the potential for reducing damages to rangelands is much higher by introducing wildlife prior to livestock.
Water and hydrological functioning	0 to -	The low demand for water provision to game makes little or no impact on surface and groundwater resources. Tourism establishments (e.g. lodges, campsites) also make some (e.g. overabstraction of ground-water, sewage disposal), mostly little, negative impact.
Air quality	0	
Landscape beauty / Sense of place	0 to +	Since scenic landscapes are an important tourism feature, the nature protection contributes positively to the landscape's beauty.

Component	Overall rating	Description
	-	High visitor numbers (to favourite spots e.g. Fish River Canyon look-out) can detract from the wilderness appeal. Tourism infrastructure locally can disturb the landscape's natural beauty
Livelihoods, employment	+ to + + +	Tourism creates jobs for local people, many of whom receive training and skills which helps their future prospects for employment.
Human health	0 to +	
Cultural heritage / social cohesion	0 to +	Cultural practices and traditions are a tourism asset that many establishments use.
Infrastructure	0 to -	Travelling by tourists and their need for services makes relatively little impact on infrastructures. Road upgrading, primarily to serve the tourism industry (e.g. tarring of the Goageb-Helmeringhausen road) is an investment for future economic growth in the sector.
Economic development	+ to + + +	Overall the protected areas and tourists they attract have a positive economic impact, with potential for much more.

6.2.3 Likely future developments

Refer to Key Issues 5.1.4; 5.1.5; 5.1.6 and 5.1.14 in the KIRLUP (SPC 2010). Developments that are projected in the KIRLUP include implementation of the Sperrgebiet Management and Development Plan, establishment of the Trans-Frontier Conservation Area (TFCA), a land consolidation plan to enlarge the link between the Sperrgebiet and /Ai-Ais, and zoning of the Marine Protected Area.

Sperrgebiet plans involve creating zones for differing levels of tourism activities. This zoning reflects a period of about 10 years of planning how this block of land should best be used as mining declines and the land is opened up for other uses. Tourism development areas are envisaged in and adjacent to the Park, such as ones for 'coastal and mining history' and the 'Aus-Lüderitz link'. Strategically placed information centres and concession areas will help to manage the numbers of people entering the Park and where and how they move around. These fit with the tourism image defined as "a remote, desolate, wild arid area and coastal National Park with Succulent Karoo vegetation, dramatic landscapes, arid area wildlife, coastal bird and sea life, and an alluring history of diamond mining in a restricted area, forming the western section of a much larger TransFrontier Conservation Area" (NNF 2008).

The TFCA includes areas of cultural significance such as Warmbad and Bethanie, multiple use areas such as along the Orange River with tourism and irrigation farming, scenic landscape areas, infrastructure corridors and urban areas. The intention is to marry the various needs and activities while emphasizing their primary vision of enhancing tourism.

The land consolidation strategy described in the KIRLUP is strongly promoted by this SEA. Benefits flowing from this development include improved conservation status of the Important Plant Area (Hofmeyer 2004), and opening up movement corridors for wildlife. It could also be considered that the Protected Area and freehold farmland could be effectively co-managed, thus removing the necessity for government to purchase additional land but still achieving the desired conservation aims.

Proclamation of the Marine Protected Area has been achieved, and zoning it to bring stronger control over the activities in the area is fully supported by this SEA.

All four of the proposed developments are expected to increase the conservation and tourism value of the area, thus realizing the optimal environmental and socio-economic value of the land.

6.2.4 Cumulative impacts, risks and conflicts with other sectors

The international tourism sector is fickle, since the products are luxury, not essential, items and the disposable income of a wealthy client can quickly be switched to other products. The sector is therefore vulnerable to events which it cannot control such as international terrorism, a worldwide economic downturn, or unexpected events such as the ash cloud disruption to international flights in April 2009. Gondwana Canyon Park management stated (Goldbeck 2010 pers. comm.) that they were not significantly affected by the 2008 worldwide recession; nevertheless, events such as this could significantly impact the sector.

This sector poses no significant cumulative negative impacts, but potentially conflicts with other land uses such as mining and transport infrastructure. The conflict is most severe in cases where mineral deposits occur in biodiversity-rich or scenic areas, and careful assessment and planning must be implemented to minimise the environmental damage.

A further consideration is that increasing popularity as a tourist destination may itself reduce the wilderness appeal. This negative consequence of its own success can be partly mitigated through careful management

6.2.5 Synergies, opportunities and suggestions for the sector

As an over-arching guideline, the continuity of areas under conservation management should be strengthened, under the motto "Karas Network Natura 2030".

This sector should try to develop facilities for a wide spectrum of tourists and visitors, from local people wanting outdoor recreation places for a day or weekend, to middle-income people with moderate expectations of serviced facilities, to high-paying tourists who are able to pay expensive fees for fully serviced, luxury facilities. This range of options will hold attractions for the whole spectrum of tourists and recreation seekers who originate from Namibia, Africa and overseas.

As a mitigation for expected climate change, the Kgalagadi Transfrontier Conservation Area (shared between South Africa and Botswana) should be extended to include Namibia's southern Kalahari, where there are currently no protected areas. (Turpie et al 2010).

The tourism sector will benefit from some of the infrastructure improvements which are described in the KIRLUP. Train travel is environmentally friendly and this SEA supports the upgrading of the Aus-Lüderitz train line for its possible value as an added tourist attraction and novel mode of travel for visitors to Lüderitz. Also, upgrading of the gravel road linking Karas Region with Walvis Bay via Bethanie

and Maltahöhe is fully supported, so long as environmental damage is minimised through proper EIA application.

The Naute Game Park is under-developed and has potential for tourism and recreation facilities to serve Keetmanshoop and the wider public.

6.2.6 Issues of concern to be addressed in project level EIAs

At the project level, the potential negative impact of tourism infrastructure on the landscape's natural beauty needs to be avoided or reduced by proper designs that fit best into the scenery.

6.3 Mining

6.3.1 National targets for this sector

Vision 2030 (Non-renewable resources): Where we want to be

- Mining well planned, resulting in minimal, if any, impacts on human health and the environment.
- All mines fully rehabilitated after closure.
- Investments resulting from mining are used to develop other sustainable industries and human capital for long term national development.
- Strong small mining sector

In the mining sub-sector of NDP3 (RoN 2008b, p118), there is clear recognition that this is one of the major contributors to the Namibian economy, and that mining has stimulated significant infrastructural development and social upliftment. Opportunities that are identified include local value addition to mineral products, and maximizing the utilization of minerals for present and future generations while minimizing environmental damage. Small scale mining receives much emphasis.

Additionally, the programme described in NDP3 to support mining output (RoN 2008c, p50), states the following:
"In support of economic diversification, the mining sub-sector will seek a closer interface with the trade and industry sub-sector to ensure support services and the regulatory environment for local beneficiation of minerals." This and the various other activities in the programme will focus on 5 regions, including Karas and Hardap.

Most of Namibia's mining revenue was generated in Karas Region, until the uranium rush in Erongo Region and the economic downturn pushed diamond revenues down and uranium investments up. The towns of Oranjemund and Rosh Pinah are sustained entirely by mining activities, salaries are paid out by

mines and distributed to other parts through social connections, and royalties and taxes are paid to government. These are significant positive impacts.

6.3.2 Present situation

Table 6.7 Summary of main mining activities and potentials in Karas Region.

Mining product and area	**Name, Mining Licence Areas, Company**	**Spatial area (km²)**	**Employment**(figures from Chamber of Mines 2009)	**Life of mine and future trend**	**Overall comments**
Diamonds, land-based	Orange River ML42, Mining Area 1 ML43, Bogenfels ML44, Elizabeth Bay ML45, Douglas Bay ML46. Namdeb	Total ML area almost 10,000 km², actual footprint = 195 km² (Burke 2008)	~1,500 permanent, ~ 150 temp (Chamber of Mines 2009)	Land-based operations gradually winding down as the resources are mined out	Large cuts in staff in 2009 due to economic downturn, "outlook for diamond prices remains fragile," (Chamber of Mines 2009)
Diamonds, off-shore	Atlantic No 1 ML47, Midwater ML128A,B,C Debmarine	~6,000 km², but only about 25% is mined (CSIR 2008a)	~500 permanent (2009)	Started 1991, now 64% of total diamond production (Mendelsohn *et al.* in prep.)	
Lead-Zinc	Rosh Pinah		~600 permanent	Expected to start closing in 2017	Lead and zinc have remained strong despite economic downturn (Chamber of Mines 2009)
Zinc	Skorpion Zinc		~700 permanent, ~60 temp, ~600 contractors	Expected to start closing in 2015	
Gemstones (small-scale mining)	Tantalite Valley (tantalum, aquamarine), a few other scattered localites e.g. Aus (tourmaline)	Not possible to identify all areas and numbers of people involved due to informal nature of operations		Geologically, relatively low potential for gemstones in Karas Region	
Slate (small-scale quarrying)	Bethanie area	Not possible to identify all areas and numbers of people involved			

Mining product and area	Name, Mining Licence Areas, Company	Spatial area (km²)	Employment(figures from Chamber of Mines 2009)	Life of mine and future trend	Overall comments
Copper	Haib	Closed		Likely to reopen if copper's high price is sustained	
Copper	Sinclair	Closed in 1998			
Copper	Lorelai	Closed			
Fluorite + Tin	Aukum Mine	Closed			
Lithium	Garub	Closed			
?	Jerusalem	Closed			
Marble	Aus	Closed			
Salt	Vertwall	Closed			
Rare earth metals	Marinkas Quelle	A future possibility			
Phosphates	Offshore	Potential not yet clear			
Uranium	Warmbad, Garub-Aus Namura Minerals Resources	Prospecting stages only			

Current mining activities in Karas Region are focussed on two main products, diamonds and base metals (lead-zinc). Small-scale mining makes a small contribution to the sector.

Currently abandoned copper mines exist at Sinclair and Haib, although it is possible (likely?) that Haib will be re-opened since it is a huge deposit, but low in grade. Pegmatites similar to the geological setting of the Uis tin mine have been mined at Aukum (tin and fluorite) and in Tantalite Valley in the south (small-scale occurrences of tantalum).

6.3.2.1 Diamond mining

Beach, nearshore and river terrace mining

The coastline and the landscape in Mining Area 1 between the Orange River mouth and Chameis has been physically and irreversibly altered by over 100 years of diamond mining activity (CSIR 2008a). Foreshore excavations, mined-out bedrock areas and overburden dumps now remain, with only minor pockets of natural vegetation which have not been significantly disturbed by mining. In some areas, water has flooded the mined out bedrock areas, creating a series of ponds separated from the sea by a thin strip of seawall deposits. These areas will not be rehabilitated, but are undergoing slow natural rehabilitation by the vigorous wind and wave regime, and unassisted re-establishment of indigenous vegetation (Burke 2008).

Land-based diamond mining is also carried out in the deflation valley deposits of Elizabeth Bay, and along the Orange River at Auchas, Daberas and Sendelingsdrif. Inland areas, away from the dynamic coastal environment, take much longer to recover naturally since plant establishment relies on above-average rains. The Namdeb rehabilitation plan proposes interventions in selected areas, together with a "mend while you mine" philosophy in current and future mining operations (Burke 2008, van der Merwe and Jurgen 2010 pers. comm.).

