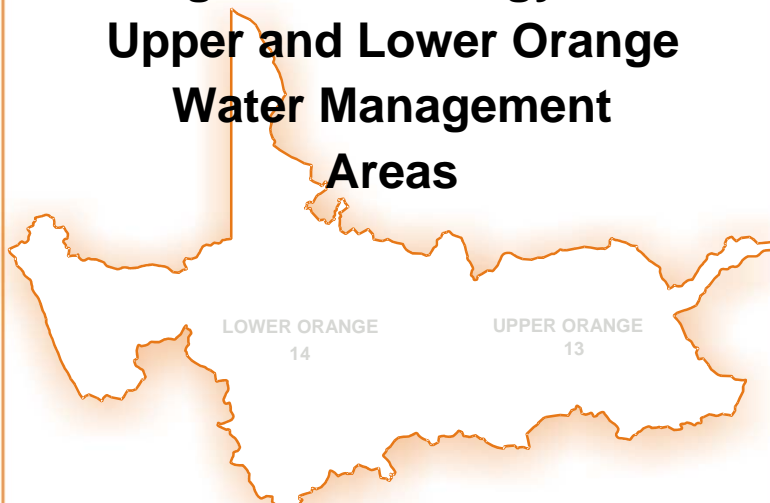




## Water Resource Planning Systems

### Water Quality Planning

# Development of an Integrated Water Quality Management Strategy for the Upper and Lower Orange Water Management Areas



## Catchment Visioning: Lower Orange Water Management Area (WMA 14)

Report No.: 4.2  
(P RSA D000/00/7909/5)

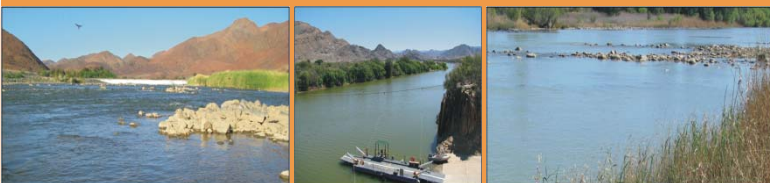
March 2009

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DOCUMENT INDEX

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**Reports as part of this project:**

REPORT NUMBER	REPORT TITLE
1*	Overview: Overarching Catchment Context: Upper and Lower Orange Water Management Areas (WMAs 13 and 14)
2.1*	Desktop Catchment Assessment Study: Upper Orange Water Management Area (WMA 13)
2.2*	Desktop Catchment Assessment Study: Lower Orange Water Management Area (WMA 14)
3**	Water Quality Monitoring and Status Quo: Upper and Lower Orange Water Management Areas (WMAs 13 and 14)
4.1*	Catchment Visioning: Upper Orange Water Management Area (WMA 13)
4.2*	<b>Catchment Visioning: Lower Orange Water Management Area (WMA 14)</b>
5**	Resource Water Quality Objectives (RWQOs): Upper and Lower Orange Water Management Areas (WMAs 13 and 14)
6**	Towards A Monitoring programme: Upper and Lower Orange Water Management Areas (WMAs 13 and 14)

\* Reports produced by the Directorate, Water Resource Planning Systems, Sub-Directorate Water Quality Planning as part of the study titled *“Development of an Integrated Water Quality Management Strategy for the Upper and Lower Orange River Water Management Areas”*.

\*\* Reports produced by Zitholele Consulting on behalf of the Department of Water Affairs and Forestry as part of the study titled *“Assessment of Water Quality Data Requirements for Water Quality Planning Purposes in the Upper and Lower Orange Water Management Areas”*.



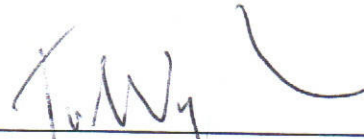
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**APPROVAL**

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**TITLE:** Catchment Visioning: Lower Orange Water Management Area  
**DATE:** March 2009  
**AUTHOR:** Samantha Boshoff  
**REVIEWER:** Jurgo van Wyk  
**FORMAT:** MSWord and Portable Document Format (pdf)

Approved for the Department of Water Affairs and Forestry by:



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Mr Jurgo van Wyk  
Assistant Director: Water Quality Planning: Central Planning Cluster



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Mr Pieter Viljoen  
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Deputy Director: Lower Orange Water Management Area





## EXECUTIVE SUMMARY

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The visioning process serves as a tool to engage stakeholders in water resource management to achieve a sense of cohesion and consensus-building, working towards a common process.

The twelve-step visioning process follows three main phases: (i) preparation, (ii) generating a vision, and (iii) formulating objectives using the vision. Using selection guidelines, four visioning areas in the Lower Orange Water Management Area (LOWMA) were demarcated and refined after stakeholder input, and thereafter mapped. Relevant baseline material has been collected and workshops were conducted in March 2008 for each of the visioning areas as part of the second round of visioning. Stakeholders currently comprise of local and district municipalities, government and non-government organisations, regulatory authorities and representative water users.

Using workshop inputs, the collective catchment context is described for each of the visioning areas detailing area-specific catchment uses and physical catchment characteristics such as precipitation trends.

The visioning process is an iterative one, which, for the LOWMA started at the Lower Orange River Forum (LORF) in August 2007, and is now approaching it's third round of visioning, with a fourth generation vision to be formulated at the LORF in October 2008. With each round, data confidence increases as does stakeholder participation and data collection.

The corporate vision for the larger LOWMA is currently stated as:

*It is the vision of all stakeholders in South Africa having an interest in the larger LOWMA to co-operatively share in the responsibility for the management of the Lower Orange River and its tributaries, whether perennial or episodic in nature, the groundwater resources in the area and the Orange River Estuary; and to endeavor to secure resource qualities that support sustainable development in the sub-region.*

Individual visions are provided for each of the four visioning areas and further outputs from the March 2008 stakeholder workshops are discussed accordingly. These include defining and evaluating area-specific strengths of the system, determinants of and constraints and threats to these strengths. Using these data, objective hierarchies were formulated for each of the visioning areas which will then form part of the process of generating Resource Water Quality Objectives for the LOWMA.



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## LIST OF ACRONYMS

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ARTP JMB	/Ai-/Ais – Richtersveld Transfrontier Park Joint Management Board
CPA	Coalition Provision Authority
DEA	Department of Environmental Affairs
DME	Department of Mineral and Energy Affairs
DTEC	Department of Tourism, Environment and Conservation
DWAF	Department of Water Affairs and Forestry
GIS	Geographic Information Systems
LORF	Lower Orange River Forum
LOWMA	Lower Orange Water Management Area
NGO	Non-governmental Organisations
SKEP	Succulent Karoo Ecosystem Project
WESSA	Wildlife and Environmental Society of South Africa
WMA	Water Management Area
WUA	Water User Association
WQP	Water Quality Planning



## 1. INTRODUCTION

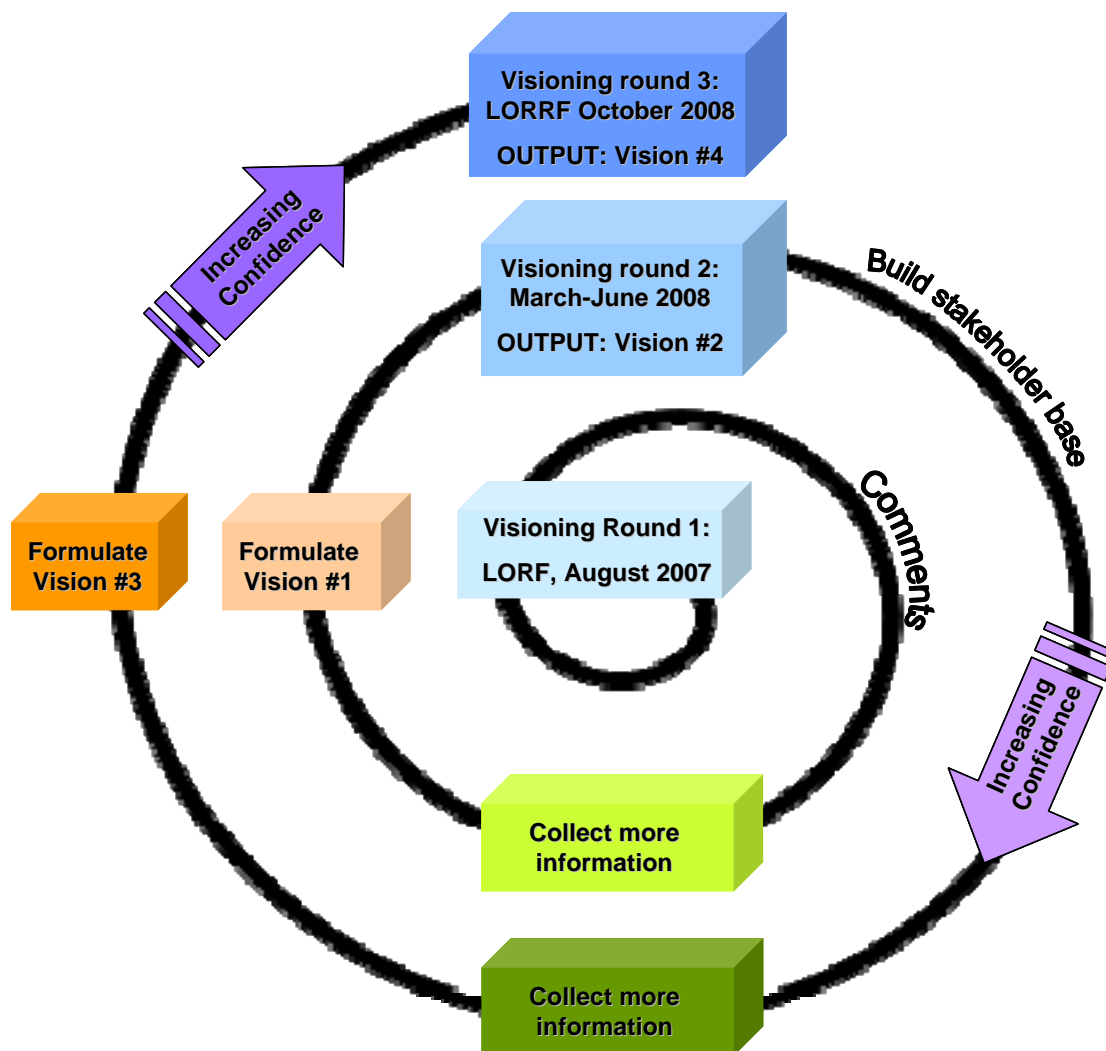
In accordance with international obligations that South Africa has with Namibia as well as signatories to Agenda 21, water resource managers need to aim to use the country's resources sustainably for future generations. All of South Africa's resources are scarce and under stress, and the Lower Orange Water Management Area is no exception. The constitution (1996) of South Africa provides the right for South Africans to be involved in issues that affect them, including water resource management. Hence, the Department of Water Affairs and Forestry has, as part of Resource Directed Management of Water Quality, developed a process of catchment visioning (DWAF, 2006).

