ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT PLAN FOR THE ORANGE RIVER MINES LIFE OF MINE EXTENSION PROJECT

RIVER ECOLOGY STUDY

Report by Dr J S de Wet

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Terminology and Abbreviations

/Ai/Ais-Richtersveld Transfrontier Park	(ARTP)
/Ai/Ais-Richtersveld Transfrontier Park Joint Management Board	(ARTP. JMB)
Electrical Conductivity in mille Siemens per meter)	(EC (mSm^{-1})
Integrated Water Resources Management	(IWRM)
Permanent Water Commission on the lower Orange River	(PWC)
Southern African Development Community	(SADC)
Sperrgebiet National Park	(SNP)
The Orange Senqu River Commission	(ORASECOM)
Total Dissolved Salts	(mg/l)
Transfrontier Conservation Park	(TFCP)
Water Demand Management	(WDM
Water Supply and Sanitation Policy	(WSASP)

EXECUTIVE SUMMARY

Background

The Orange-Senqu River is a river of international importance and special care should be taken to treat it as such. Namibia, as a SADC member, should ensure that its people adhere to the various treaties and protocols it is signatory to. Namibia is a watercourse state (riparian state) to the Orange-Senqu River, and has been abstracting water from it long before any construction of dams in South Africa took place. Certain institutional arrangements, i.e. SADC, ORASECOM and PWC were put in place and the various Commissioners and Government officials should ensure that Namibia's rights are protected. Namibia has a right to water from the river; therefore the ORM LOM project should have ample water of good quality for its operation.

Scope of Work

A desk study has been undertaken of all previous projects in the ORM LOM project area. Recommendations are made for future water quality monitoring.

Water Requirements

Water requirements for the proposed mining activities are minimal and will not reduce the flow of the river. The ORM LOM project will therefore not have any influence on the Orange River mouth.

However, the cumulative effect of all current (19 million people in the basin) and future users (the RSA irrigates 155 000ha) along the 2 300km stretch may reduce the water flow in the lower Orange River. Namibia has a right to good quality and a certain quantity of water from the Orange-Senqu River. The role of established and international institutional arrangements, as previously mentioned, is vital for protecting Namibia's rights.

Water Quality

The general water quality of the lower Orange River is acceptable for agricultural, domestic, recreational and industrial use. There are periods when water quality deteriorates to such an extent that the Upington Municipal Water Works finds it difficult to maintain their drinking water quality standards. The main problem is irrigation return flow from the Vaal River irrigation scheme that results in blooms of blue-green algae, *Microcystis* and *Anabaena*. In 2000 the toxic algae *Cylindrospermopsin* was recorded in the Orange River for the first time. For the ORM LOM project area it is proposed that treated drinking water should be supplied.

Water Quality Monitoring

ORASECOM, with donor support, is in the process of setting up water quality monitoring sites along the Orange River. NamWater is doing quarterly water quality analysis on their raw water at Rosh Pinah. For the ORM LOM project area, water quality monitoring could be done by doing Electrical Conductivity (EC). This can be done monthly at the Daberas pump station. It is recommended that a spot with easy access is chosen.

Riparian Vegetation

The ORM LOM project activities will be more than 245 m from the current river bank, therefore no harm to the riparian vegetation is envisaged.

1. Introduction

1.1 Background

Namdeb is considering adding the Sendelingsdrif deposit to the current mine plan to extend the life of mine along the Orange River, as a means of meeting its objective of maximum sustainability when the ML42 mining licence expires in 2020. A detailed Rehabilitation Plan for land operations received governmental approval in 2008. This plan identified nature based tourism, or mining-based tourism, for Sendelingsdrif and Daberas, as a future end-land use. It is intended that rehabilitation will be integrated with the mine plan to ensure that the area does not compromise any future nature-based tourism. Namdeb's mining operations are well managed within the ambit of an ISO 14001 certified Environmental Management System (CSIR Enviro Dynamics Namdeb Description of Namdeb Tender no E097-ND-2009 Environmental Impact Assessment and Environmental management Plan for Orange River Mines Life of Mine Extension Project. 2009 Project Description).

The Sendelingsdrif ore deposit consists of ancient Orange River gravels, and the intention is that these are to be retrieved from the surface of bedrock at selected sites, and for the treatable material to be transported to Daberas for further processing and recovery. Mining will be undertaken with hydraulic excavators and dump trucks. Product will be transported from Sendelingsdrif to Daberas, and waste material will be backfilled into the mined out areas. Run of Mine material will be loaded and hauled to the front end of a scalping and screening dry mining system on site at Sendelingsdrif.