Directly affected areas are thoroughly turned over in the land-moving and diamond separation processes. Animals restricted to the beach and nearshore habitats include desert rain frog and two known species of intertidal spiders, and these endemic species are threatened (CSIR 2008b, Griffin 2005). Land based mining operations have affected about 195 km² altogether (Burke 2008).

Marine diamond mining

Marine diamond mining in the Atlantic 1 Mining Licence Area is concentrated in areas of 40 – 140 m depth close to the Orange River mouth (CSIR 2008a). Current technology uses heavy-duty, remotely operated equipment which does drill and crawler mining and dredging. High risk impacts include destruction and loss of plants and animals on the muddy sea floor in and adjacent to the target areas, from the dredging of sediments as well as discharging of the tailings. Medium risk impacts arise during prospecting and sampling, which generates underwater noises and disturbs the sediments, and during the dredging operations through disturbance to the sea-floor sediments and smothering of bottom-dwellers, release of hydrogen sulphide gases that are trapped in the muds, and oil pollution from the ships. Mining currently covers an area of about 5 km² per year, and since starting in 1991 has probably disturbed over 60 km², altogether less than 1% of the licence area and an even smaller proportion of the continental shelf area between the Orange River and Lüderitz. This makes the overall environmental impact on biodiversity less significant, in the light of the fact that marine biological communities are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone.

Marine diamond mining also occurs in a narrow strip adjacent to the coast further north, from Chameis to Lüderitz, in the mid-water area between ~50 - 120 m depth (CSIR 2008b). The mining activities are similar to those in deeper water but involve divers, airlift trenching tools and dredges, operating from small boats and from shore. The environmental impacts are also similar, but affect more species since the bays, estuaries, intertidal areas and kelp beds are important nursery areas for marine eggs and larvae and juvenile fish, including species that ultimately migrate into deeper water offshore (CSIR 2008b). The commercial rock lobster fishery is mostly directed at shallower waters than mining activities.

This shallow water mining occurs in the newly proclaimed Marine Protected Area (MPA). Possible impacts on this area, which includes the feeding grounds of African Penguins and Bank Cormorants (both Red Data birds), are oil pollution, litter and sediment plumes that affect fish (the food of seabirds).

Because of the relatively shallow water they operate in, marine diamond mining activities do not interact directly with commercial (deep-water) fisheries. The pipeline bringing gas onshore from the Kudu gas field will make part of the mining area inaccessible (CSIR 2008a).

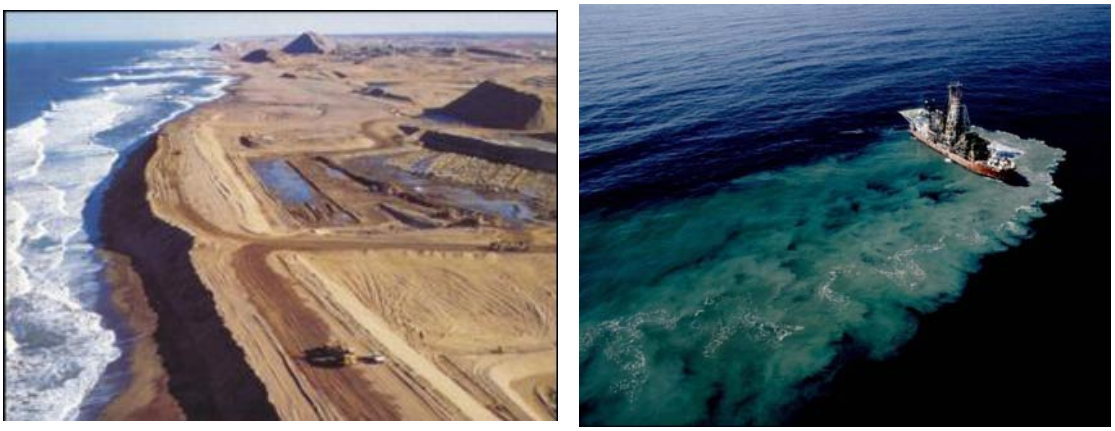


Figure 6.2 Land and marine based diamond mining by Namdeb. (Photos from Schneider 2010)

Table 6.8. Strategic assessment of diamond mining in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	0 to -	While terrestrial and nearshore mining has destroyed the natural vegetation and associated fauna in its direct footprint, there has been surprisingly low impact on ecological functioning since indigenous plants and animals are returning naturally. A few species (such as desert rain frog) occur only in the foggy, sandy, hummock vegetation of the nearshore, and are threatened.
	0 to - -	Similarly, marine diamond mining as it is presently carried out (about 5 km^2/year) is destructive where it occurs. But recovery of benthic communities takes place within 5 years (Schneider 2010). Considering these dimensions, marine diamond mining has a small overall footprint, even if it would double in scale in the future. A possible impact of greater importance is the risk of oil pollution, especially in the Marine Protected Area.
Rangeland health and soils	0	No impact, all the beach and marine mining occurs where there is zero farming potential.
Water and hydrological functioning	0	There are no surface or groundwater features to be affected in beach mining areas.
	-	Water quality is degraded (higher salt concentrations) by return flows from mining at Daberas (Ellmies 2009).
	- -	Although not a Namibian problem, the salt marsh at the Orange River mouth has been significantly degraded by flood protection works for Alexander Bay, jeopardizing the ecological integrity of this Ramsar site.
Air quality	0	Smoke emissions from the earth-moving equipment and diamond processing plants are insignificant.
Landscape beauty /	- -	Tranquility and natural beauty of the beach and river environment

Component	Overall rating	Description
Sense of place		significantly degraded in the areas of operations.
Livelihoods, employment	+ + +	Very strong benefits from employment, and remittances are spread country-wide through family networks.
Human health	0	Diamond mining poses no hazards to health.
Cultural heritage / social cohesion		
Infrastructure	+ +	The town of Oranjemund, including road network and the bridge over the Orange River, electricity reticulation etc. was established and is sustained entirely by diamond mining.
Economic development	+ + +	Mining is the largest contributor to Namibia's GDP. Diamond production accounts for roughly 8% of total GDP, and 38% of the primary industry output (CSIR 2008a).

6.3.2.2 Base metals

The main base metal mines in Karas Region are Rosh Pinah (lead-zinc) and Skorpion Zinc. The town of Rosh Pinah is a privately run municipality set up by the two mines owned and run by RoshCor, while the mine is owned by the company Exxaro. The underground mine produces lead and zinc concentrate for export to SA and world markets. Skorpion Zinc is about 20 km north-west of Rosh Pinah on land that has been excised from the Sperrgebiet. The open pit mine produces special high-grade zinc for export to world markets. The associated company NamZinc runs the refinery in an EPZ arrangement.

Table 6.9. Strategic assessment of base metal mining in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	-	Relatively small impact due to the direct footprint of the mines in this sensitive (Succulent Karoo) area.
Rangeland health and soils	0 to -	Contamination of soils by metals (lead, zinc, copper, iron) around Rosh Pinah and Skorpion by wind-blown dust from tailings dumps (Amkongo *et al.* 2010)
Water and hydrological functioning	- -	Lead contamination of groundwater around Rosh Pinah by seepage from tailings dump and/or pollution of stream sediments (Amkongo *et al.* 2010) The mine might be able to reduce water consumption from the Orange if it can use and/or recycle water that is pumped out from underground operations
Air quality	0 to -	Air-borne dust contaminated with heavy metals over Rosh Pinah (Amkongo et al. 2010)
Landscape beauty /	-	Urban centre and the roads, powerlines, pump stations and informal

Sense of place		settlement in the vicinity of Rosh Pinah contrast strongly with wilderness sense of place along eastern edge of Sperrgebiet. But the negative impact is localised (~30 km along main road).
Livelihoods, employment	+ +	Employment is positive.
Human health	+ to 0 0 to -	Recognised 'healthy worker effect' amongst mine staff and their families. Possible health hazards from heavy metal toxicity (Amkongo *et al.* 2010)
Cultural heritage / social cohesion	0	
Infrastructure	- + +	The Skorpion refinery has a massive electricity demand, consumes about 25% of Namibia's total. Establishment and running of Oranjemund and Rosh Pinah is entirely due to the mines. In the absence of many livelihood options for Karas residents, well managed urban hubs are vital.
Economic development	+ +	Infrastructure development, employment, taxes, all cumulatively make a strong positive contribution to Karas.

6.3.2.3 Small-scale mining

The gemstone small-scale mining sector is small in Karas Region, even though there are many claims (Ellmies 2009). Due to the small-scale and informal nature of these operations, it was not possible to find figures on the numbers of people involved, the areas that are active, or the economics of the operations. The geological potential for gemstone mining in Karas is much lower than in Erongo: the region has some pegmatite swarms which are promising (e.g. Tantalite Valley) but lacks the widespread igneous intrusions which are richly endowed in Erongo Region.

Some small-scale quarrying for slate occurs in the Bethanie area, but similar rock formations closer to Windhoek offer the same product at a lower transport price for this small niche market. If a concentrated effort is made to promote this 'slate-cladding' building style then the Bethanie deposits might become more viable. Small-scale mining for building materials and aggregates offer the synergy of job opportunities and use of locally available mineral resources to make structures that have a 'natural' character. This is being promoted by Namibia's Geological Survey (Ellmies 2009)

An assessment of small-scale mining in Erongo Region (NPC 2010a) concluded that their environmental impact was relatively small, even cumulatively, and that most problems could be resolved through a fairly simple set of guidelines applicable to miners, land-owners and government.

6.3.3 Likely future developments

Existing diamond mining is likely to reduce on land and increase at sea. Current projections from Debmarine indicate that the mining rate, presently at about 5 km^2/year, will increase but to not more than double this figure, which is still very small in terms of the overall environmental impact (Mungungu 2011, pers. comm.). In the base metals sector, life-of-mine extensions of Rosh Pinah and Skorpion are

likely as new ore bodies are identified and/or new chemical treatments make it possible to extract those elements in demand.

Uranium deposits in the vicinity of Warmbad in the south and around Aus/Garub in the west may be mined in future. The main focus of uranium mining is in Erongo Region, but if the demand for this strategic mineral is sustained long-term then the Warmbad and Aus deposits could become economically viable. It is impossible to predict at this stage (Hoffmann 2010, pers. comm.).

The copper deposit at Haib is very large but very low grade, and has seen sporadic prospecting and investigation over many years. It is surprising that the high price of copper at the moment (2010) has not triggered renewed activity (Hoffmann 2010, pers. comm.).

The exceptional biological productivity of the Benguela Current leads to the formation of sediments high in phosphorous of organic origin. Phosphates are used in fertilisers. They occur in reasonable concentrations (up to 23%) on the Karas ocean floor, and may be exploited in future. There is some concern about the impact of sea floor mining, notably disturbance of fish such as the pelagic goby (Schneider 2010), and processing and extraction can be hazardous as they contain heavy minerals such as cadmium, lead and uranium (Mendelsohn *et al.* in prep.)