The visioning process serves as a tool to involve multiple stakeholders from the beginning in the strategic planning process of water resource management. It aims to achieve the following (DWAF, 2006):

- Generate a sense of cohesion and common purpose amongst stakeholders with diverse interests in the water resource. This includes providing a culture of co-operation and consensus-building.
- Direct activities towards a common purpose.
- Continuously improve water resource management practices and the state of the resource.
- Provide a chain of accountability, linking the vision to management objectives and management actions.
- Provide clusters of objectives that allow operational managers to strategically interpret license applications and to formulate and recommend license conditions.

## 2. THE VISIONING PROCESS

The visioning process should provide stakeholders a means to voice their desired future state of the resource. Associated with this is the collective of goods and services that stakeholders want. This involves defining the appropriate levels of protection and use that will provide these goods and services. Notably, the visioning process is an iterative one (figure 1), which increases in confidence and acceptability as the degree of stakeholder engagement increases, as the strengths and weaknesses of a vision are refined, and as more data are collected.

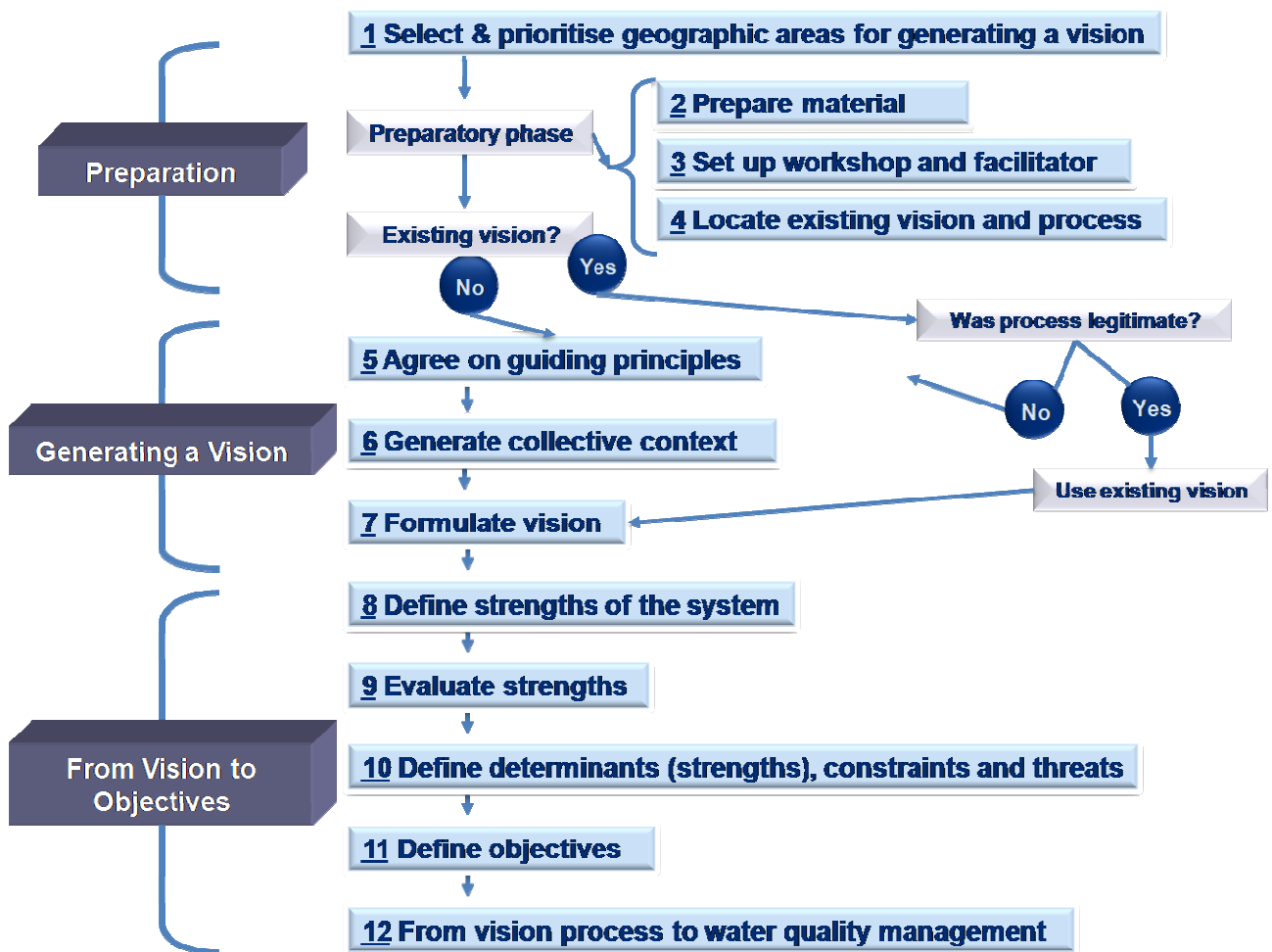


**Figure 1: The relationship between different rounds of visioning. The degree of confidence and acceptability increases as more information becomes available.**

[\*More information has been collected for this visioning process in the format of concurrent work, i.e. 'Catchment Assessment Study for the Lower Orange River' and the 'Orange River System: Assessment of the Water Quality Data Requirements for Water Quality Planning Purposes, Project No.: WP9600']



One of the management instruments that were developed as part of Resource Directed Management of Water Quality includes a step-by-step process for carrying out a visioning exercise (DWAF, 2006). This process includes 3 phases: (1) preparation, (2) generating a vision, and (3) translating the vision into objectives. Currently, two rounds of visioning have been completed for the Lower Orange WMA. These are detailed in section 2.3 below. Figure 2 summarises the twelve step visioning process and the process followed for the Lower Orange WMA is detailed below, according to these twelve steps.



**Figure 2: Twelve step process to conducting a visioning process**

## **2.1 Select and prioritise geographical areas for generating visions**

The Lower Orange WMA (LOWMA) is dominated by the Orange River, with few perennial tributaries and several episodic tributaries. Most of the activities dependant on the river are concentrated within close proximity of the main stem of the river. Hence, as a point of departure, the LOWMA was divided into four sub-components or sub-catchments (with a focus on the main stem of the Orange River) to make the visioning process a logistically viable one for stakeholders. These areas are to be termed visioning areas. The following were used as guidelines for generating the four visioning areas:

- Homogenous resource units
- Ecological considerations
- Resource users and uses
- Man-made divisions, such as dams or weirs
- Natural divisions, such as waterfalls
- The size of the sub-catchments
- Logistical practicality

The four visioning areas proposed were:

[Area 1] Just upstream of the confluence of the Orange River with the Vaal River to Boegoeberg Weir (including just upstream of both the Orange and Vaal Rivers)

[Area 2] Boegoeberg Weir to Kanoneiland

[Area 3] Kanoneiland to Pella

[Area 4] Pella to Alexander Bay

After stakeholder consultation at the second round of visioning workshops (discussed in section 2.3 below) it was decided that there should be an overlap between the first and second area, around Boegoeberg Weir, and between the second and third area, around the area of Kanoneiland. This was due to overlapping in the area jurisdictions of the Upington Water Board and the Boegoeberg Water Use Association and to allow stakeholders that are situated on the border of these two areas to be able to participate in a visioning workshop closest to them. Hence, Boegoeberg weir was included in both area 1 and 2 and Kanoneiland was included in both area 2 and 3. This decision may be taken under review in future, as new information becomes available.

From these four provisional visioning areas, and with the aid of Geographic Information Systems (GIS), quaternary catchments and rivers draining within these four areas were used to demarcate the areas further. Figure 3 presents the results of this demarcation for each of the visioning areas, including the overlap between the first three areas.

The entire Lower Orange WMA was demarcated into wall-to-wall visioning areas, with overlaps as indicated (figure 3). It should be noted that it will be possible in future to further sub-divide these visioning areas, especially if the nature of groundwater use in some of these areas warrants further demarcation.

## **2.2 Prepare material**

This step entails collecting all available baseline material. As part of a Water Quality Catchment Assessment Study (internal report in progress), a literary review has already been compiled. This review discusses all existing material relating to the above-mentioned geographical areas. This includes a strategic discussion on Integrated Development Plans, Water Services Development Plans, Internal Strategic Perspectives, Land Development Objectives, the National Spatial Development Perspective, Water Resources Situation Assessment, State of the Rivers Report and the Arid Areas Programme.

## **2.3 Set up workshop and facilitator**

The purpose of this step is to set up a workshop, identify individuals to participate and to identify and involve an appropriate facilitator. An initial workshop was set up with the Lower Orange River Forum (LORF) in August 2007. This workshop was attended by representative from the following organizations:

- Khara Hais Municipality
- Namakwa District Municipality
- Namakwa Water Board
- Sedibeng Water
- University of the North West
- Enviro Water Services
- Eskom
- Oasis Community Centre
- Department of Water Affairs, Head Office (including Water Quality Planning (WQP) and National Water Resource Planning Directorates)
- Department of Water Affairs, Northern Cape Regional Office (Upington)
- Upington Islands Hoofraad
- Department of Tourism, Environment and Conservation
- Department of Housing and Local Government
- Emanti Management Group





**FIGURE 3**  
**WMA 14 : LOWER ORANGE**  
**Visioning Areas**

**LEGEND**

- City / Town
- Settlement
- Dam
- River
- International Boundary
- Provincial Boundary
- Tertiary Drainage Region
- Quaternary Drainage Region
- Water Management Area

- Visioning Areas
- [Area 1] Douglas to Boegoeberg Dam
  - [Area 2] Boegoeberg Dam to Kanoneiland
  - [Area 3] Kanoneiland to Pella
  - [Area 4] Pella to Alexander Bay

Data sources:  
 Business Connexion GIS (Roads)  
 Department: Land Affairs, Chief Directorate: Surveys and Mapping (Towns, Rivers, Dams, Elevations and International Boundaries)  
 Municipal Demarcation Board (Provincial Boundaries)  
 Department: Water Affairs & Forestry (Water Management Areas and Drainage Boundaries)



Locality Map: WMA 14 (Lower Orange)

Map produced by:  
 Department: Water Affairs and Forestry,  
 Directorate: Spatial & Land Information Management  
 June 2008 (Ref: GM08\_020)



The meeting was chaired by the head of the LORF and the visioning exercise was facilitated by J van Wyk from DWAF, WQP. A signed register of attendees is included as Appendix A.