For the product material treated at Daberas mine, water requirements for the treatment facility will be supplied from the Orange River at Daberas via pump and pipeline. Undersize discharge will be deposited into a fine tailings residue deposit dam at Daberas if input sliming is not feasible. Treatment facility rejects are to be discarded on a dump site in close proximity to it. Mining will be undertaken with hydraulic excavators and dump trucks. Product will be transported from Sendelingsdrif to Daberas, and waste material will be backfilled into the mined out areas. Run of Mine material will be loaded and hauled of to the front end of a scalping and screening dry mining system on site at Sendelingsdrif (CSIR Enviro Dynamics Description of Namdeb Tender no E097-ND-2009 Environmental Impact Assessment and Environmental Management Plan for Orange River Mines Life of Mine Extension Project; Project Description).

The Orange River Mining License (42) is in the proclaimed Sperrgebiet National Park (SNP) and borders towards the east on to the /Ai/Ais Hot Springs Game Park. This park and the Richtersveld Park in South Africa form the /Ai/Ais-Richtersveld Transfrontier Park (ARTP).

What happens upstream in Namibia, South Africa, Botswana and Lesotho is therefore very important for the future of the project area. The two main concerns from the River Ecology side are what the future situation will be regarding water availability and water quality for the industry, and which institutional arrangements are in place in Namibia to ensure ample water supply of good quality from the upstream countries in the future.

Another possible concern regarding the Orange River water is the influence of the Orange River Mines Life of Mine Extension Project on the downstream water quality and on the Orange River Mouth, which is a Ramsar site.

1.2 Scope of Work

A desk study was undertaken of all previous projects in the Project area that deal with the baseline of the Orange River ecology and water quality. These results were summarised and made applicable to the current project to produce appropriate impact statements, accompanied by mitigating measures to avoid potential deterioration of the Orange River ecology and water quality.

1.3 Assumptions and Limitations

The accuracy and availability of data and reports are a limitation. Recommendations will be made for future monitoring required.

1.4 Locality

The Sendelingsdrif project area is approximately 12 km east of Daberas; 20 km south west of Rosh Pinah town and Oranjemund is approximately 90 km to the west. The Orange River Mining License (ML42) is in the proclaimed Sperrgebiet National Park (SNP) and borders towards the east on to the /Ai/Ais Hot Springs Game Park. This park and the Richtersveld Park in South Africa form the /Ai/Ais-Richtersveld Transfrontier Park (ARTP). The Dreigat port of entry is in Namibia and the Ochta port of entry (border post) is in South Africa just upstream from the Sendelingsdrif project area. Both Namibia and South Africa operate the pontoon to take tourists across the Orange River at Sendelingsdrif. The Orange River forms the southern border of the project area.

1.5 Methodology

The following methodology was used during this study.

- **Literature search**: Identify and obtain literature on the project area and Orange River, in particular dealing with its ecological status and water quality, sources of pollution, etc.; Obtain water quality data from Namdeb and NamWater; Conduct interviews with key informants.

- **Desktop study:** Conduct literature search; Obtain report and data from Namdeb staff; Write up river ecology baseline; write up legal review.

- **Prepare river ecology assessment:** Compile a report summarising the ecological baseline of the Orange River, providing a broad overview and then focusing on the stretch of the river in the project area; Summarise the expected river ecological impacts that relate to the ORM LOM Extension Project using the assessment methodology provided by the CSIR.

- **Specialist team meetings:** Specialist findings are integrated into the EIA report.

- **Cognisance of the following was taken:**Namdeb's strategic Rehabilitation Plan for the land based operations.; Existing information i.e. EMPR for ML42, Daberas EIAs, Sendelingsdrif EIA.; Hydrogeological information for the area.; De Beers Group Requirements; The use of Namibian specialists (e.g. socio-economic and restoration ecologist) for the project is recommended.

2. INSTITUTIONAL ARRANGEMENTS AND LEGAL REVIEW

2.1 The Constitution of the Republic of Namibia (1990)

Chapter 11, Principles of State Policy, Article 95, **Promotion of the Welfare of the People**, states that

> The State shall actively promote and maintain the welfare of the people by adopting inter alia, policies aimed at the following: (l) maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future; in particular, the Government shall provide measures against the dumping or recycling of foreign nuclear and toxic waste on Namibian territory.

Article 100, **Sovereign Ownership of Natural Resources**, states that

> Land, water and natural resources blow and above the surface of the land and in the continental shelf and within the territorial waters and the exclusive economic zone of Namibia shall belong to the state if they are not otherwise lawfully owned.

Article 101:

> The principles of State Policy contained in [Chapter 11] shall not have and by themselves be legally enforceable by any Court, but shall nevertheless guide the Government in making and applying laws to give effect to the fundamental objectives of the said principles. The Courts are entitled to have regard to the said principles in interpreting any laws based on them.