Apart from the places mentioned above, there are about 10 known occurrences of minerals that have been mined in the past (which might become viable again) or may be mined in future (Table 6.7). There are also rocks which are quarried for building aggregate or dimension stone. Whether these deposits are mined or not depends on many factors: Demand for minerals changes e.g. lithium may be more sought after for its role in rechargeable batteries; rare earth elements for their role in renewable energy technologies. World markets play an important role. Proximity of roads and powerlines can determine whether a small deposit can be viably mined and marketed. Some deposits are too small to attract large-scale investments, but they can be productively mined at a small scale with picks and shovels. All these factors determine whether a mineral occurrence becomes 'developed', and they make it impossible to predict the future focus of mining in the region.

6.3.4 Cumulative impacts, risks and conflicts with other sectors

Water demand will be a limiting factor to any future mining development. This conflicts directly with the intended use of Orange River water for irrigation farming. It is likely that future mining endeavours will need to consider desalination of sea water to supply their water needs.

Contamination of water supplies from mines is a high risk, as reported for Rosh Pinah. Prevention must be a priority to ensure adequate and safe water resources for the future.

There have been conflicts between proposed mining and irrigation schemes along the Orange River e.g. at Aussenkehr (Hoffmann 2010 pers. comm.). Even though mining might not take place directly on irrigable land, there are other issues such as dust emanating from mining which could taint fruit and vegetable harvests.

Exclusive Prospecting Licences (EPLs) for minerals grant the holder access to any land, and almost the entire Karas Region is covered by EPLs. This is a potential problem in areas that are under farming or conservation management, through activities such as off-road driving, drilling and poaching and just the presence of people where wilderness value is the main land use. The Minerals Ancillary Rights Commission offers a dispute-resolution forum in the case of such conflicts.

Direct threats to biodiversity might arise from mining, especially considering the high conservation status of the Succulent Karoo, the Orange River mouth and the offshore islands. In the marine sphere, oil spills arising from mining and prospecting for diamonds, phosphates or hydrocarbons pose the greatest risk.

As the mines wind down and approach closure, the towns of Oranjemund and Rosh Pinah must find other means to keep going. The Local Authorities that take over will face difficulties to keep services and maintenance functions running in the face of dwindling income from the smaller resident base.

6.3.5 Synergies, opportunities and suggestions for the sector

Closure of mines presents opportunities to use the existing transport, town and industrial infrastructure for alternative industries. For Oranjemund, this might come from the Kudu Gas development. For Rosh Pinah, a possible focus is to develop a hub for solar power research and development. Possible synergies in this plan are the demand for power for desalination at the coast, which could be supplied either by Kudu gas and/or by Rosh Pinah solar.

Mining tourism has been started at some mines e.g. Skorpion. Although the scale is small, this economic diversification within the mining sector is fully supported.

6.3.6 Issues of concern to be addressed in project level EIAs

Pollution from mines is a significant impact that must be strongly mitigated, both during the design (EIA) stage and with monitoring through the operational phase of the mine. These measures need to be carried through to prevent hazardous pollution occurring after mine closure.

Although marine diamond mining is expected to have a small overall footprint and that benthic communites may recover within 5 years, all marine mining proposals must ensure that the harm to seafloor and aquatic ecosystems is properly minimised. Restoration and environmental recovery must be well researched and effectively implemented, as an obligatory component of operational and closure plans in the EIA. Rehabilitation is mandatory under the Environmental Management Act.

Mining proposed in any of the identified sensitive areas in Karas (see Fig. 5.3) requires special attention at mitigating damage to the identified sensitive components.

Rehabilitation plans are mandatory for small scale mining operations as part of their mining licence conditions. However monitoring and law enforcement of this aspect are very weak.

6.4 Energy

This section deals with electricity and renewable energy, and domestic fuels such as firewood and paraffin. Liquid fuels for vehicles are not addressed.

6.4.1 National targets for this sector

The White Paper on Energy Policy (MME 1998) recognises that the energy sector is a vital component of the economy, since it provides essential inputs for other economic sectors and for basic needs and social services.

Since Karas Region has resources in both hydropower and natural offshore gas, the policy intentions of broadening the electricity supply base are relevant. The White Paper states that electricity supply in Namibia shall be based on a balance of economically efficient and sustainable electricity sources including gas, hydropower, other renewable energy sources and imported electricity. It is the aim of government that 100% of the peak demand and at least 75% of the electric energy demand will be supplied from Namibian sources by 2010.

Namibia has abundant renewable energy resources. Solar radiation is the highest measured in any country in the world (up to 3,100 kWh/m^2/a in certain areas) and excellent wind resources at the coast. While these are virtually untapped, biomass resources (firewood) are being heavily over-exploited.

The potential use of hydro-power, wind turbines and possibly large-scale solar power plants for grid connected electricity can contribute to the goals of sustainability and security of supply. The widespread use of decentralized solar photo-voltaic systems to provide basic rural electricity services has the potential to achieve the strongest impact. These are often cheaper than extending the grid over long distances, allowing for improved economic efficiency in rural electrification.

With regard to rural electrification, the White Paper states that it is government's intention that at least 25% of the country's rural households should be connected to the national grid by 2010. This will be driven in priority areas and will select the most appropriate means of electricity supply. Notably, it states that renewable energy systems, particularly solar systems, will substitute grid electrification in areas where it is not viable to extend the national grid.

NDP3 (RoN 2008) states that the government plans to (*inter alia*):

- Improve energy efficiency
- Support electricity generation and distribution, including rural electrification
- Promote the use of renewable energy
- Support the exploration and efficient use of fossil fuels.

The Plan also urges the private sector and communities to:

- Look into the area of renewable energy and provide technical expertise and material assistance to promote renewable energy use;
- Create awareness about the advantages of renewable energy projects. Energy saving can reduce electricity fees and lessen Namibia's dependence on foreign energy sources.
- Make capital investments in gas exploration and product development.

6.4.2 Present energy situation

This sector, probably more than others, is strongly influenced by developments and demands in the regional context, specifically the Southern African Power Pool (SAPP). Plans and proposals in this sector in Karas Region therefore need to fit with the bigger picture of electricity transmission and generation on a regional scale.

At present there is no generation of electricity in Karas. The region relies totally on electricity transmitted into the region on the national grid, generated in Namibia, South Africa and Zambia (Livingstone). The biggest manifestation of energy needs in Karas is powerlines.

6.4.2.1 Powerlines

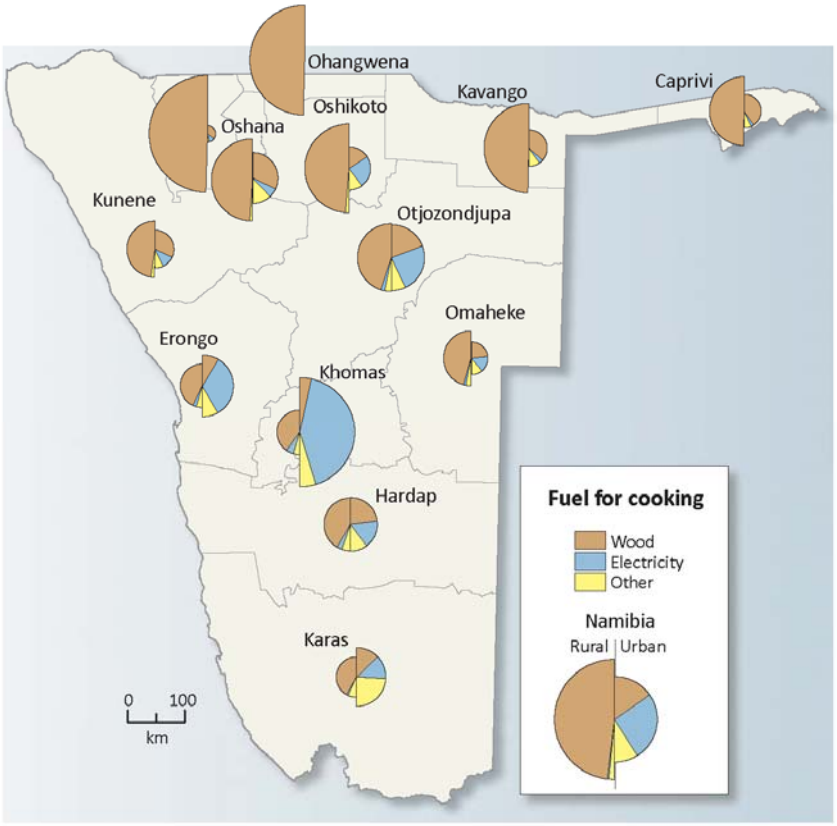
Table 6.10 Strategic assessment of powerlines in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	**0 to -**	Powerlines are a major cause of mortality to large birds, especially raptors and bustards. Ludwig's Bustard recently upgraded to Endangered status, largely due to this threat. Mitigation is possible by careful routing of lines and using raptor-friendly designs, but the latter are not yet adequately researched or implemented. The negative impacts are still significant. Footprint of powerlines has small local impact on biodiversity and heritage. Careful routing of lines can avoid sensitive areas.
Rangeland health and soils	**0 to -**	On a small scale, gully erosion exacerbated by tracks, especially damaging to bare soils (i.e. usually initiated by overgrazing)
Water and hydrological functioning	**0**	No significant impacts
Air quality	**0**	No impacts
Landscape beauty / Sense of place	**0 to -**	Significant degradation of landscape beauty, can usually (but not always) be mitigated to some extent by careful routing of powerlines .
Livelihoods, employment	**+**	Linked to the positive impact on economics.
Human health	**0**	Insignificant impacts
Cultural heritage / social cohesion	**0 to -**	No significant impact. Employment for construction often attracts people from northern Namibia, who come to Karas as migrant labourers and bring migrant labourer problems with them.
Infrastructure		Not applicable
Economic development	**+ +**	Strong positive impact, since energy provision facilitates employment, productivity, economic growth

6.4.2.2 Domestic energy needs

Domestic energy is mostly derived from firewood as a cooking fuel in the rural areas, and (in decreasing order) from electricity, wood and paraffin in towns (NPC 2007) (Figure 6.3). This is considered to not have significant environmental impacts except for local deforestation around towns. *Prosopis* grows commonly in many of the towns and coppices abundantly, but is an alien invasive tree. It plays a major role in providing firewood, and should not be targeted for removal because of its alien status.

Figure 6.3. Use of domestic fuels in Namibia, showing that firewood dominates in the north and in the rural sector. 'Other' in the case of Karas is mainly electricity and gas (NPC 2007). Map from CBS 2010.



6.4.3 Likely future energy developments

Refer to Key Issues 5.1.7; 5.1.8 and 5.1.13 in the KIRLUP (SPC 2010). Future plans for the energy sector include the following

- Kudu gas
- Run-of-the-river hydropower schemes on the Orange River
- A wind farm at Lüderitz
- Solar power generation arrays

The Desert Star town development intends to supplement its NamPower electricity with solar electricity (LM Consulting 2010).

6.4.3.1 Kudu gas

This project involves construction of a pipeline to transport the gas to shore, a 300 MW generation plant at Uubvlei, and powerlines linking the plant to the national electricity grid. The project has been under discussion for many years and has even gone through a lengthy EIA process up to 2006, after which it was shelved for financial reasons. Financial viability depends on the price obtained for the gas, and indications are that the conditions for go-ahead will be achieved soon, so that the project will be restarted in 2011.

Table 6.11 Strategic assessment of the Kudu gas development in Karas Region.