A general consensus was reached at the LORRF meeting to conduct a second round of visioning to include a wider spread of stakeholders and to focus to a greater extent on the catchment specific situations in each of the visioning areas. A further four visioning workshops were scheduled for the following year, corresponding to the four geographic areas mentioned above. DWAF, WQP would drive and facilitate the process. Table 1 summarises the date and place where these workshops were held. A signed register of attendees is included as Appendix B. The fourth workshop was held three months after the first three due to logistical and time constraint reasons for the workshop facilitators.

**Table 1: Summary of second round of visioning workshops conducted**

<b>Workshop No.</b>	<b>Place workshop was held</b>	<b>Area Covering</b>	<b>Date workshop was held</b>
1	Douglas	[Area 1] Douglas to Boegoeberg	4 March
2	Upington	[Area 2] Boegoeberg to Kanoneilande	5 March
3	Kakamas	[Area 3] Kanoneilande to Pella	6 March
4	Springbok	[Area 4] Pella to Alexander Bay	3 June

For each of the workshops, care was taken to avoid a bias towards one water use and to invite key stakeholders representing diverse perspectives and experiences. These included DWAF regional offices, municipalities (both local and district), water user associations, water and/or irrigation boards farming unions, mining representatives, nature enthusiasts, nature conservation enthusiasts. Attention was given to stakeholders that were area specific, for example a representative from the wineries in the Upington/Kanoneilande area, or Working for Wetlands, for the Alexander Bay RAMSAR wetland site. Figures 4-6 are photos taken at some of the visioning workshops.





**Figure 4: J.J. van Wyk from WQP facilitating visioning workshop in Area 1, hosted in Douglas, 4 March**



**Figure 5: Workshop participants in the first of the second-round of visioning in Area 1, hosted in Douglas, 4 March**





**Figure 6: Workshop hosted in Uppington, 5 March, for the Visioning Area 3**



**Figure 7: Workshop hosted in Springbok, 3 June, for the Visioning Area 4**

## **2.4 Find and consider an existing vision**

The purpose of this step is to locate, make use of and form an existing vision. This includes visions formulated at different levels within the catchment. Any attempt to achieve synergy between different types of visions formulated from different users and uses at various levels and scales forms the basis for co-operative governance (DWAF, 2006). From all the existing reference material for the Lower Orange River, no existing vision referencing particularly to water quality could be found. After consultations with stakeholders at the LORF, a preliminary vision was formulated:

“To ensure that the watercourse remains a reliable source of water of acceptable quality, and that it supports a healthy environment, through interactive stakeholder participation.”

This preliminary vision was presented at the second round of visioning workshops for further stakeholder input.

## **2.5 Agree on guiding principles**

This is an important step in the vision process as this step identifies the principles that will guide planning, decision making and management for the desired state of the river. Ideally, they should reflect the core values of all stakeholders while moving towards the future state.

Below are the guiding principles as they evolved in the second round of visioning:

### **WORKSHOP 1:**

- **Protection:** Healthy aquatic ecosystem (Improve, no further degradation) and other user requirements.
- **Stakeholder engagement:** Active participation and good representation.
- **Integration / Shared resource (Upper Orange, Vaal):** Consider user requirements downstream, allowing upstream use.
- **Institutional efficiency:** Service delivery, sufficient skills base, integration, accountability.
- **Sustainability:** Balance between ecosystem protection and good water use practices.
- **Economic growth:** From agriculture and mining.

## WORKSHOP 2:

- **Protection:** Healthy aquatic ecosystem (Improve, no further degradation) and other user requirements.
- **Stakeholder engagement:** Active participation and legitimate representation.
- **Integration / Shared resource (Upper Orange, Vaal):** Consider user requirements downstream allowing upstream use.
- **Institutional efficiency:** Service delivery, sufficient skills base, integration, accountability.
- **Economic growth:** From economic sectors.

## WORKSHOP 3:

- **Protection:** Healthy aquatic ecosystem (Improve, no further degradation) and other user requirements.
- **Stakeholder engagement:** Active participation and legitimate representation, including Namibian stakeholders.
- **Integration / Shared resource (including Namibia):** Consider user requirements downstream allowing upstream use.
- **Institutional efficiency:** Service delivery, sufficient skills base, integration, accountability.
- **Economic growth:** From economic sectors.

## WORKSHOP 4:

- **Protection:** Healthy aquatic ecosystem (Improve, no further degradation, RAMSAR site) and other user requirements, especially conservation.
- **Stakeholder engagement:** Active participation and legitimate representation, including Namibian stakeholders and local Nama communities.
- **Integration / Shared resource (including Namibia):** Consider user requirements downstream allowing upstream use.
- **Institutional efficiency:** Service delivery, sufficient skills base, integration, accountability.
- **Economic growth:** From economic sectors, including ecotourism, sustainable development and land use practices.

## **2.6 Generate collective catchment context**

This step brings together those participating in the visioning exercise so that there is a shared understanding of the current state of the area in question. It should also identify the stakeholders whose well-being depends on the possible goods and services deliverable by the water resource in question. In this step, stakeholders are encouraged to describe the water resource issues that are pertinent to them and describe the context of the catchment as they see it.

For all four workshops, there was an overall consensus that the overall collective context of the Lower Orange WMA is that it is largely arid with a very low mean annual rainfall and high evaporation rates. Figure 8A shows mean annual precipitation trends for each of the visioning areas. Area 1 receives between 200 and 300 mm of rainfall per annum, whereas, moving westwards, visioning areas 2, 3 and 4 largely receive less, i.e. between 0 and 100mm per annum.

For each of the four areas, land uses and key interest groups and stakeholders were identified and are summarized in tables 2 and 3. Land uses that were common to all four areas included stock farming, diamond mining and/or diamond prospecting, irrigation farming and conservation areas. Interest groups or stakeholders common to all four areas included fishing/fisherman, farmers, local and district municipalities, the DWAF regional office, the Department of Minerals and Energy (DME), diamond diggers/prospectors, Department of Tourism and Environmental Conservation (DTEC), and local irrigation or water boards.

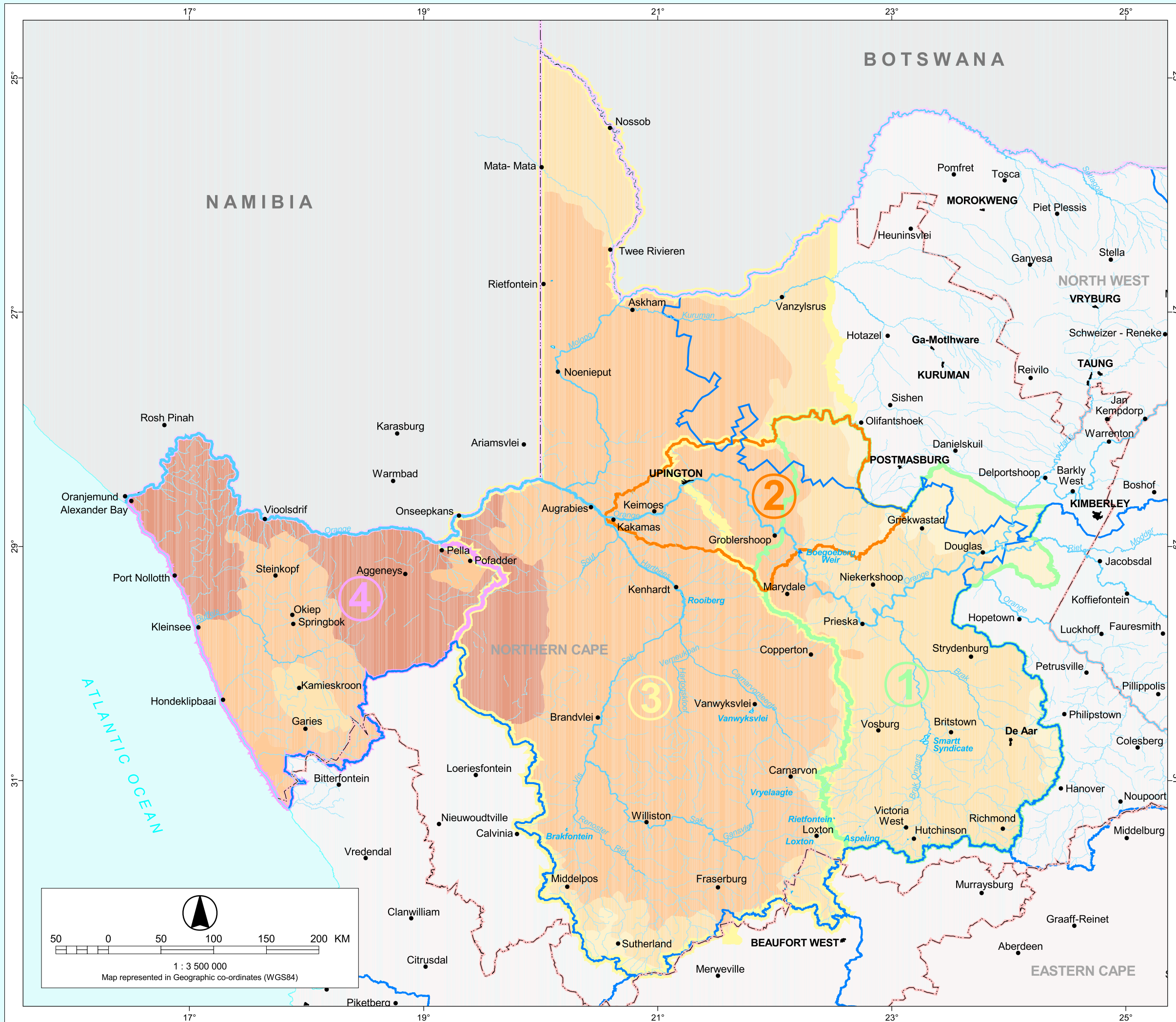
Groundwater use is common for towns that are situated a fair distance from the main stem of the Orange River, especially if their water supply is not augmented by formal pipelines or supply schemes, and there is little or no surface water available. The availability of potable groundwater is limited. Nitrates contamination (in areas of intense cultivation), fluorides and high TDS represent the majority of serious groundwater quality problems (DWAF, 2004).