2.2 SADC Regional Water Policy and SADC Regional Water Strategy

The main water related policy documents at the Southern African Development Community (SADC) level are the **SADC Regional Water Policy and SADC Regional Water Strategy**. Both subscribe to Integrated Water Resource Management (IWRM) principles; (IWRM means a process that promotes the coordinated development and management of water, land and related resources, in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems).

The aim of the SADC Regional Water Policy is to provide a framework for sustainable, integrated and coordinated development, utilisation, protection and control of national and transboundary water resources in the SADC region for the promotion of socio-economic development and regional integration and improvement of the quality of life of all the people in the region. These documents provide important guidelines for the ongoing harmonisation of national water policies of the SADC member states.

2.3 The Revised SADC Protocol on Shared Watercourses 2000

The Southern African Development Community (SADC) is a regional organisation and has adopted a number of protocols to promote cooperation between the 14 member states of the region. The **Revised SADC Protocol on Shared Watercourses** was signed by the SADC leaders on 7 August 2000. The Revised SADC Protocol came into force on 22 September 2003 following ratification by two-thirds of the signatory states. This Revised Protocol is therefore the source of applicable treaty law for the four states that border the Orange River (they have all ratified this instrument).

The Orange River is an international watercourse in terms of the definition in this protocol. The Revised Protocol in particular wants to promote the establishment of shared watercourse agreements and institutions, to advance sustainable, equitable and reasonable utilization, sound environmental management, harmonization and monitoring of legislation of the states involved and the promotion of research, technology development, information exchange and capacity building.

The Revised Protocol contains the fundamental principles of international water law, Article 3 (7), equitable and reasonable utilisation, Article 3 (10), obligation to prevent significant harm and Article 4(1) (b), notification of planned measures.

2.4 Shared Watercourse Agreements

The Orange Senqu River Commission (ORASECOM Agreement). In November 2000 the Orange Senqu River riparian states (Lesotho, Botswana, South Africa and Namibia) have concluded the Agreement on the Establishment of the Orange-Senqu River Commission.

The Orasecom Agreement includes specific obligations such as (Article 7.12) to “protect and preserve the River System”, (Article 7.13) to “prevent, reduce and control pollution of the River System that may cause significant harm to one or more Parties, including harm to the environment, or to human health or safety, or to the ecosystem of the River System”, (Article7.14) to “protect and preserve the estuary” and (Article 7.15) to “prevent the introduction of species, alien or new, that have a detrimental effect to the ecosystem of the watercourse”.

With this approach the Orasecom Agreement takes IWRM principles in consideration and therefore allows for holistic management of resources in the basin.

The Permanent Water Commission (PWC Agreement). In September 1992 a bilateral agreement was signed between the Government of the Republic of South Africa and the Government of the Republic of Namibia on the Establishment of a Permanent Water Commission on the lower Orange River.

Some of the first tasks were the Pre-Feasibility Study into Measures to Improve the Management of the Lower Orange River and to provide for future developments along the border between Namibia and South Africa. From this study a re-regulating dam in the lower Orange River at Noordoewer was proposed. The issue of proportional benefit from this project has not been cleared, therefore it is not moving forward.

Other important issues still to be dealt with by the PWC is a Water Use Agreement on the lower Orange River. Long before any dams were built in South Africa, Namibia was already using water from the lower Orange River. During the South African governance over South West Africa there was also no need for developments on the Namibian side along the river. Shortly after independence Namibia started to develop along the Orange River and therefore needed more water from the regulating dams in South Africa. South Africa wants to limit Namibia regarding the use of the water and also wants Namibia to pay for the operation and maintenance cost of the Vanderkloof Dam. Namibia being a riparian state however is of the opinion that it has a right to a certain amount of water.

Another issue to be taken up by the PWC is the border between Namibia and South Africa. On 1 July 1890, at the Berlin Conference a treaty between Germany and the United Kingdom was signed that defined the border in Article III;

> "To the south by a line commencing at the mouth of the Orange River, and ascending the north bank of that river to the point of its intersection by the 20th degree east longitude".

This agreement delimited the boundary; it did not demarcate it (Gerhard Erasmus, 1989).

This is ambiguous and open for interpretation because a line commencing and ascending the northern bank is very dependent on the river flow. The Germans took the view that the waterline marked the bank and so they advance and retreat their boundary as the water fell and rose. Currently the border is still considered to be the same and therefore the river needs to be properly surveyed, the border agreed on and demarcated by regional, local, interested and affected parties and GRN Official.

2.5 Water Supply and Sanitation Policy (2008)

The Water Supply and Sanitation Policy (WSASP) of July 2008 replaces the WASP of 1993. Its principles are in line with Integrated Water Resources Management (IWRM), including a strong focus on Water Demand Management (WDM). The overall principles for water supply priorities are first for domestic use and then provision for economic activities. Section 2.5.1 states that "Priorities for the allocation of water for economic activities will, in each individual case, have to be determined by their respective value including economic multiplier effects by local value addition and social benefits in relation to the overall development objectives and plans of the country".