Component	Overall rating	Description
Biodiversity and ecological functioning	0 to –	Relatively small impact from disturbance of marine life caused by rig and anchors, smothering by drilling muds, toxic pollutants and wastes off the rig, helicopter activity.
	0	The power plant will occupy degraded land in Mining Area 1 at Uubvlei, with little impact from its footprint.
	-	Powerlines from Uubvlei across the Sperrgebiet will make an incremental addition to the cumulative impact of collisions of birds. The most significant impact is on Ludwig's Bustard, an Endangered species.
	- -	Potentially significant threat from risk of oil spills
Rangeland health and soils	0	
Water and hydrological functioning	0	
Air quality	0	
Landscape beauty / Sense of place		The greatest impact of this development is likely to be caused by the powerlines, causing visual degradation of landscapes in the Sperrgebiet. This will impact most significantly on tourism activities being planned for the Sperrgebiet. The impact can be partly mitigated by careful planning of the route.
Livelihoods, employment	+	The labour force during construction is about …, and during operation relatively small at …
Human health	0	
Cultural heritage / social cohesion	0	
Infrastructure	-	The gas pipeline running from the drill rig to shore will pass through a marine diamond mining area, sterilising part of this resource for Namdeb.
	-	Powerlines crossing the Sperrgebiet may slightly reduce the possibilities for tourism concessions being planned in the newly proclaimed National Park.
Economic development	+ +	Strong positive impact, since energy generation facilitates employment, productivity, economic growth.

This SEA supports the proposed Kudu Gas development, on condition that the mitigatory measures suggested in the earlier EIAs and the revised planning process to be undertaken when the project is re-started, are properly implemented. The power station will increase water consumption from the lower Orange, increasing the cumulative impact on the river.

6.4.3.2 Lower Orange River Hydro Electric Power Scheme (LOHEPS)

This project involves establishing nine relatively small hydropower stations on the Orange River between Onseepkans and Vioolsdrif. At each of the sites, water will be directed through a tunnel or canal over a short distance to drive a turbine. In addition, there will be powerlines (max 33kV capacity) running from the river out of the Orange River valley to join the national grid.

Table 6.12 Strategic assessment of the LOHEPS scheme

Component	Overall rating	Description
Biodiversity and ecological functioning	-	Possible impacts on the survival and abundance of lower Orange River aquatic organisms such as fish, water-breeding insects (e.g. blackfly pest), crabs.
Rangeland health and soils	0	
Water and hydrological functioning	0 to -	Low flows in the Orange are a seasonal occurrence, and they may become longer and more frequent as upstream use of the water increases and climate variability increases. This means that the stations might not have enough water to generate power. With economic pressure to maintain electricity supplies, the water may be diverted through LOHEPS stations even though environmentally it should not be. This poses a threat mainly to the Ramsar wetland at the mouth.
Air quality	0	
Landscape beauty / Sense of place	0 to -	Probably a relatively small negative impact on the views and landscapes that the LOHEPS structures are built in, and roads and powerlines to the sites.
Livelihoods, employment	+	Small positive contribution to employment in the region
Human health	0	
Cultural heritage / social cohesion	0	
Infrastructure	+	Power generated at the various stations will be directed to the electricity grid along low capacity powerlines (33 kV and lower), making them usable for local power consumers.
Economic development	+ +	Strong positive impact, since energy generation facilitates employment, productivity, economic growth.

Any use of lower Orange River water is at the mercy of upstream users. Securing adequate downstream flow is theoretically regulated by Orasecom, but South Africa does still have the practical power to shut off water flow downstream. This is a potential risk to the viability of the LOHEPS scheme.

This SEA supports the proposed LOHEPS project, on condition that mitigation measures to reduce and prevent environmental damage are implemented.

6.4.3.3 Lüderitz wind farm

No information has been released about this project and the proponent (United Africa) consistently refused to make any information available. This makes it impossible or very difficult to identify potential impacts or conflicts or synergies, which is not in the national interest. Lack of reasonable transparency goes against the principles of the Environmental Management Act.

There is a likely impact on birds through collisions and interference with flight patterns around Lüderitz. This may be significant if it affects Red Data or endemic species such as Cape Gannet.

6.4.3.4 Photo-voltaic solar power arrays

Various solar power projects are being suggested in Karas Region, such as arrays for infeeding at Tses, Bethanie, Komsberg and Keetmanshoop None of these projects were verified by NamPower and the ECB, so the plans, if they exist, are still very preliminary. This makes assessing them impossible. Synergies could involve the potential for rural electrification. According to the Rural Electrification Master Plan (2005, quoted in SPC 2010), about three-quarters of the 327 rural localities in the Karas Region would be assisted with solar power as part of the off-grid programme.

High levels of incoming solar radiation (insolation) are recognised as a strong positive feature of the natural environment of Karas Region. This resource should be developed.

This SEA supports energy generation from wind and solar power as these are less environmentally harmful than fossil fuel and nuclear generation. Still, it is important to follow the EIA process as an integral part of planning to optimise the developments and achieve possible synergies.

6.4.4 Cumulative impacts, risks and conflicts with other sectors

Each new powerlines is an incremental addition to the cumulative impact on bird mortalities, which impacts on ecological integrity and tourism potential. This impact can be reduced through careful design and route planning. NamPower has shown commitment to spending money on improving the designs of powerlines to reduce this impact, and is urged to continue doing so.

Water is a critical limiting factor for sustainability of the LOHEPS scheme.

While the region appears to be ideally suited for generating solar power, there are practical barriers. Firstly, photo-voltaic apparatus is still prohibitively expensive. Secondly, renewable energies suffer from the drawback that they are not continuous, so a conventional source needs to be put in place to gener-

ate at the times when the renewable source is out of action (e.g. at night for solar power, or during calms for wind power). This makes them doubly expensive.

These barriers are likely to be overcome within the next few years as technologies improve and the cost of 'conventional' electricity rises. Concentrated Solar Power (CSP) particularly has great potential in Karas due to the wide expanses of open, flat land and the intensive solar radiation. It is estimated that CSP solar arrays would be able to generate for 16 hours even though sunlight only lasts for 10-14 hours.

The 'solar chimney' concept is appealing but the design only becomes really effective at generating power if the chimney is higher than 1500 m (van der Merwe pers. comm. 2010). This makes it unlikely to be developed, considering that constructions taller than 200 m are technically very challenging.

Generation of electricity using algae in enclosed ponds has potential where there is a strong water supply, abundant sunlight and wide open spaces. While there are places in Karas region where these criteria are met, the technology is still so preliminary that it cannot be seriously considered.

6.4.5 Synergies, opportunities and suggestions for the sector

The region holds great potential for helping Namibia achieve its aims as set out in the White Paper on Energy Policy (MME 1998) and NDP3, and is making concrete steps to doing so. A recent study (Emcon 2007) showed that a 'mixed basket' of generating options is the most economically and environmentally favourable solution for Namibia's power sector. Karas can contribute significantly in this regard, with the Kudu Gas and Lower Orange River Hydropower schemes, and the strong potential for renewables.

Solar water heating should be mandatory for all new buildings being constructed, since it can significantly help reduce the demand for domestic electricity. Solar water heating in Karas is a 'low-hanging fruit' for creating the desired mix of power generation options (Emcon 2007).

Abundant wood resources at a few places in the region, such as dense stands of *Prosopis* along the Nossob and Fish Rivers, hold potential for bush-to-electricity projects. *Prosopis* infestations are considered to be good for this as they have a high density of wood and the cut trees coppice quickly, so regeneration of the resource is relatively quick. Bush-to-electricity projects could be used for grid infeeding or for off-grid generation. The amount of electricity generated from such a scheme would be small (less than 1 MW) (DRFN 2009, NPC 2010b).

The proposed Neckartal Dam should be used to generate hydropower. This is now being considered in the design of the dam.

Firewood for cooking is the main domestic fuel in rural areas, and is in high demand in and around towns. Where construction camps for any project are set up, bottled gas should be provided as a cooking fuel to reduce the need for workers to strip local trees for wood.

This SEA strongly encourages renewable energy developments in the region, and goes even further to propose the idea of making Karas a thriving hub for renewables. Specifically, Rosh Pinah with its infrastructure and mine facilities qualifies very well to be transformed from a mining town to a centre for

solar power generation, research and development. Even a production industry could be established in future. Electricity could be used to power desalination at the coast, providing water for Oranjemund and Rosh Pinah, Lüderitz and possibly Aus, as well as new mines and for tourism facilities.

6.4.6 Issues of concern to be addressed in project level EIAs

Impacts of powerlines on biodiversity (especially large raptors and bustards), cultural heritage and sense of place are mostly avoidable. These impacts can be mitigated through careful routing of lines and specific bird-related measures.

Growing needs for energy mean that the powerline network will continue to expand. Proliferation of powerlines, especially where there are ranks of parallel powerlines, should be avoided.

The LOHEPS scheme is vulnerable to continued adequate flows in the Orange. For avoiding or mitigating impacts on the wetland ecosystems, the hydropower stations must be planned in accordance with the water flow requirements of the Orange River, and the possible incidence of drought and low-flow periods. Environmental components are likely to become more stressed during droughts, and maintaining environmental flow requirements during these events will be crucial. These situations should be properly modeled in the EIA and over-arching planning done by Orasecom.

Overall, this SEA supports the development of the Lüderitz wind farm for its positive impacts on carbon-neutral electricity generation. However, the project still needs to be assessed so that it does the least possible harm to the environment, particularly its likely impacts on birdlife and the sense of place. In South Africa, wind energy developments have prompted formation of a Bird and Wind Energy Specialist Group (BAWESG), which offers advice and assistance to the planning of wind generation projects to reduce unnecessary environmental impacts. Importantly, such interest groups can guide pre-construction monitoring of birds in the areas to be affected.

6.5 Fisheries

6.5.1 National targets for this sector

Vision 2030 (Fisheries and marine resources): Where we want to be

- Sustainable yields reached and managed effectively to prevent over-exploitation
- Strict pollution control leading to increased exportation of high value fish and increased mariculture opportunities
- Marine reserves and and increase in high-earning, low-impact nature centred tourism activities
- Intensive commercial marine and freshwater aquaculture

Programmes described for the fisheries sub-sector in NDP3 (RoN 2008b) that are relevant to Karas Region include:

- Survey and stock assessment, with the outcome of efficient management and regulation of marine and inland fisheries. A key activity is setting appropriate TAC quotas to promote fish stocks recovery.
- Monitoring, control and surveillance, with the outcome of improved compliance with policy and regulations. The main activities are monitoring off-loading of fish products at mid-water, harbour and onshore processing plants, coastal inspections and aerial surveillance, and sea patrols. Lüderitz is an important base for these activities.
- Promotion of aquaculture, with the outcome of aquaculture contributing more to employment and increased incomes. Farming of shellfish (oysters and abalone) is expected to increase. Regarding fresh water systems, there will be more participation of local and traditional authorities in the management of inland fisheries, and expansion of community-based freshwater fish activities.

6.5.2 Present situation

The economy of Lüderitz is largely dependent on the fishing industry, as it is Namibia's second most important fishing port and centre for industrial development on the Namibian coast. 40% of Namibian demersal (sea-floor) catches are from the southern region (CSIR 2008). The commercial rock lobster fishery is centred around Lüderitz and forms an important part of the coastal economy of southern Namibia.