Catchment characteristics that are specific to each visioning area include:

[Area 1]

- This area marks the confluence of the Vaal and Orange River. The Vaal is a highly utilised river, supplying the densely populated province of Gauteng.
- The confluence of the Vaal and Orange River also marks the boundary between the Upper Orange WMA and the Lower Orange WMA.
- The towns of Douglas and Prieska are situated on the banks of the Orange River. These towns exist mainly due to irrigated agricultural activities along the banks of the Orange.





**FIGURE 8A**  
**WMA 14 : LOWER ORANGE**  
**Mean Annual Precipitation**

**LEGEND**

- City / Town
- Settlement
- Dam
- River
- - - International Boundary
- - - Provincial Boundary
- Tertiary Drainage Region
- Quaternary Drainage Region
- Water Management Area

- Visioning Areas**
- ① [Area 1] Douglas to Boegoeberg Dam
  - ② [Area 2] Boegoeberg Dam to Kanoneiland
  - ③ [Area 3] Kanoneiland to Pella
  - ④ [Area 4] Pella to Alexander Bay

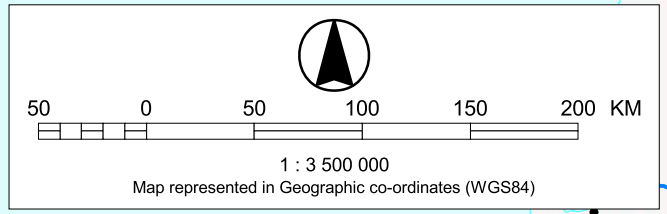
- Mean Annual Precipitation**
- 0 - 100mm
  - 100 - 200mm
  - 200 - 300mm
  - 300 - 400mm

Data sources:  
 Business Connexion GIS (Roads)  
 Department: Land Affairs, Chief Directorate: Surveys and Mapping (Towns, Rivers, Dams, Elevations and International Boundaries)  
 Municipal Demarcation Board (Provincial Boundaries)  
 Department: Water Affairs & Forestry (Water Management Areas and Drainage Boundaries)



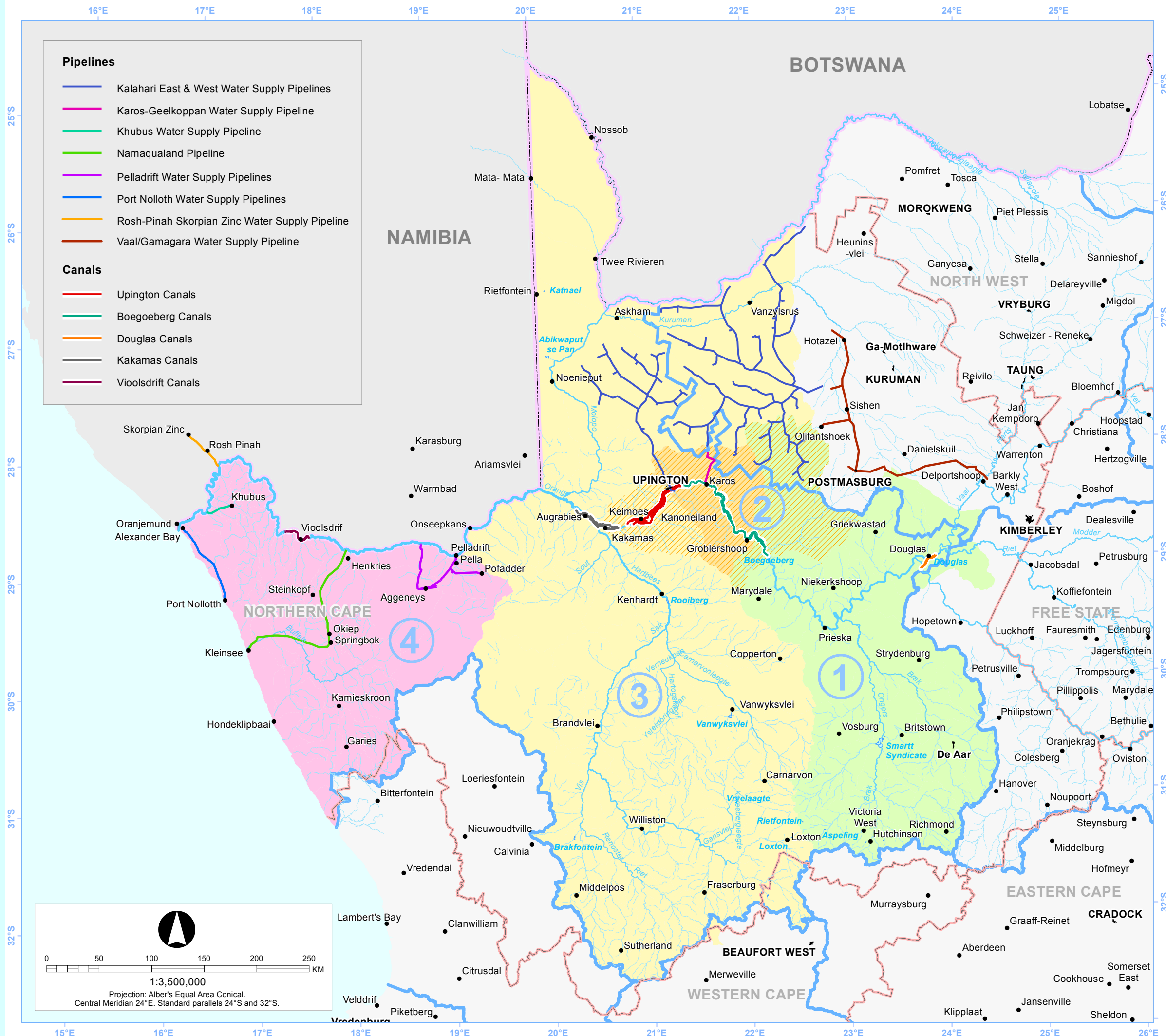
Locality Map: WMA 14 (Lower Orange)

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 August 2008 (Ref: GM08\_153)





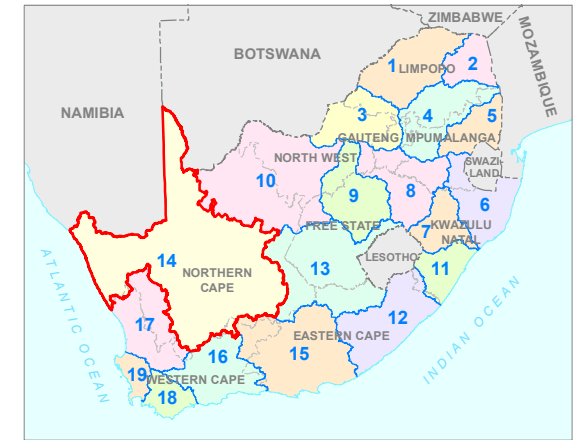
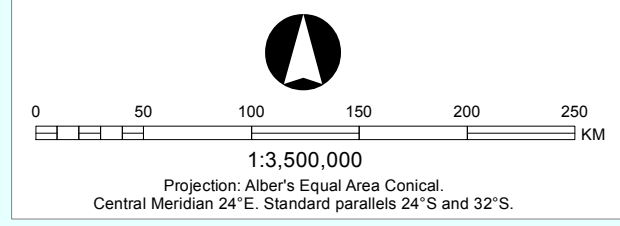
**FIGURE 8B**  
**WMA 14 : LOWER ORANGE**  
**Irrigation Canals and Supply Pipelines**



- Pipelines**
- Kalahari East & West Water Supply Pipelines
  - Karos-Geelkoppan Water Supply Pipeline
  - Khubus Water Supply Pipeline
  - Namaqualand Pipeline
  - Pelladrift Water Supply Pipelines
  - Port Nolloth Water Supply Pipelines
  - Rosh-Pinah Skorpion Zinc Water Supply Pipeline
  - Vaal/Gamagara Water Supply Pipeline
- Canals**
- Uppington Canals
  - Boegoeberg Canals
  - Douglas Canals
  - Kakamas Canals
  - Vioolsdrift Canals

- LEGEND**
- Major City / Town
  - Town
  - Dam
  - River
  - Water Management Areas
  - Provincial Boundary
  - - - International Boundary
- Visioning Areas**
- 1 [Area 1] Douglas to Boegoeberg Dam
  - 2 [Area 2] Boegoeberg Dam to Kanoneiland
  - 3 [Area 3] Kanoneiland to Pella
  - 4 [Area 4] Pella to Alexander Bay

Data sources:  
 Department: Land Affairs, Chief Directorate: Surveys and Mapping (Towns, Rivers, Dams and International Boundaries)  
 Municipal Demarcation Board (Provincial Boundaries)  
 Department: Water Affairs & Forestry (Water Management Areas and Drainage Boundaries)  
 DWAF Northern Cape GIS Unit (Pipelines and Canals)  
 Orange/Vaal Water User Association (Douglas Canals)



Locality Map: WMA 14 (Lower Orange)

Map produced by:  
 Department: Water Affairs and Forestry,  
 Directorate: Spatial & Land Information Management  
 March 2009 (Ref: GM09\_033)





- Agricultural activity is made up of variable crop production, including mielies, wheat, potatoes, and some Lucerne.
- Towns situated a distance from the main stem of the Orange and which rely primarily on groundwater resources include Marydale, Niekerkshoop, Griekwastad, Strydenburg, Vosburg, Britstown, De Aar, Victoria West, Hutchinson and Richmond.

[Area 2]

- Irrigation canals feeding off from Boegoeberg Dam provide irrigation water for farmers downstream.
- The towns of Upington, Keimoes and Kakamas are situated along the banks of the Orange River and irrigation water is supplied to these areas via an extensive network of irrigation canals. Grape production for table grapes and wine as well as dried fruit production are the dominant agricultural produces in this area.
- Stock farming (sheep and goats) is also common in the area with the Uitkoms feedlots situated just outside Upington which also supplies a large local meat market and a small export market.
- Upington is the town that supports the most infrastructure in the Lower Orange WMA. This includes Upington International Airport supported by a large fuel depot, a golf course and casino, and some small-scale industries such as the salt works and the Orange River wine co-op which receives grapes for wine production from all neighbouring vineyards.
- Upington is also classified as a core economic area according to the National Spatial Development Perspective (NSDP, 2006). Hence, Upington is characterised by a high level of economic potential, with a diverse economy and relatively high levels of formal infrastructure, transport nodes, education and health services.
- Nature conservation plays a lesser role in this area compared to Area 3, with the smaller-sized Spitskop Nature Reserve situated just outside of Upington.
- The Orange River in this area also supplies the Karos-Geelkoppan rural water supply scheme and approximately 0.5 mil m<sup>3</sup>/a of water to the Kalahari West rural water supply scheme. Both schemes are situated north of the Orange River (Figure 8B).
- No significant groundwater use occurs in this area.

[Area 3]

- This area overlaps with Area 2 for the towns Upington, Keimoes and Kakamas.
- This is the first of the visioning areas to border with Namibia north of the Orange River.
- This area also borders with the Gouritz and Olifants/Doorn water management areas far south of the Orange River,
- Water in this area is not augmented from any supply schemes.

- Importantly for this area, the Orange River flows through the 15 000ha of Au-grabies Falls National Park and also boast eco-adventure tourism ventures such as canoeing and white water rafting, hiking, game drives and mountain bike riding.
- Extending the tourism industry in this area is the Kgalagadi Transfrontier Park, with almost one of the largest conservation areas in the world – 3.7 million ha (NCTA, 2007).
- The area also supports a sizeable private game farm industry and a salt industry associated with the Witpan and Grootwitpan salt pans situated 115km and 95km northwest from Upington respectively.
- Extensive livestock farming is evident where the carrying capacity of the land is favourable with some evident agricultural activities including grapes, watermelons and spanspek.
- Towns in this area which are situated a distance from the main stem of the Orange and which rely primarily on groundwater resources include Kenhardt, Brandvlei, Vanwyksvlei, Williston, Fraserburg, Loxton, Sutherland and Carnarvon.

[Area 4]

- The town of Klein Pella marks the boundary between Area 3 and Area 4 and is characterized by extensive data plantations that supply dates to both local and export markets.
- Other activities include smaller scale agriculture of grapes, hoodia and tomatoes, ostrich farming and semi-precious gems and quartzite mining.
- The Orange River in this area forms the border with Namibia and is characterized by four transfer schemes (figure 8B), one of which supplies water to two mining towns in Namibia:
  1. **Pelladrift water supply scheme** where 4.7 mil m<sup>3</sup> per annum of water is abstracted and transported by two pipelines, one supplying local farmers and the towns of Pofadder and Pella, and the other supplying domestic use for the small town of Aggenys, but more importantly for industrial use for the base metals mine, Black Mountain at Aggenys.
  2. **Springbok regional water supply scheme** which abstracts 4.2 mil m<sup>3</sup> of water at Henkriesmond and is transferred via a long pipeline to supply domestic use and small-scale livestock watering in the farming communities of Springbok, Steinkompf, Nababeep, Okiep and Kleinsee.
  3. **Namibian pipelines.** Before Alexander Bay, close to Sendelingsdrift, Karas, on the Namibian side, there are two pipelines leading from the main stem of the Lower Orange River that supply the mining activities of Rosh Pinah and Skorpion Zinc.
  4. **Port Nolloth** is supplied by a pipeline leading off from the Orange River at Alexander bay for the purpose of domestic use, a small fishing harbour and small-scale diamond mining.

- The Orange River also plays a significant role in supporting eco-tourism in this area as it flows through the Richtersveld, a World Heritage Site, and forms the livelihood of local Nama communities.
- The river mouth at the town of Alexander Bay has been classified as a RAMSAR site, which signifies that it is a wetland of international importance, especially for providing habitat to water birds. However, this site was placed on the Montreaux Record as a result of a severely degraded state of the salt marsh on the south bank (ARTP JMB, 2008).
- Alluvial diamond mining activities increase nearing the coastal and mining-dominated town of Alexander Bay.
- Towns in this area which are situated a distance from the main stem of the Orange and which rely primarily on groundwater resources include Kamieskroon, Garies and the coastal town of Hondeklipbaai.

**Table 2: Land uses identified in the four geographic areas**

<b>[Area 1] Douglas to Boegoeberg</b>	<b>[Area 2] Boegoeberg to Kanon Islands</b>	<b>[Area 3] Keimoes to Pella</b>	<b>[Area 4] Pella to Alexander Bay</b>
Sheep and goat farming.	Sheep and goat farming, including feedlots.	Sheep and goat farming.	Stock farming and ostrich farming.
Irrigation Farming (banks of Orange, Vaal and Riet Rivers): table grapes, vineyards, mielies, wheat, potatoes, Lucerne.	Irrigation Farming (banks of Orange): Table grapes, vineyards, dried fruit.	Irrigation Farming (banks of Orange): vineyards for wine and table grapes, watermelons, spanspek. Also dried fruit production.	Irrigation Farming (banks of Orange): vineyards, Hoodia, dates, paprika, tomatoes.
Diamond mining and prospecting.	Diamond mining and prospecting.	Diamond prospecting and base metal mining.	Alluvial diamond prospecting and larger-scale alluvial diamond mining at Kleinsee, Alexander Bay and Hondeklipbaai. Also semi-precious gems and quartzite mining.
Douglas conservancy	Conservation areas (Spitskop)	Conservation areas (Augrabies Falls National Park) and eco-tourism.	Conservation areas (/Ai-/Ais-Richtersveld Transfrontier Park) and eco-tourism. Including RAMSAR site at Alexander Bay Estuary.
Interest groups – Farming, Fishing.	Interest groups – Farming, Fishing.	Interest groups – Farming, Fishing.	Interest groups – Farming, Fishing, Recreation/ Canoeing.
	Urban infrastructure: airport, fuel depot, golf course, casino, salt works.	Industries: Game farming and salt works.	Recreation

<b>Existing Lawful Uses:</b> • Abstraction (agriculture, domestic), dams	<b>Existing Lawful Uses:</b> • Abstraction (agriculture, domestic), dams	<b>Existing Lawful Uses:</b> Abstraction (agriculture, domestic)	<b>Existing Lawful Uses:</b> • Abstraction (agriculture, domestic) • Mining
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**Table 3: Interest groups and key stakeholders identified for the four geographic areas**

Area 1	Area 2	Area 3	Area 4
<b>Douglas to Boegoeberg</b>	<b>Boegoeberg to Kanon Islands</b>	<b>Keimoes to Pella</b>	<b>Pella to Alexander Bay</b>
Upington and Kimberley regional offices, DWAF	Upington regional office, DWAF	Upington regional office, DWAF	Upington regional office, DWAF
District municipalities: • Pixley Ka Seme (Karoo) Local Municipalities: • Siancuma (Douglas) • Emthanjeni (De Aar) • SiyaThemba (Prieska)	District municipalities: • Siyanda (Upington) Local Municipalities: • !Kheis (Groblershoop) • Khara Hais (Upington)	District municipalities: • Siyanda (Upington) Local Municipalities: • Khai-Ma (Pofadder) • Kai Garib (Kakamas)	District municipalities: • Namakwa Local Municipalities: • Nama Khoi (Springbok) • Richtersveld
DME	DME	DME	DME
DTEC	DTEC	DTEC	DTEC, ARTP JMB
	Dept of Environmental Affairs	Department of Agriculture	Department of Agriculture
		N Cape Conservation	Department of Science & Technology
Orange/Vaal WUA / Irrigation Boards	Upington Irrigation Board, Upington Islands Irrigation Board (includes 7 at time of workshop)	Pella Water Board	Vioolsdrift Irrigation Board
Boegoeberg WUA	Boegoeberg WUA	Kakamas WUA	Namakwa Water Board
Farmers from Douglas and Prieska	Farmers	Farmers	Farmers and resource poor farmers (4 000ha for whole of N Cape)
Diamond diggers	Diamond prospectors	Prospectors, miners	Prospectors, miners
Nature conservation (fishing, etc.)	Nature enthusiasts (fishing, etc)	Nature enthusiasts (fishing, etc) and conservation	Namakwa Community
	Recreation and tourism	Recreation and tourism	Recreation and tourism, including African Paddler's Association
		NGOs: • Botsoc • Conservation International • SKEP • WESSA • Social NGOs	NGOs: • SKEP • Working for Water • Working for Wetlands SPP (Surplus People's Project)
			World Heritage Site CPA

## **2.7 Formulate a vision**

This step of formulating the vision is where the stakeholders discuss and generate a joint perception around the previously discussed context of the catchment. This will lead the visioning team and the stakeholders to a joint understanding of current issues, problems and points of strength.

The initial round of visioning was conducted at the LORF in August 2007. As illustrated in figure 1, the visioning process is an iterative one, and is a continual process, increasing in confidence as each round of visioning is completed. After each round of visioning, further information is collected, in this study, in the form of a water quality catchment assessment strategy (draft report in progress). The first vision (Appendix C1) was generated as per figure 1 and re-processed at the second round of visioning, where a second vision was generated (Appendix C2). Further information was collected regarding the catchment context and combined together with the inputs of the second round of visioning, and a third generation vision was formulated, first as a corporate vision for the LOWMA and then as individual visions for each of the visioning areas. The third generation visions are as follows:

### **Corporate Vision: LOWMA**

It is the vision of all stakeholders in South Africa having an interest in the larger LOWMA:

- to co-operatively<sup>1</sup> share in the responsibility<sup>2</sup> for the management of the Lower Orange River and its tributaries, whether perennial or episodic in nature, the groundwater resources in the area and the Orange River Estuary; and
- to endeavour to secure resource qualities<sup>3</sup> that support sustainable development in the sub-region.

#### **It is implied that:**

<sup>1</sup> “co-operatively” includes international co-operation with Namibian and Botswana stakeholders.

<sup>2</sup> “share in the responsibility” refers to the varying roles that various interest groups have to play in water resource management as a broad function.

<sup>3</sup> “resource quality” refers to aquatic ecosystem health, water quality and water quantity that individually and collectively contribute towards the over-all quality of the water resource in question.

**Area 1: Boegoeberg to Kanon Islands**

*It is the vision of all interested and affected parties within Visioning Area 1:*

To contribute towards the integrated management of the surface and groundwater resources in all LOWMA catchments between Douglas and Boegoeberg Dam, to secure sufficient water that is fit for all beneficial uses, specifically including domestic and variable agricultural use, and to support a healthy aquatic ecosystem, particularly for ecological sensitive areas such as the Douglas Conservancy.