It is recognised that major declines in fishery stocks have occurred over the past 40 or so years (e.g. of pilchard [=sardine], anchovy, hake, orange roughy and rock lobster), partly caused by over-exploitation (Molloy and Reinikeinen 2003). For example, orange roughy was 'discovered' in the 1990s as a deep-sea fish with high commercial value. Rapid exploitation of the stocks depleted them considerably, and the realization that it is slow-breeding and that stocks will not recover quickly came about 10 years later.

The sector of the fishing industry that exploited it has dropped to less than half (Boyer *et al.* 2001, Mendelsohn *et al.* in prep.). Environmental factors have also been important in the demise of the fishing industry, such as the Benguela el Niño events in 1984/85 and 1994/95, causing intrusion of warm water from Angola which led to less upwelling and many fish moving away from their spawning grounds (Mendelsohn *et al.* 2002.). The combined effect has been a substantial loss of Namibia's marine resources, and the fishing industry remains vulnerable to future 'shocks' that will likely recur.

The Namibian commercial fisheries operating from Lüderitz target mostly the deep-sea species (hake, orange roughy and monkfish), and species associated with the coastline (rock lobster, seals and guano). There are two fish processing plants in Lüderitz. This and the servicing of fishing fleets are the main economic activities in the town. Small boats that characterise subsistence fisheries elsewhere in southern Africa are not used in Lüderitz because of the hazardous, high energy coastline (Nacoma 2009).

Mariculture (farming of marine organisms such as oysters, mussels, seaweeds) is a fluctuating enterprise but generally holds strong potential (Nacoma 2009). The sheltered bays and lagoons around Lüderitz are well suited for this purpose and several companies operate in the area, growing and harvesting oysters, abalone, mussels and rock lobsters. The operations fluctuate on account of occasional 'shocks' such as a big red tide disaster which closed down some of the businesses in 2008. According to Nacoma (2009), Lüderitz is less prone to devastating red tides and sulphur eruptions than the Walvis Bay - Swakopmund area. There is potential for mariculture using ponds close to the beach left behind by diamond mining in the areas close to Oranjemund, and this is being implemented.

Harvesting of *Gracilaria* seaweeds involves both collection of washed up material and open-water cultivation (Molloy and Reinikeinen 2003). All of it is exported in an unprocessed state, and there are potentially a few more species that could be commercially harvested.

Table 6.13 Strategic assessment of marine fisheries activities in Karas Region

Component	Overall rating	Description
Biodiversity and ecological functioning	-	Over-exploitation of fish stocks can lead to degraded functioning of marine ecosystems. Although Total Allowable Catches are now set for long-term sustainable yields, examples such as recent collapse of the orange roughy fishery point to TACs still not set conservatively enough.
Rangeland health and soils	0	
Water and hydrological functioning	0	
Air quality	0	
Landscape beauty / Sense of place	0 to +	Fishing boats at sea and in Lüderitz harbour add to the fishing atmosphere of the town.
Livelihoods, employment	+	

Component	Overall rating	Description
Human health	0	
Cultural heritage / social cohesion	0	
Infrastructure	0	
Economic devel-opment	+	Jobs, value addition, infrastructure

Aquaculture (farming of freshwater fish) is carried out at a few places in the region, as described in the KIRLUP and shown in its Map 13 (SPC 2010). These enterprises take place with support from MFMR and have not been established for long enough to make any conclusions about their viability. Environmental impacts of these operations are likely to be very small. A possible threat is introduction of alien species into natural rivers, where indigenous populations of fish and other aquatic organisms could be threatened by predation and competition. The ephemeral nature of Karas rivers makes it unlikely (but not impossible) that alien populations could get established, but the Orange River is vulnerable and measures need to be taken to prevent mistaken or purposeful introductions from occurring.

6.5.3 Likely future developments

It is likely that commercial harvesting and processing of marine fish stocks will gradually decline in importance, due to the growing difficulties in catching enough fish. On the other hand, cultivation of fish by mariculture is expected to increase.

Shellfish production in Lüderitz Bay is expected to increase over the coming years, and onshore production of fish is considered a significant development option for the Oranjemund area (Nacoma 2009).

6.5.4 Cumulative impacts, risks and conflicts with other sectors

Biological communities in the coastal and marine ecosystem are familiar with localised and short-duration, natural perturbations such as hydrogen sulfide eruptions, red tide events, river flooding which causes high turbidity (muddiness) and storm events, all of which occasionally cause large die-offs of marine organisms. Moreover, Namibia's marine environment is highly vulnerable to climate change (Molloy and Reinikeinen 2004, Turpie *et al.* 2010), since the coastal environment depends on active upwelling cells to maintain a high rate of productivity, and upwelling depends entirely on wind patterns. Southward extension of the warm Angolan Current to the north is already occurring (Turpie et al. 2010), suggesting that climate-induced changes to the BCLME are already underway.

6.5.5 Synergies, opportunities and suggestions for the sector

Use of mining facilities (e.g. ponds and pumping equipment) after closure of mined areas. Inshore ponds created during mining of the beach in Mining Area 1 immediately north of Oranjemund are being re-used for fish breeding, and benefit from the equipment and maintenance which the mine can provide while it is still operational in the overall area.

6.5.6 Issues of concern to be addressed in project level EIAs

A possible threat from aquaculture projects is introduction of alien species into natural rivers, where indigenous populations of fish and other aquatic organisms could be threatened by predation and competition. This must be avoided at all costs.

6.6 Infrastructure and towns

6.6.1 National targets for this sector

Vision 2030 (The urban environment (p172) and Transport infrastructure (p67): Where we want to be

- Well planned, well managed, clean, safe and aesthetically pleasing urban areas
- Opportunities for innovative and sustainable employment
- Equitable access to land and essential services
- Healthy, self-sufficient rural populations and reduced rates of rural-to-urban migration
- Recreation facilities (parks, monuments, museums etc) available in cities
- Pro-active citizens with high levels of civic pride, involved in decision-making.
- The transport sector contributes to economic growth, employment creation and poverty reduction in a competitive, safe, efficient, effective, reliable and affordable manner

One of the strategies outlined in Vision 2030 to achieve these goals is:
Incorporate a clear urban development plan into the national development plans, to improve infrastructure for water supply, provide opportunities for water and energy savings, and to make recycling of waste and water more cost-effective.

The mission of the Transport subsector in NDP3 (RoN 2008a) is “the provision of safe, secure, effective infrastructure and services, which are responsive to the socio-economic needs of Namibian and others in the region.”

6.6.2 Present situation

Water infrastructure is described in Section 6.1 with regard to irrigated agriculture and livestock farming.

The road, rail and port infrastructure is generally well developed. Namibia is known for its good quality roads. Although roads basically can be considered as barriers especially to animal movement,, no major negative environmental impacts are known from the Karas roads. The railway network is rudimentary and the upgrading of the Keetmanshoop to Lüderitz line has been underway for many years with long

interruptions. No major negative environmental impacts are identified. The harbour facilities serving the fishing and mining sector at Lüderitz are adequate and no significant pollution or other negative environmental impacts are identified.

Urban poverty in Karas is severe (NPC 2007). There are alarmingly high levels of alcohol abuse and STDs in the Karas urban population (GET STATS from NPC 2007 and Mendelsohn 2010).

Informal towns such as Aussenkehr are a 'mixed blessing'. Although they are centres of employment and people even from far northern Namibia are eager to find work there, the poor conditions of sanitation and housing makes people vulnerable to sickness and poverty in a place with little social fabric. Education and health services are inadequate for the large number of people, especially during the 3-month harvesting season when population jumps from about 6,000 to over 12,000 (NPC 2007). The inadequacy of schooling at growing informal settlements along the Orange River is recognised but this is a very difficult situation to resolve because of the temporary nature of influxes and the unwillingness of people to settle permanently and pay for rates and services (Boois 2010, pers. comm.)

6.6.3 Likely future developments

6.6.3.1 Water infrastructures

Refer to Key Issue 5.1.15 in the KIRLUP (SPC 2010).
Future dams that are proposed in the region are Neckartal on the Fish River close to Keetmanshoop, and Noordoewer Dam on the Orange River. These are discussed in Section 6.1.

6.6.3.2 Road infrastructure

Refer to Key Issues 5.1.17 and 5.1.11 in the KIRLUP (SPC 2010).
Proposed road developments in the region are:

- Upgrading of Bethanie-Maltahohe-Walvis Bay road to a tar surface. Most of the traffic on this very scenic route along the eastern edge of the Namib is tourism-related. Although roads basically can be considered as barriers especially to animal movement, no significant environmental impacts are predicted for this proposed upgrading.
- Establishment of the Desert Star town will also involve upgrading of roads and possibly a new bridge over the Orange River (Trumper 2010, pers. comm.). These possible developments synergise with establishment of the town, which is discussed below.

6.6.3.3 Rail and port infrastructure

Refer to Key Issues 5.1.9; 5.1.10 and 5.1.16 in the KIRLUP (SPC 2010).
Proposed rail and port developments in the region are:

- Proposed Trans-Kalahari railway link to Botswana. This depends on high-level strategic planning around export of coal from Botswana. New traffic routes might attract developments along the corridor, especially at intersections such as where the Kalahari railway will cross the Bethanie-Maltahöhe road. While such developments may enhance economic and livelihood benefits, there may be negative impacts on the environment as well.

- Upgrading of Aus-Lüderitz railway. This has been underway for many years but not brought to completion. Rail travel is an efficient method for transporting bulk goods and is an under-rated tourism experience. For its benefits for reducing road traffic, rail transportation is fully supported by this SEA.
- Possible expansion of port facilities in Lüderitz at Shearwater Bay. This also hinges on coal exports from Botswana. Possible impacts can arise with the likely increase of traffic.

6.6.3.4 Towns

Refer to Key Issues 5.1.11 and 5.1.12 in the KIRLUP (SPC 2010).

Establishment of new town for Desert Star South Project
Planning for this development is underway and the EIA is in progress for the first phase. Information is therefore incomplete, but the following is available from the information document and from the environmental consultant (LM Environmental Consulting 2010).

The development is to be phased over 10 years, commencing in 2011.
Phase 1 – creation of a film-making destination with necessary infrastructure for film sets, resort housing and a hotel, a 'Golf Course of the Stars' with a golf estate, a second golf course, an air field, extension of the railway line from Ariamsvlei, and re-introduction of the ferry across the Orange River;
Phase 2 – development of tourist attractions such as themed accommodation, star-gazing facilities and observatory, winery, amphitheatre, game park (extending into SA), sports and health centre, and upgrading of the airfield to an international airport;
Phase 3 – development of a town called Desert Star City, with about 10,000 properties and full urban infrastructure on the farm Jericho.

The total water demand for Phase 1 A-C of the development, but excluding the 'Orange River Golf Course' is projected to be 2.4 Mm^3/a. No fatal flaws have been identified in the project, and the few significant impacts are planned to be mitigated through careful planning (LM Environmental Consulting 2010).

Table 6.14 Strategic assessment of establishment of Desert Star South project.

Component	Overall rating	Description
Biodiversity and ecological functioning	0	▪ Increase of cumulative impacts due to downstream effects of water abstraction from and pollution of the Orange River on the aquatic and semi-aquatic ecosystem generally and the Ramsar Site at the river mouth specifically. ▪ The development must take cognisance of its situation in an Environmentally Sensitive Area and in the land use zoning for wildlife and tourism.
Rangeland health and soils	0	▪ No fatal flaws or highly significant biodiversity impacts identified.