**Area 2: Boegoeberg to Kanon Islands**

*It is the vision of all interested and affected parties within Visioning Area 2:*

To contribute towards securing suitable water supplies of qualities for all LOWMA catchments between Boegoeberg and Kanon Islands, that will sustain:

- a thriving table grape export market and wine production;
- local agricultural activities via an extensive irrigation canal system;
- a thriving stock farming industry;
- domestic and light industrial water use in all towns, specifically including Upington; and
- supplying water to rural communities via both the Kalahari West and Karos-Geelkoppan water supply schemes.

**Area 3: Kanon Islands to Pella**

*It is the vision of all interested and affected parties within Visioning Area 3:*

To promote the participatory<sup>1</sup> and integrated management of all water resources pertaining to the LOWMA catchments situated between Kanon Islands and Pella in order to ensure that water supplies are of an acceptable quality to all water users, in particular to sustain a prominent conservation and ecotourism industry, as well as livestock and private game farming, while allowing room for beneficial water use.

**It is implied that:**

<sup>1</sup> “participatory management” includes international co-operation with Namibian and Botswana stakeholders.

#### **Area 4: Pella to Alexander Bay**

*It is the vision of all interested and affected parties within Visioning Area 4:*

To contribute towards the participatory and integrated management of all water resources, including the Orange River estuary, falling within the LOWMA catchments situated between Pella and Alexander Bay to secure sufficient water of qualities that are fit for use. These water uses include:

- A thriving conservation and eco-tourism industry;
- A favourable diamond mining industry;
- A viable date export market; and
- Various water supply schemes for the purpose of supplying the needs of commercial and subsistence farmers, domestic users and base-metal mining.

**It is implied that:**

<sup>1</sup>“*participatory management*” includes international co-operation with Namibian stakeholders.

## **2.8 Define strengths of the system**

The eighth step marks the start of the third phase of the visioning process which is translating the vision into objectives. This step begins with defining the strengths of the system as well as identifying constraints. A strength can be defined as “a positive characteristic of the system to be managed and may be scientific, ecological, value judgments, legal, historic and socio-economic (DWAF, 2006). Ideally, the resource manager should aim to maintain the strengths of the system and overcome constraints.

In order to assist the stakeholders to identify the strengths and constraints, a table of possible strengths was formulated and used at each of the second-round visioning workshops. Stakeholders were given a chance to add or take-away from the list of proposed objectives and also comment on the degree to which they either agreed or disagreed with the proposed strengths. An example of such a table is provided in Table 4. The tables produced from each of the four workshops are included in Appendix D.

## **2.9 Evaluate strengths of the system**

In this step, stakeholders were given a chance to evaluate the strengths identified in the system. A second table was used where all the known and perceived current and future strengths of the social ecological system were listed and rated according to a scale 1 ('strong' strength) to 4 ('strong' weakness).

An example of such a table is provided in Table 5 and the completed tables for each of the second-round of visioning workshops are provided in Appendix E.

In summary, the following are strengths for each of the four visioning areas, indicating whether it was rated [2] (a strength) or [1] (an obvious strength):

### **Douglas to Boegoeberg:**

- [1] Rating: Legal Frameworks, Regulation
- [2] Rating: Economic activity, Ecology, Water quality

### **Boegoeberg to Kanoneilande:**

- [1] Rating: Legal Frameworks
- [2] Rating: Economic activity, Ecology

### **Kanoneilande to Pella:**

- (1) Rating: Legal Frameworks,
- (2) Rating: Economic activity, Ecology, Conservation

### **Pella to Alexander Bay:**

- [1] Rating: Ecology, Conservation, Ecotourism
- [2] Rating: Existing information, Social values, Legal frameworks

Stakeholders from all four workshops agreed that Legal Frameworks were an obvious strength and that ecology and/or conservation was at least a strength.



## **2.10 Determinants of and constraints and threats to strengths**

By defining and evaluating the strengths of the system, this helps guide the stakeholders to ultimately define the determinants, threats and constraints of the system. The major purpose for management is to maintain those factors that are determining and maintaining the strengths of the system. This step was aided by the use of a matrix at each workshop. These are summarized for each of the visioning areas in tables 6a to 6d.

**Table 4: Table used to assist stakeholders in identifying strengths and constraints of the system**

<b>Strengths</b>	<b>Strongly Agree</b>	<b>Agree</b>	<b>Disagree</b>	<b>Strongly Disagree</b>	<b>Comment</b>
<b>Economic and social objectives</b>					
Economic empowerment					
Maximise job creation					
Maximise capital growth					
Increase subsistence irrigation and resource poor farmers					
Social upliftment					
Beneficial use of water resources					
<b>Promote the following sectors to achieve the above</b>					
Mining					
Agriculture (tomatoes, pumpkins, Lucerne, dates, Hoodia, essential oils)					
Eco tourism					
Stock and game farming					
<b>Ecological Water Requirement of the water resource</b>					
Maintain overall present status					
Improve present status					
Maintain water quality present status					
Improve water quality of main stem					
Allow deterioration of present status					
Allow deterioration of selected water resources in the short term					

**Table 5: Table used to rate all the known and perceived current and future strengths of the social ecological system**

Attributes	Strength			Weakness
	1	2	3	4
Existing information				
Ecological				
Social values				
Legal frameworks				
Regulation				
Enforcement				
Conservation				
Economic activity				
Water Quality				

**Table 6a: [Area 1] Determinants, threats and constraints for the strengths of the system for the visioning area between Douglas and Boegoeberg.**

Strength	Determinant	Threat	Constraint
Ecology	Reserve Determination: Aquatic Biota, Riparian Vegetation, Instream habitat	Illegal and irresponsible Diamond mining, agriculture, sewage, operation of system	No high confidence Reserve
Legal frameworks	NWA, NWRS, ISP	Lack of implementation	Capacity limitations
Economic activity	GDP, agricultural output	Decreased water quality	Soil productivity, poor water quality
Water quality	Water quality parameters: TDS, nutrient enrichment	Effluent discharge, diamond mining, irrigation return flows, global warming, operation of system	Poor water quality upstream (Vaal & Riet)

**Table 6b: [Area 2] Determinants, threats and constraints for the strengths of the system for the visioning area between Boegoeberg and Kanoneiland.**

Strength	Determinant	Threat	Constraint
<b>Ecology</b>	Reserve Determination: Aquatic Biota, Riparian Veg, Instream habitat	Agriculture, sewage, regulation of system	No high confidence Reserve
<b>Legal frameworks</b>	NWA, NWRS, ISP, EIAs, SEAs, other environmental legislation	Lack of implementation	Capacity limitations
<b>Economic activity</b>	GDP, agricultural output	Decreased water quality	Soil productivity, poor water quality, not many manufacturing industries
<b>Water quality</b>	Water quality parameters: TDS, nutrient enrichment	Effluent discharge, irrigation return flows, global warming, operation of system	Poor water quality upstream

**Table 6c: [Area 3] Determinants, threats and constraints for the strengths of the system for the visioning area between Kanoneiland and Pella.**

Strength	Determinant	Threat	Constraint
<b>Ecology</b>	Reserve Determination: Aquatic Biota, Riparian Veg, Instream habitat	Agriculture, sewage, regulation of system	No high confidence Reserve
<b>Legal frameworks</b>	NWA, NWRS, ISP, EIAs, other environmental legislation, EMPs	Lack of implementation	Skilled Human Resources
<b>Economic activity</b>	GDP, agricultural output, mining output	Decreased water quality	Soil productivity, poor water quality, not many manufacturing industries
<b>Conservation</b>	Formalisation of conservation parks, transfrontier initiatives	Commercial farming, decreased water quality, groundwater pollution	Financial and human resources, communal land ownership, land ownership dispute (Riemvasmaak)

**Table 6d: Determinants, threats and constraints for the strengths of the system for the visioning area between Pella and Alexander Bay.**

Strength	Determinant	Threat	Constraint
<b>Ecology</b>	Reserve Determination: Aquatic Biota, Riparian Veg, Instream habitat	Agriculture, sewage, regulation of system, prospecting and tourism (destruction of rip habitat), stock farming, mining, invasive species, illegal fishing	No high confidence Reserve, no consistent biomonitoring
<b>Ecotourism</b>	Established industries	Decreased water quality and quantity,	Lack of control
<b>Conservation</b>	Formalisation of conservation parks, transfrontier initiatives, TFCA, ARTP treaty	Unsustainable land use practices, decreased water quality and quantity	Financial and human resources, lack of co-operative governance

## **2.11 Define objectives hierarchy**

The last and final step is defining the objectives for the visioning area. The aim of setting objectives is to enhance the strengths of the system and overcome the constraints. Figure 9 graphically represents the relationship between maintaining strengths, overcoming constraints and threats and the objectives.

An objectives hierarchy can help identify the different levels of management required to achieve the objectives. A proposed objective hierarchy is provided in figures 10a to 10d.



**Figure 9: Graphical representation of the inter-connectedness of maintaining strengths, overcoming constraints and threats, and the setting of objectives**



Figure 10a: Objectives Hierarchy - Area 1

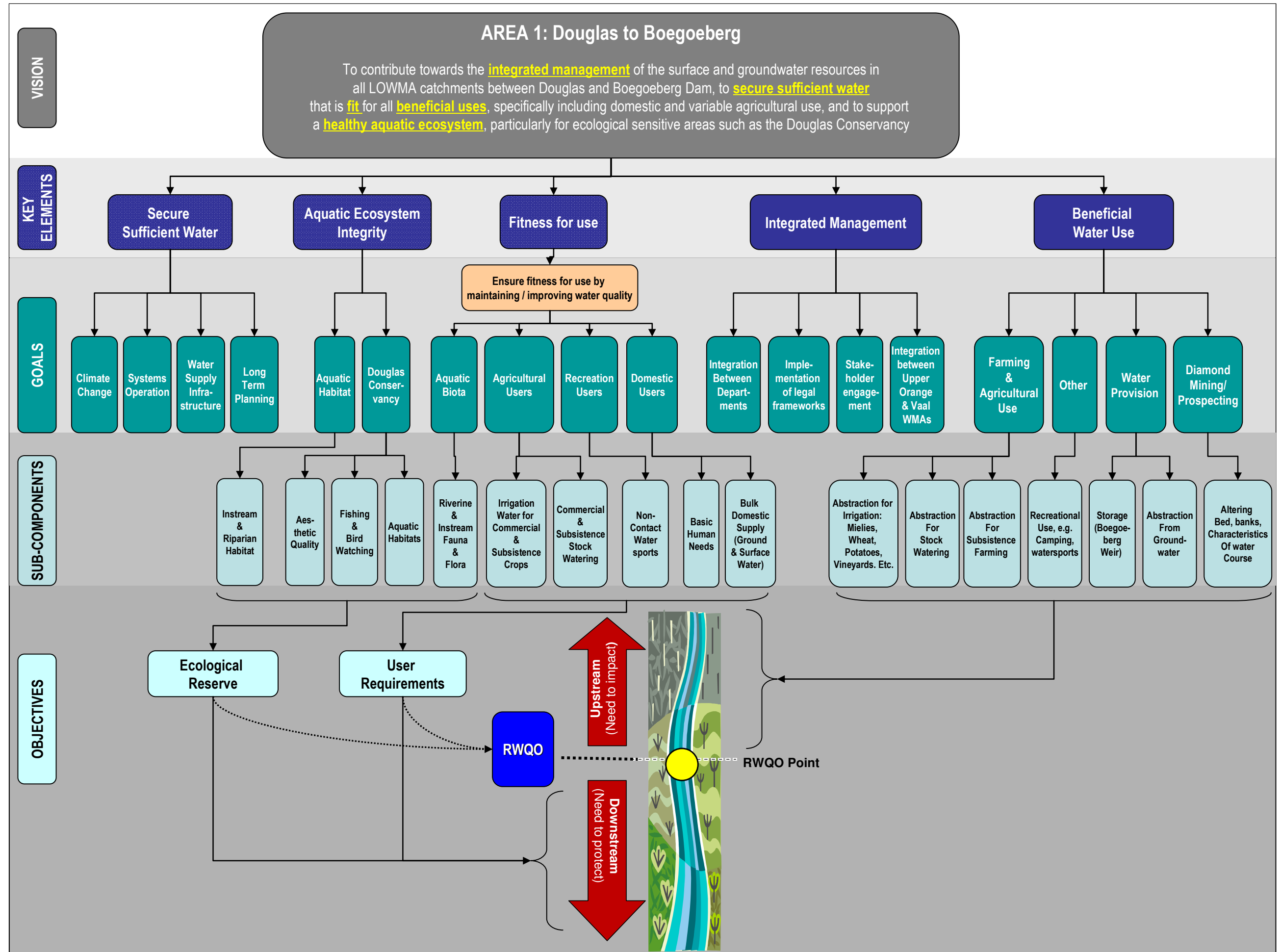






Figure 10b: Objectives Hierarchy – Area 2

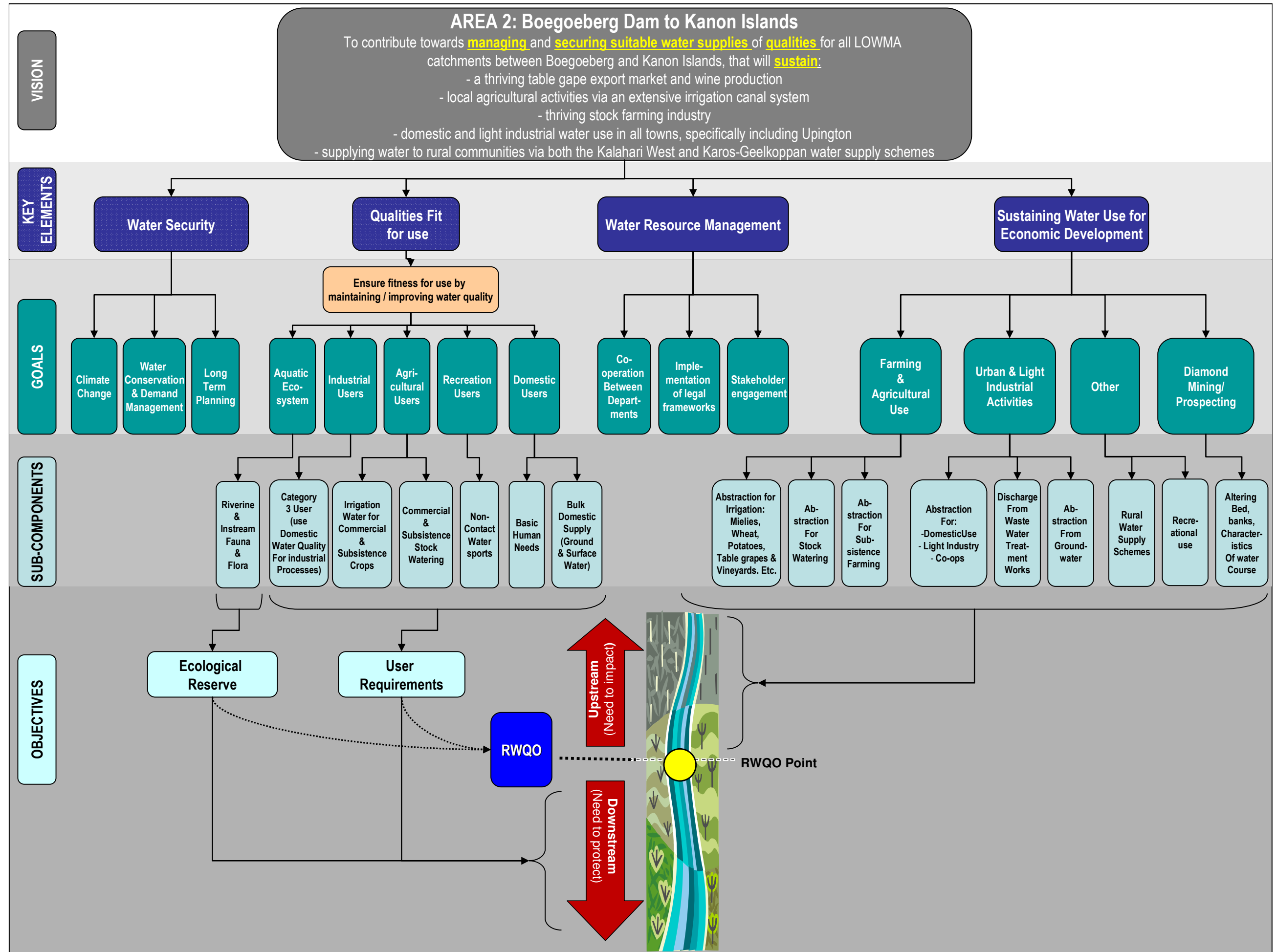




Figure 10c: Objectives Hierarchy – Area 3

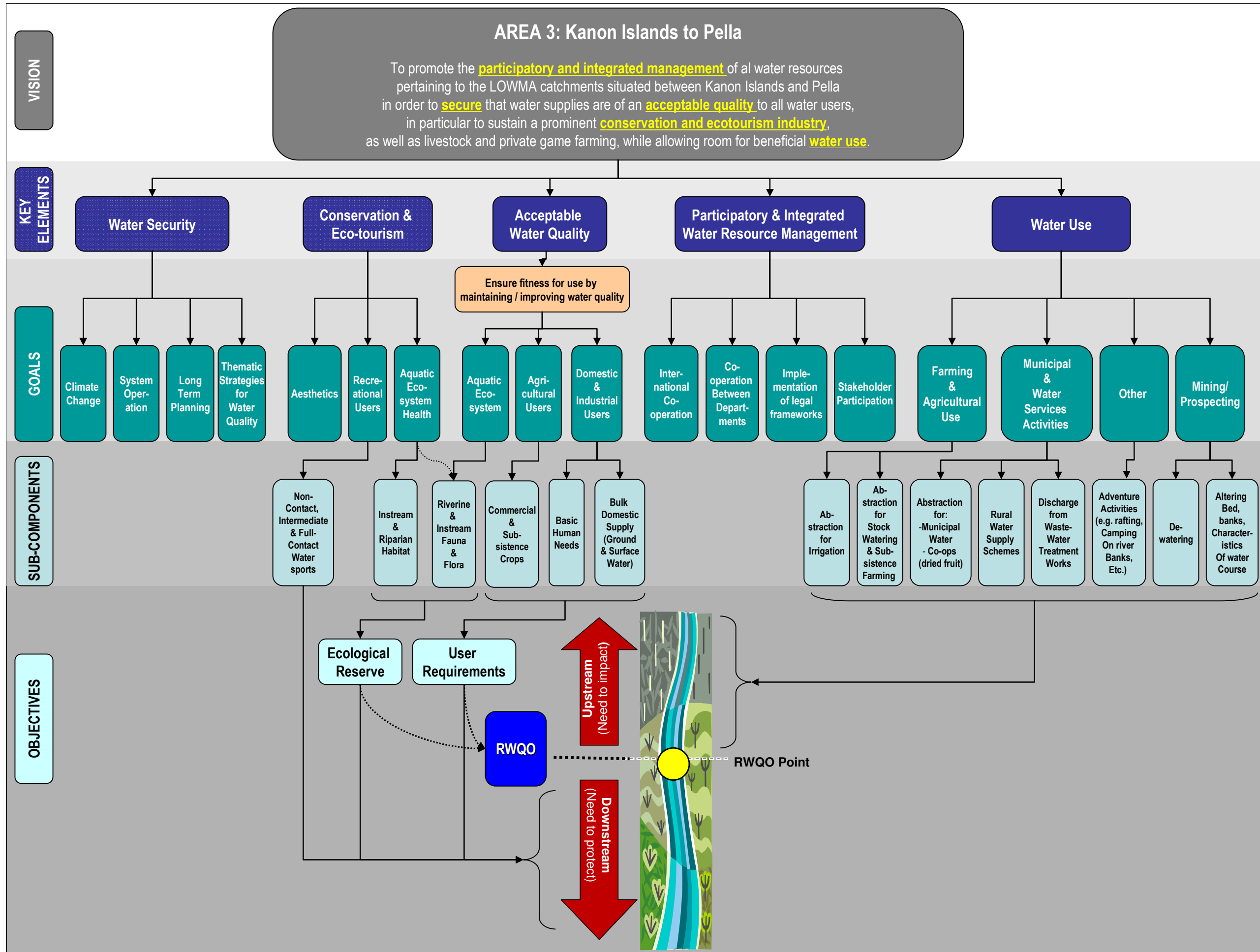
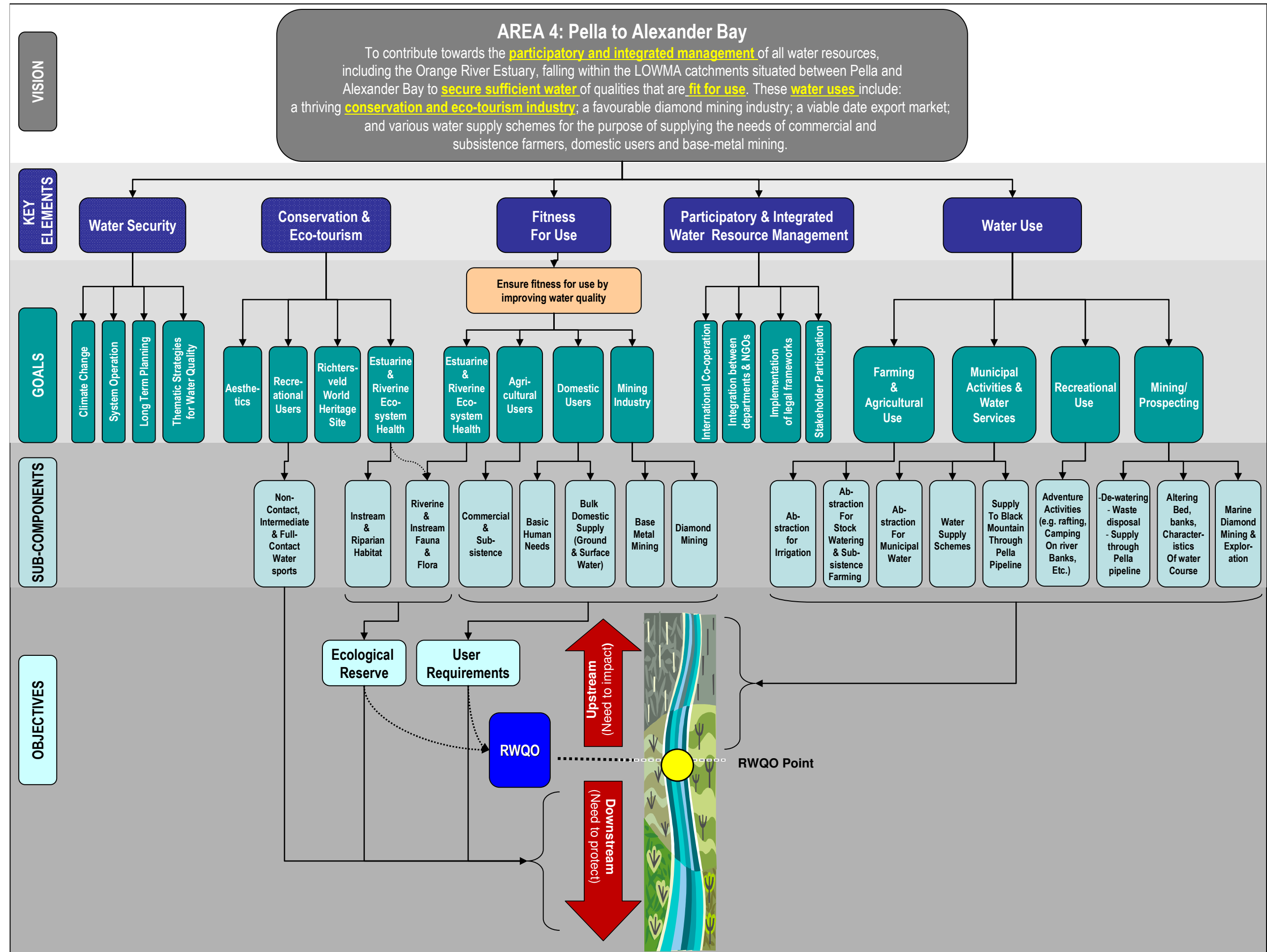