Component	Overall rating	Description
Water and hydro-logical functioning	-	▪ Incremental cumulative impact of abstraction from the Orange River for domestic and recreational (golf course) use.
Air quality	0	No significant impact.
Landscape beauty / Sense of place	?	▪ Unable to assess as plans not yet available.
Livelihoods, em-ployment	+	▪ Employment of construction and operational phase staff
Human health	?	▪ Waste disposal site and methods not part of the EIA of the de-velopment, but they should be. Waste disposal site and proce-dures not yet identified.
Cultural heritage / social cohesion	?	▪ May cause some local tensions if there is a large influx of work seekers from outside Karas Region.
Infrastructure	+	▪ Upgrading of roads and rail network, construction of a bridge across the Orange River, and construction of solar power genera-tion plant, make positive contributions to infrastructure.
Economic develop-ment	+	▪ Positive impact to southern Namibia through tourism develop-ment, but heavy water abstraction carries opportunity costs.

This SEA gives qualified support to the Desert Star South project. The development intends to attract international recognition for Namibia as a high quality tourism and filming destination, which benefits the overall country and especially the south which is under-utilised in this respect. Compared to the pre-sent use of the land (livestock farming and some irrigation areas not yet utilised) it represents a marked improvement in value addition. The intended infrastructures are quite contained and, according to the EIA, do not pose a significant threat to the fauna and flora. The intention to set up a solar power array is welcomed, and other conservation measures such as water efficiency need to be highlighted. The EMP should emphasise strong mitigatory measures to minimise any environmental damage that is predicted, in view of the fact that the development is situated in a sensitive area (Orange River valley, #6 in Table 5.2). Our support to the overall project is therefore conditional on the stipulations of the EMP, which is not yet released.

While a golf course may be considered as a logical part of the overall theme of 'high-end' recreation and tourism facilities, a second course seems excessive. The high water demand, although within Namibia's allowed allocation of Orange River water (Heyns 2010), cumulatively makes an incremental addition to the stressed Orange River system.

6.6.4 Cumulative impacts, risks and conflicts with other sectors

Water requirements for towns and recreational use might lead to conflict with other intended develop-ments in the irrigation and mining sectors. Water abstraction from the Orange River and polluted return flows into the river will cumulatively add to the impact on the sensitive wetland ecosystem along the Orange River and particularly its Ramsar wetland at the mouth.

Urban poverty places great pressure on government and local authorities to provide social services such as education and health facilities, as well as sanitation, security (policing) and outlets for recreation. Since unemployment levels are high, the authorities often suffer from shortages of income from rates

and payment for services. The Participatory Poverty Assessment (NPC 2007) relates how service provision to the poor sectors of the Karas population is inadequate. This situation is expected to get worse. The Neckartal Dam development, for instance, is likely to increase poverty levels in Keetmanshoop and make it more difficult for the Keetmanshoop municipality to provide services to the work-seekers and hopefuls that move there. Overall, poverty, deterioration of social services and of the social fabric in Karas communities, is identified as a **RED FLAG.**

6.6.5 Synergies, opportunities and suggestions for the sector

Water demand management is a necessary and valuable tool for controlling water consumption. This urgently needs to be implemented and actively managed by all the Local Authorities in the region, so that water for domestic consumption is provided equitably and efficiently.

Methods to 'formalise' the informal (squatter) sections of towns need to be introduced. Heavily subsidised interventions in this direction are being piloted in Rundu and Katima Mulilo, and might bear useful ideas to be implemented in Karas.

The combination of large swells, fog and high winds conspire to make the Namibian coast dangerous waters. Ship wrecks can be a source of acute and chronic pollution (Molloy and Reinikeinen 2003), and disaster and emergency relief strategies need to be in place for this eventuality.

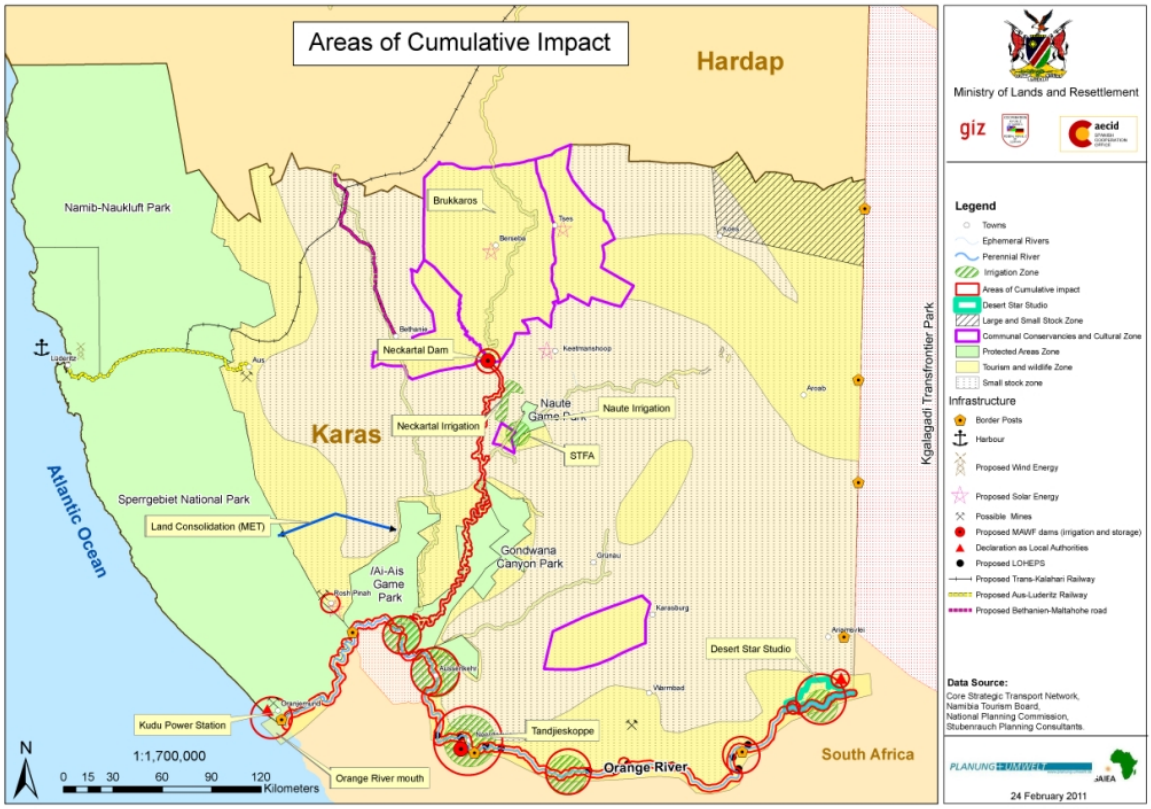
6.6.6 Issues of concern to be addressed in project level EIAs

This SEA repeatedly shows that water consumption along the Orange River is a key concern, and should be assessed carefully in future EIAs. All projects should carefully assess the social and economic benefits achieved from any water use from the Orange, and all opportunities for water efficiency and conservation should be pursued.

7 CUMULATIVE IMPACTS OF PRESENT AND FUTURE LAND USES

Figure 7.1 shows the Land Use Plan and those areas identified in this SEA as carrying the most significant cumulative negative impacts from the various present and proposed land uses in Karas Region.

Figure 7.1 Areas of greatest cumulative impacts (highlighted in red) in Karas Region



7.1 The Orange River

The Orange River is understandably a focus area for development in the Region, but is reaching its limit in terms of availability of water for abstraction. Additionally, water quality is declining significantly. This report cites the considerable body of information which shows that the Orange River water resource is over-exploited and abused, and that its Ramsar wetland at the mouth is now placed on the Montreux Record as a degraded wetland. The cumulative impacts of irrigation schemes, water for towns and developments such as golf courses, and mining, is highly significant and is likely to influence how these developments continue in future. Future planning should not take for granted that ample water will always be available. Planners and developers also need to recognise the importance of environmental flow requirements so that the resource is kept in a healthy state and is able to support people's needs in future.

7.2 The Fish River

The Fish is the most important ephemeral river in the region, and has been described as Namibia's closest resemblance to a perennial river within its borders. It is going to be significantly impacted by the Neckartal Dam development, which will also cumulatively add to the pressures on the Orange River mouth since its flow contributions to the Orange will decline.

7.3 Climate proofing the KIRLUP

The Climate Proofing Tool developed by GTZ (2010) was applied to the Land Use Plan and this SEA, to assess whether the suggestions are likely to help Karas become 'climate proofed'. A new factsheet on SEA and climate proofing has been launched by GIZ (2011). The following steps will document how climate proofing has been applied within this SEA.

Step 1: Analysis of adaptation needs

Activities likely to be impacted by climate change	Climate trends that will have an influence	Biophysical impacts	Socio-economic impacts	Level of risk in next 10 years	Adaptive capacity – do adaptation options exist?	Adaptation options
Livestock farming	Increased rainfall variability, increased temperatures, increased evapotranspiration	Lower primary production (fodder), lower livestock production	Less farm labour, greater urbanisation	Med-high	Yes, but slow in being implemented	Diversify rural livelihoods, wildlife and tourism show greatest potential
Irrigation farming	Lower Orange River flows, increased flow variability	Erratic crop production	Loss of seasonal harvesting livelihoods	Med-high	Yes, limited, but slow in being implemented	Use more water-efficient irrigatn methods
Marine fishing	Collapse of Benguela upwelling system	Lower fish harvests	Loss of fish processing employment	Low	No	

Step 2: Selection of feasible adaptation options

	Do we have or can we hire the technical skills to implement the measure?	Do we have enough resources to implement the measures?
Livestock farming	Yes	Yes
Irrigation farming	Yes	Yes
Marine fishing	No measures available	

Ranking:

- Adaptation option 1 (diversify into wildlife + tourism) is effective, more costly initially, sustainable and can be implemented by modifying existing activities.
- Adaptation option 2 (water-efficient irrigation methods) is effective, more costly than continuing with present methods, sustainable and can be implemented by modifying existing activities.

The suggested adaptation options carry roughly equal rank and should not be prioritized as they are both implementable.

There is no suggested adaptation option for the fishing sector, so this sector is still very vulnerable to climate change impacts.

Step 3: Integration of selected adaptation options into KIRLUP

Based on the Climate Proofing results, the recommendations of the KIRLUP and SEA do not need to be modified. They should be implemented.

8 DIFFICULTIES AND LACK OF INFORMATION

8.1 Difficulties and Lack of information within the SEA methodology

SEA and the Namibian Planning System

Since the Namibian planning procedures lack in regulations that clarify dependencies and competence among the decision making levels it is difficult to address appropriate issues to the strategic environmental assessment (refer to Figure 1.1 and Figure 2.1 for details). In the case of the SEA for the Karas IRLUP, it was difficult to separate the level of assessment for the project level from that for the level of the regional land use plan.

8.2 Difficulties and Lack of information within the assessment part of the SEA

Existing irrigation activities

Within the assessment of the existing irrigation activities, it was claimed that the Komsberg - DWA has a permit for 13Mm^3/a. That assertion requires confirmation from MAWF.