Figure 10d: Objectives Hierarchy – Area 4





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APPENDIX A: Attendance register, LORF meeting, August 2007, Uppington

ATTENDANCE REGISTER

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**APPENDIX B: Attendance register for second round of visioning for each of the four visioning areas**

WQ Visioning Workshop Gee huis Restaurant, Douglas, 4 March 2008

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WQ Visioning Workshop Uplington, 5 March 2008

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12 Mike Mokgwabone		0836355130	054 3385800	054 3340067	Mokgwabone@dwaf.gov.za	[Signature]



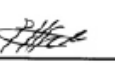



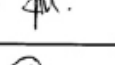
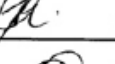

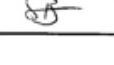
Van pella Water Kaad

WQ Visioning Workshop Vergeligen Guest House, 6 March 2008

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### **APPENDIX C1: Vision #1**

- We are custodians of our river that sustains our economy and heritage.
- We protect and manage our river so that it can continuously bring benefits on an equitable basis to our people and neighbours.
- We ensure the wise use of all water resources and maintain an adequate supply of acceptable quality to all users to sustain the integrity of the natural environment.
- To promote a healthy, safe and sustainable environment that is fit for all uses through interactive stakeholder participation within the catchment
- Maintain the biodiversity in all its natural facets and fluxes to provide benefits to the water users.

### **APPENDIX C2: Vision #2**

The following is a broad vision that was generated combining the input provided by stakeholders from both the first round of visioning and from each of the four workshops at the second round of visioning:

- Ensure sustainable and acceptable water quantity and quality fit for all users and where relevant, strive towards no further degradation and/or improvement.
- i.e. strive towards managing the Orange River system in a holistic and sustainable way that it can provide acceptable quality water to all users as well as supporting a healthy ecosystem and enhancing economic growth and job creation
- Commitment to collaborate with Namibia to strive towards the above (where relevant).

**APPENDIX D: Strengths identification tables for second-round visioning workshops**

First workshop, 4 March, Douglas

	Strongly Agree	Agree	Disagree	Strongly Disagree	Comment
<b>Strengths</b>					
<b>Economic and social objectives</b>					
Economic empowerment	X				
Maximise job creation		X			
Maximise capital growth		X			
Increase subsistence irrigation		X	(X)		
Social upliftment	X				
Beneficial use of water resources	X				
<b>Promote the following sectors to achieve the above</b>					
Industry (growing industries supp'd by diamond diggers, 1 tannery planned)	X				
Mining		X			
Grapes		X			
Grain production	X		(X)		
Eco tourism	X				
Sheep farming on pastures	X				
Stock farming	X				
<b>Ecological Water Requirement of the water resource</b>					
Maintain overall present status	X				
Improve present status			X		
Maintain water quality present status	X				
Improve water quality of main stem	X				
Allow deterioration of present status				X	
Allow deterioration of selected water resources in the short term			X		

Second workshop, 5 March, Upington

	Strongly Agree	Agree	Disagree	Strongly Disagree	Comment
<b>Strengths</b>					
<b>Economic and social objectives</b>					
Economic empowerment	X				
Maximise job creation		X			
Maximise capital growth		X			
Increase subsistence irrigation and resource poor farmers		X			
Social upliftment	X				
Beneficial use of water resources	X				
<b>Promote the following sectors to achieve the above</b>					
Industry	X				
Mining		X			
Grapes	X	(X)			

Grain production	X				
Eco tourism	X				
Fruit and nuts	X				
Stock and game farming	X				
<b>Ecological Water Requirement of the water resource</b>					
Maintain overall present status	X				
Improve present status		X	(X)		
Maintain water quality present status	(X)		X		
Improve water quality of main stem	X				
Allow deterioration of present status				X	
Allow deterioration of selected water resources in the short term			X		

Third workshop, 6 March, Kakamas

Strengths	Strongly Agree	Agree	Disagree	Strongly Disagree	Comment
<b>Economic and social objectives</b>					
Economic empowerment	X				
Maximise job creation		X			
Maximise capital growth		X			
Increase subsistence irrigation and resource poor farmers		X			
Social upliftment	X				
Beneficial use of water resources	X				
<b>Promote the following sectors to achieve the above</b>					
Wine Industry	X				
Mining		X			
Grapes	X				
Eco tourism	X				
Fruit and nuts	(X)	X			
Stock and game farming	(X)	X			
<b>Ecological Water Requirement of the water resource</b>					
Maintain overall present status	(X)		X		
Improve present status	X	(X)			
Maintain water quality present status			X		
Improve water quality of main stem	X				
Allow deterioration of present status				X	
Allow deterioration of selected water resources in the short term			(X)	X	

Fourth workshop, 3 June, Springbok

Strengths	Strongly Agree	Agree	Disagree	Strongly Disagree	Comment
<b>Economic and social objectives</b>					
Economic empowerment			X		Gov focusing on social upliftment
Maximise job creation		X			
Maximise capital growth		X			
Increase subsistence irrigation and resource poor farmers	X		(x)		Disagree for area between Vioolsdrift & Goodhouse
Social upliftment	X				
Beneficial use of water resources	X				
<b>Promote the following sectors to achieve the above</b>					
Mining		X			
Agriculture (tomatoes, pumpkins, Lucerne, dates, Hoodia, essential oils)		x			
Eco tourism	X				
Stock and game farming		X			
<b>Ecological Water Requirement of the water resource</b>					
Maintain overall present status			X		(want to improve)
Improve present status	X				
Maintain water quality present status			X		
Improve water quality of main stem	X				
Allow deterioration of present status				X	
Allow deterioration of selected water resources in the short term				X	



**APPENDIX E: Rating table for known and perceived current and future strengths of the system**

First workshop, 4 March, Douglas

Attributes	Strength			Weakness
	1	2	3	
Existing information			x	
Ecological		x		
Social values				x
Legal frameworks	x			
Regulation	x			
Enforcement				x
Conservation				x
Economic activity		x		
Water Quality		x		

Second workshop, 5 March, Upington

Attributes	Strength			Weakness
	1	2	3	
Existing information			x	
Ecological		x		
Social values				x
Legal frameworks	x			
Enforcement				x
Conservation				x
Economic activity		x		
Water Quality		(x)	x	

Third workshop, 6 March, Kakamas

Attributes	Strength			Weakness
	1	2	3	
Existing information			x	
Ecological		x		
Social values				x
Legal frameworks	x			
Enforcement				x
Conservation		x		(x)
Economic activity		x		
Water Quality			x	

Fourth workshop, 3 June, Springbok

Attributes	Strength			Weakness
	1	2	3	
Existing information		x		
Ecological	x			
Social values		x		
Legal frameworks		x	(x, DME Legislation, Namibian Leg)	
Enforcement				x
Conservation	x			
Ecotourism	x			
Economic activity			x	
Water Quality			x	