Socio-economic description of current situation

Poverty info from PPA could not be included so far.

Impacts on water and hydrological functioning

- The data that could be gathered about the hydrological situation in Karas was good enough for the assessment of the current situation but not as good for predicting future effects.
- The long term impact of groundwater abstraction for stock farming could not been predicted properly.

Impacts due to small scale mining

Due to the small-scale and informal nature of these operations, it was not possible to find figures on the numbers of people involved, the areas that are active, or the economics of the operations.

Suggestions for the sector Infrastructure and towns

It is not yet been confirmed if a strategy for disaster and risk management is in place for the Karas Region.

9 MONITORING

INDICATOR	GOAL	MONITORING MEASURE	DATA-SOURCE/ REQUIREMENT FOR INVESTIGATION
Biodiversity and ecological funtioning			
Abundance of species both endagered and not endangered	Keep biodiversity as it is today	Regular census of wild life species, eventually reduction to best indicating ones	National wild life census
Rangeland health and soils			
no monitoring requirements so far			
Water and hydrological functioning			
Level of groundwater tables	No further lowering of fossil groundwater table but sustainable use of rechargeable groundwater bodies	Measure groundwater levels regularly	Monitoring programme for the Orange River Basin Management
Minimum water flow requirements in rivers	Sustainable use of river water and no abstractions that don't meet minimum water flow requirements	Measure water flows at selected points along the affected rivers	▪ Monitoring Programme of the Orange River Ramsar Site ▪ Elaboration of criteria for minimum flow requirements of the rivers that will be affected by land uses (Fish R., Orange R.)
Groundwater quality	No legacy of pollution and health risks left by the mines	Regular groundwater analysis on heavy metals	▪ The threat of long-term contamination needs to be properly addressed in the closure plans of all mines
Air quality			
no monitoring requirements so far			
Landscape beauty / Sense of place			
no monitoring requirements so far			
Livelihoods, employment			
no monitoring requirements so far			
Human health			
no monitoring requirements so far			
Cultural heritage / social cohesion			
no monitoring requirements so far			
Infrastructure			
no monitoring requirements so far			
Economic development			
no monitoring requirements so far			

10 CONCLUSIONS AND RECOMMENDATION

10.1 General conclusions on the SEA process

- The participation in the SEA of KIRLUP was good in involving experts and stakeholders as they were authorities who could give professional opinions and rational contributions in each sector. However, the participatory process lacked public involvement. For future Land Use Planing SEAs it is recommended that:
  - A minimum of meetings should include Scoping (1x) and Focus Group Discussions (FGDs) (1x/sector)
  - For public participation it is recommended to organise two information meetings, during the planning and assessment phases.
- Although SEA has to be involved at a much earlier stage than it was for the Karas work, parallel elaboration of the LUP and the SEA, and close collaboration between the teams, has added considerable value. The process must closely integrate both components.
- For carrying out an efficient SEA (time and cost efficient) it is essential to consider these three components:
  - **Tiering**, that means addressing issues and impacts at appropriate decision-making levels (e.g. from regional to project levels). Tiering is widely used as a way of concentrating on the issues specific to the action being evaluated, and streamlining "lower-tier" documents. The level of detail of an SEA therefore should be proportional to that of the strategic action, here the land use planning. For instance, the SEA for the Karas Integrated Land Use Plan will be more broad-brush than an SEA for a town planning scheme of Keetmanshoop or the EIA for Neckartal Dam.
  - **Linkage of SEA and EIA** where appropriate (e.g. close collaboration between SEA for a regional land use plan and the EIA of a large scale sectoral project)
  - **Multiple data use**. Depending on the availability of data that meet the quality needs for the assessment being worked on, it is imperative that these data are used rather than starting surveys and elaboration. For this SEA, many data could be drawn from the Atlas of Namibia (Mendelsohn *et al.* 2002). Refer to recommendation on Environmental Information Systems (EIS) below.
- Efficiency of SEAs and EIAs as well often depend on the baseline data that are available. The less data are available the more need for surveying could arise that will take time and consume money. Available data must also meet quality standards. It is therefore strongly recommended that an **environmental information system** (EIS) will be established by the responsible ministry or other authority. An EIS should provide the different planning levels within the decision making hierarchy with environmental data in different levels of detail. The data should be provided digitally e.g. through internet connections.
- Strengthening of environmental awareness in general and of SEA specifically within decision making institutions is a major requirement.
- A Disaster Risk Management Strategy for the Region of Karas is recommended.
- When the LUP gets into the implementation phase, the Regional Development Coordinating Committee (RDCC), which advises on the suitability of projects, can use this SEA to avoid or mitigate negative cumulative environmental impacts and to enhance synergies.

- Additionally, a planning forum for the region (such as the RDCC) should oversee the plan implementation. The forum (with representatives of at least MLR, MAWF and MET) can monitor the process of implantation of recommendations of the LUP and SEA, and should report their findings to the public annually.

10.2 Recommendations for impact mitigation in the Karas Region

- Mitigation of impacts due to farming
  - Livestock farming:
    Sustainable rangeland management practices should be more strongly implemented, and carrying capacities should be observed. In this arid climate, carrying capacity varies from year to year depending on the rainfall, and farmers should add and decrease their stock numbers accordingly.
    The expansion of open land, by removing fences, allows livestock and game to migrate with food availability. This approach would be facilitated by creating larger-scale, cooperative farming units.
  - Irrigation farming:
    Irrigation methods should become much more water-efficient. Examples include drip irrigation, micro-sprays and underground irrigation (water delivered directly to the root zone).
    Carefully considered tariff systems should be used as a demand management strategy that incentivises farmers to use water-efficient irrigation methods and to concentrate on high value crops.
    Dams, if developed, should be hubs of economic development. They can be used for irrigation, tourism and recreation, hydropower and possibly aquaculture. All these 'sub-projects' can help to increase the economic value derived from the dammed water. Obviously, they must be well planned (including EIAs) and implemented with strong management guidelines.

- Mitigation of impacts due to tourism
  - The potential negative impact of tourism infrastructure on the landscape's natural beauty needs to be avoided or reduced by proper designs that fit best into the scenery.

- Mitigation of impacts due to mining
  - Pollution from mines is a significant impact that must be strongly mitigated, both during the design (EIA) stage and with monitoring through the operational phase of the mine. These measures need to be carried through to prevent hazardous pollution occurring after mine closure
  - New mines should not start up new settlements (e.g. for accommodating labour), but should rather accommodate their labour force in existing towns and focus their accommodation investments there. This is to prevent future ghost towns after mine closure.
  - As part of their social responsibility, mines should invest in training and capacity building programmes that will help to build skills for a diversified economy after closure.
  - The legacy of any mine should continue in improved socio-economic conditions, and sustained environmental health, after the mineral resources have been removed.

- Mitigation of impacts due to energy infrastructure
  - Impacts of powerlines on biodiversity (especially large raptors and bustards), cultural heritage and sense of place are mostly avoidable. These impacts can be mitigated through careful routing of lines and specific bird-related measures.

- Mitigation of impacts due to fisheries
  - Introduction of alien fish into Karas' rivers must be avoided at all costs, since indigenous populations of fish and other aquatic organisms could be threatened by predation and competition from the 'newcomers'.

- Mitigation of impacts due to infrastructure and towns
  - Water efficiency and conservation measures should be standard features for all town and infrastructure developments. These should be facilitated by strong demand management incentives implemented by MAWF.

10.3 Four ideas for the Karas Region (Scenarios)

Considering the key natural resources and the limiting factors of the Karas Region, the following scenarios are suggested to help Karas Region achieve sustainable development and contribute to Vision 2030.

10.3.1 Strengthen the role of Integrated Water Resources Management

The Orange-Fish River Basin Committee and its parent ministry, MAWF, should take the lead in promoting Integrated Water Resources Management in the region. NDP3 states a key activity in the water sector is to undertake a "pilot study on efficient irrigation methods to be used along the Lower Orange River". Water demand management, i.e. managing the amounts of water consumed through pricing or other incentives, can play a key role in achieving should be urgently introduced. This management activity is also consistent with NDP3 which urges more value addition per unit of water consumed, and a strong role for functional basin management committees.

Since water is the most critical limiting factor in the region, it is appropriate that the management and monitoring systems around water use are given a high priority.

10.3.2 Strengthen the wildlife and conservation sector

As an over-arching guideline, the continuity of areas under conservation management should be strengthened, under the motto "Karas Network Natura". This supports the existing trend to farm with wildlife as these animals are better suited to the arid conditions, and builds adaptation measures to cope with future climate change. The protected areas and adjacent areas can be used as economic engines for growth in the tourism sector, which promotes rural livelihoods. It is recommended to implement the following measures:

- Promote wildlife populations by removing fencing to create larger contiguous management areas that facilitate movements in response to seasonal variations.
- Further facilitate wildlife movements by maintaining a corridor network that will allow animals to respond to seasonal variations and changing climates. The eastern edge of the Namib protected areas should be open with farming neighbours into the escarpment area. Open corridors should be maintained along the Orange and main ephemeral rivers (especially the Fish River),
- Cooperate with neighbouring states to implement trans-frontier conservation areas, as is being done between South Africa and Namibia. The Kgalagadi Transfrontier Conservation Area (shared between South Africa and Botswana) should be extended to include Namibia's southern Kalahari, where there are currently no protected areas.

10.3.3 Establish Karas as Namibia's solar power hub

As Namibia's sunniest region, its coastal strip the windiest, and the Ocean with almost infinite water, Karas has great potential for renewable energy generation and water provision. This SEA strongly supports the proposed wind park for Lüderitz and the scattered solar power generation projects. The argument goes further, to propose the idea of making Karas a thriving hub for renewables. Specifically, Rosh Pinah with its infrastructure and mine facilities qualifies very well to be transformed from a mining town to a centre for solar power generation, research and development. Even a production industry could be established in future. Electricity could be used to power desalination at the coast, providing water for Oranjemund and Rosh Pinah, Lüderitz and possibly Aus, as well as new mines and for tourism facilities. Sea salt production could be considered as well. It is recommended to start with a feasibility study, considering technical, economic and environmental feasibility of this proposal, as well as economic and social benefits.

10.3.4 Build the skills base

With a poor skills base, the region will continue to struggle to really move forward. It is therefore essential to implement effective education and training programmes. As partners in this drive, major economic drivers, such as the mines, large irrigation schemes, and large-scale tourism developments like Desert Star, should include support to schools and vocational training as part of their corporate social responsibility programmes. On-the-job training and experience and apprenticeships are invaluable. Irrigation centres such as Green Schemes and Aussenkehr should run well organised training in irrigation farming. Livestock farming training (e.g. in the karakul sector) is offered and should be expanded. Hospitality training should be offered through tourism enterprises. Technological training is offered through NIMT and Cosdef, and should be expanded. All these initiatives are worthwhile and essential investments in the future prosperity of the region.

10.4 Comments on the land use planning process

The MLR intends that regional LUPs will be reviewed every 5 years. This implies that the intervening periods will not involve active future planning on a region-wide basis.

At present, long-term planning for land use is carried by the MLR, while development planning is done by the MRLGHRD. This separation of very similar roles appears to be unnecessary and confusing. The KIRLUP has been characterized by an almost complete lack of involvement by the Regional Council. This points to a serious lack of integration.

These shortcomings could be addressed by combining the two planning roles into one, and by keeping it alive as a continuous and dynamic process. The Regional Councils in the MRLGHRD have their Regional Development Coordinating Committees (RDCCs) and any plans and proposals that might affect the region should be brought to and addressed at this forum, as soon as they are known.

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12 APPENDIX

Annex 1: Energy FGD agenda

KARAS LAND USE PLAN AND STRATEGIC ENVIRONMENTAL ASSESSMENT

ENERGY SECTOR FOCUS GROUP DISCUSSION

Monday 20 September, 9h00 – 11h00, SAIEA

Organisations/institutions/individuals invited to participate:

- NamPower – Generation, Renewable Energy, Transmission, Environmental departments
- DRFN – Energy Desk
- MME – rural electrification representatives
- DEA
- GTZ
- Directorate Land Use Planning and Allocation, MLR

Proposed agenda

Rough time slot	Main topic	Content	Role of participants
9.00-9.20	Overview of LUP and SEA process		
9.20-10.00	Energy sector in Karas – what is known, what are the issues	• Go over the maps to ensure all information captured and correct	Consider impacts on identified components of the socio-economic and biophysical environment
10.00 – 10.30	Proposed developments and their possible impacts	• Kudu gas • Orange R hydropower • Lüderitz wind farm • Solar arrays • Biofuel crops along Orange • Rural electrification?	Identify conflicts with other projects, consider risks and opportunity costs, suggest ways to enhance synergies
10.45 – 11.00	Opportunities / adjustments for the sector	• What's possible? / desirable? / in the national interest? • What should not happen / should be guarded against?	Think broadly

Annex 2: Jointly worked out scoping matrices on workshop 16 August 2010, Keetmanshoop

	Liveli-hoods, Jobs	Human Health	Cultural Heritage / Social co-hesion	Economic developmt	Biodiver-sity / Eco-logical functioning	Rangeland health / Soils	Water / Hydrologi-cal func-tioning	Air quality / Climate	Landscape beauty / Sense of Place	Infrastruc-ture
Irrigated agriculture and dryland crops High value crops – grapes, dates, olives, other fruits? Crops for local use – lucerne, vegetables Developments and issues to assess:	**+**	**0 to -** Pesticide movement into the Orange River.	Child labour reported at Aussen-kehr.	**+** but oppor-tunity costs if low value crops grown.	**-** Pesticides, fertilisers, effluents, and water abstraction, all impact on lower Orange River and Ramsar Site at mouth.		**-** Down-stream ground - and surface water qual-ity and quantity concerns			
Komsberg	Proposed to grow grapes, olives, vegetables. High cost of water jeopardises economic viability of projects.									
Aussenkehr	Possible land use conflict between mining and a proposed formal settlement									
Neckartal Dam	Downstream impacts in Fish River as well as in Orange. Hydropower function of the dam will determine water releases.									
Orange River water abstrac-tion	Abstraction in Karas Region, on SA side of border, and in whole upstream catchment. Major determinant of potential land uses. Consider boundary issues (border presently on N bank of Orange River). Water resource is limited., must use appropriate irrigation methods if irrigation is preferred land use. Potential conflict with proposed hydropower plants.									
Economic value and food security/self sufficiency de-bate	While foreign revenue from crops is good, should there be some crops for local consumption (not export)?									
Hoodia farming (no irriga-tion)	Medicinal value varies depending on geographic area. Consult Hoodia working group for information on optimal areas									
Small scale orchards for subsistence.										
Downstream impacts	Orange River mouth Ramsar site.									

Game + Livestock Farming Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Stock farming overall – Sheep Goats Cattle	**+** But less positive as farmers switch to cattle (needs fewer farm workers).	**0**	**0 to +**	**+** But de-creasing sheep ex-ports to SA due to trade regu-lations	**0 to –** Depending on rangeland management practices		**0** possibly **–** Info gap: long term impact of gwater ab-straction for stock farming	**0**	**0 to +**	**0**
Climate change	Climate change will bring much lower rangeland productivity. Stock farming is marginal throughout Karas and climate change will make it even more marginal. Livelihoods will be less vulnerable under mixed stock + wildlife farming.									
Trade regulations	Present trade regulations encourage small stock farmers to change to cattle, even though cattle more marginal. Significant impact on what stock farmers keep. Are the regulations causing accelerated land degradation from cattle?									
Impact of bush encroach-ment	See DRFN-OFRB report and recommendations re the impact on groundwater and recovery rates after bush clearing.									
Game farming Hunting/ meat production	**+**	**+**	**0**	**+**	**+ to -** Depending on rangeland management practices		**0 to +**	**0**	**+**	**0**
Game farming and ecotourism	No significant swing to wildlife in Karas Region. Gondwana example: production per hectare much greater, offers more employment (6-8 times greater) in lodges than there was from farm labour, revenue much higher. While this shows that wildlife + tourism is much higher value, the example cannot be extrapolated to the whole region.									
Consider impacts of HIV, Urbanisation	Less people on the land, less people who want to farm. Potentially significant future impact.									
Balance between stock and game farming	Big future potential for mixed wildlife – livestock integration. Open landscapes more viable (allow animal movements, build up bigger popula-tions)									

Mining Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Large scale mining Diamonds – Namdeb opera-tions Lead-zinc mines Future possibilities: Warmbad uranium Slate quarrying Haib copper Offshore phosphates	**+**	**+** potential **–** Healthy worker ef-fect on mines. Emissions are regu-lated, well monitored, and re-ported on – mines say no risks. Public per-ception: possibly there is contamina-tion that cannot be pinpointed to the mines.	**-** Mines em-ploy many migrant workers. Trad Au-thorities concerned about im-pacts of 'intruders' on Nama culture.	**+** But oppor-tunity costs for other sectors e.g. tourism, irrigation	**0 to –** Depends on mine op-erations and mitiga-tion meas-ures. Rehabilita-tion re-quired, but how ffecttive is it? Potential long-term hazards from post-closure contamina-tion.	**0 to -** EPLs cover almost all of Karas – prospecting and off-road driving can be very damaging	**0 to -** Depends on effective-ness of mitigation activities to prevent pollution, minimise water use, avoid down-stream im-pacts.	**-** Dust emis-sions – Im-pacts local.	**-** EPLs cover almost all of Karas – prospecting and off-road driving can be very damaging. Landown-ers con-cerned that mining al-ways gets 'right of way'	**+** Mines are able to build roads, social infra-structure e.g. schools, clinics.
Pollutants and post closure rehabilitation	Concern about decommissioning funds – even though mandatory, will there be enough money for proper restoration? Karas has many aban-doned mines – must be proper rehabilitation in future.									
Aus marble	Between Aus and RPinah									
Bethanie slate	Check status of operations									

Mining Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Small scale mining (Southern Small Miners As-sociation)	Check status, extent of activities									
Value addition	More beneficiation desired, employment creation									

Energy Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Power lines								**0**	**-**	
Power Plants: Kudu gas								**-**	**-**	
Wind farming								**0**	**-**	
Hydro power: Orange River schemes Nekkartal									**-**	
Solar energy: Komsberg solar array, solar array at Tses? Infeed-ing to grid?								**+**	**-**	
Domestic fuel requirements	Firewood availability and sustainability									

Marine fishing Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Deep sea fisheries Crayfish Abalone Seaweeds Oysters Seals	**+**	**0**	**0**	**+**	**0** Quotas to prevent overfishing	**0**	**0**	**0**	**0**	**0**
Fish populations	Collapsing resource – future potential declining									
Sea bed mining	Land use conflict?									
Synergy with mining?	Proposed re-use of mining ponds along coast for fish production									
Tourism potential	Small fishing vessels could take tourists for day trips – seabirds, trawling, …									
Inland fishing										
Fish farming Keetmans 'Fonteine' project operational Naute Fishery project, Proposed CPP project at Bethanie – info from NDT					**0 to –** Invasive spp		**-** Potential	**0**	**0** Small scale	**0**
Concentrated production	Consider Israeli approach – possible supply to supply food for local + tourist needs.									

Conservation Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
National Parks Conservancies Private Parks Recreational Resorts Nama Cultural Areas ? - clarify	**+**	**+**	**+**	**+/-** !Khob !Naub Consvcy the only one that is pro-viding eco-nomic benefits in Karas.	**+**	**+**	**+**	**0**	**+** **-** small scale potential	**0**
Conservancies	MET - Mr Karonda runs CBNRM in Karas									
PAs generate little wealth	Areas locked up and their potential not realised.									
Fences	Fences restrict opportunities to increase populations.									
Succulent Karoo	21st world biodiversity hotspot – must be recognised inLUP.									
Offtake	No hunting concessions in PAs. Should this change?									

Tourism Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
	+	**0**	**+/-**	**+**	**+**	**-**	**-** Possible over-abstraction of gwater by luxury lodges, and sewage disposal.	**0**	**0/-**	**+/-**
Huge potential in Region,	Vast areas untapped potential. Need nodes of accommodation to begin to realise the potential. Opening of Oranjemund and Spgbiet expected to give boost.									
Existing concessions in Karas -	Trans Gariep River Lodge (near Ai-Ai), Aus Info Centre, Omaweendo Safaris betw Lüderitz –Wbay.									
Future concessions in Spgbiet	Almost finalised – info from Samson Mulango (SPAN).									
Data Provision	NDT – Mrs Hamaseb. Also Namibia Tourism Board									
Protected Area status doesn't always provide adequate protection	Protected areas can be compromised by higher priorities such as mining or commercial tourism interests. Selected very special areas should be nominated for higher status e.g. World Heritage status. Fish River Canyon and Sperrgebiet suggested in Karas.									
Eco awards	Provide guidelines for environmentally sensitive tourism establishments									

Water Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
	+	**+** **-** if not man-aged prop-erly	**0**	**+**	**+/-**	**+/-**	**-** Potential. Regulations require permit for water user	**0**	**-**	**0**
Monitoring sites	Determined by Dep. of Water Affairs									
Groundwater quality	Poor in some areas – not suitable for human consumption									
Earth dams	How many, distribution? – do they have a significant impact on gwater, on livelihoods?									
Permanence of boreholes	Concern that any borehole attracts permanent settlement and grazing, leads to land degradation.									
Urban development Airports, towns, villages, settlements, border posts Future: filmstudio										
Nekkartal	Likely to grow into an urban settlement. Consider resource requirements.									
Aussenkehr	Development plan available from the Regional Council – Mr Naseb. Consider viability of formal settlement									
Towns along Orange River	Need for schools and other social services. Already there are inadequate schools to serve Aussenkehr. What when Komsberg starts? Secondary School at RPinah serves whole river.									

Infrastructure Developments and issues to assess:	**Liveli-hoods, Jobs**	**Human Health**	**Cultural Heritage / Social co-hesion**	**Economic developmt**	**Biodiver-sity / Eco-logical functioning**	**Rangeland health / Soils**	**Water / Hydrologi-cal func-tioning**	**Air quality / Climate**	**Landscape beauty / Sense of Place**	**Infrastruc-ture**
Roads, railway lines, tele-phone and cellphone struc-tures					**-** Roads as potential barriers				**-**	**+** cellphone towers along trunk roads
Trans-Oranje Road Transportation Corridor										