The basic principle for cost recovery is that water is an economic good and that there is a social responsibility to make water available to the poor. In determining tariff policies in consultation with the service providers and the public, the following general principle should be applied, in adherence to Section 2.5.3 (2); "any industrial, commercial or mining activity should pay the full cost recovery tariff taking the scarcity of water and the cost of future water supply augmentation into account". Mining water supply, Section2.6.6; "Mining companies should develop their own water supply schemes or should provide the capital for the construction and development of water supply and sanitation infrastructure to mines, provided that the government or the service provider only contributes to the expenditure if other consumers benefit from such infrastructure".

2.6 The National Water Policy 2002

In 2002 the Namibian cabinet approved the National Water Policy White Paper that forms the basis for the new Water Resources Management Bill that is currently being finalised. The policy subtitled 'Policy framework for equitable, efficient and sustainable water resources management and water services," stresses sectoral co-ordination, integrated planning and management and resource management aimed at coping with ecological and associated environmental risks. It clearly states that water is an essential resource to life and that an adequate supply of safe drinking water is a basic human need. The policy makes it clear that water concerns extend beyond human needs for health and survival, that water is essential to maintain natural ecosystems and that in a country as dry as Namibia, all social and economic activity depends on healthy aquatic ecosystems.

2.7 The Water Act No 54 of 1956

This Act gives the Minister the power to investigate water resources, plan water supply infrastructure, develop water schemes, control pollution, protect, allocate and conserve water resources, inspect water works, levy water tariffs and advise on all matters related to the water environment in general. It basically makes the Department of Water Affairs responsible for the use, allocation, control, and conservation of Namibia's surface and groundwater resources. It made provision for the protection of river catchments, drilling of boreholes and making of wells, it controls effluent discharge into rivers and outlines regulations that govern the optimal use of water resources. It clearly defines the interests of the state in protecting water resources.

According to Water Act 54 of 1956 private entities are entitled to water-user rights exercised through a permit issued by the State. Permit holders are required to submit monthly returns to the Department of Water Affairs stipulating the quantity of water used.

The 1956 Water Act determines the quality of effluent to be disposed in public wastewater systems and a permit is needed for the disposal of effluents in any ephemeral or perennial rivers.

Until the new Water Act is finally commenced the legal position is still governed by the Water Act 54 of 1956. This instrument is outdated and will not provide the required legal and institutional basis that will allow Namibia to face the present challenges.

2.8 Water Resources Management Act, Act x of 2010 (Draft New Water Act).

The aim of the act is to provide for the management, development, protection, development, use and conservation of water resources; to provide for the regulation and monitoring of water services, to repeal and amend certain laws; and to provide for incidental matters (This act is also based on Integrated Water Resource Management Principles).

For the ORM LOM project it is important to take note of section 98 (b).

> 98. A person must not cause or allow any groundwater to run to waste from a borehole, well, shaft, mine or other excavation, except

(a) for the purpose of testing the capacity or quality of the supply, or to clean, sterilize, examine or repair a borehole; or
(b) when the water interferes or threatens to interfere with mining operations or performance of any other underground work; or
(c) when groundwater poses a threat to life or property.

Details of the Act are appended to this document as **Annexure 6.**

2.9 The Namibia Water Corporation Act, No 12 of 1997

This Act established the water utility company, NamWater, and important for this review, it places an obligation on NamWater to conduct its functions in an environmentally sustainable and sound manner, and as it specifies a "duty to conserve and protect the environment". It should conduct all activities with due regard for the protection and conservation of ecological resources and habitats.

Nationally, water is allocated through a permit regulatory system and NamWater is entitled to apply for a permit to impound surface runoff in ephemeral rivers, and to abstract water from perennial rivers as well as groundwater.

2.10 Minerals Prospecting and Mining Act No 33 of 1992

The act has significance for water supply in Namibia in general as it has several references to adequate protection of the environment including water. The details of this Act are appended to this document as **Annexure 7**.

2.11 Environmental Assessment Policy of Namibia (1995) and Environmental Assessment Act, 2007 (Act No. 7 of 2007)

The Environmental Assessment Policy of Namibia was approved by Cabinet in 1994 and it also lists policies, programmes and projects requiring an environmental assessment. Mining and water is included as projects that need an EA.

The Environmental Assessment Act, 2007 (Act no. 7 of 2007) is to promote the sustainable management of the environment and the use of natural resources by establishing principles for decision making on matters affecting the environment; to establish the Sustainable Development Advisory Council; to provide for the appointment of the Environmental Commissioner and environmental officers; to provide for a process of assessment and control of activities which may have significant effects on the environment; and to provide for incidental matters.

Section 27. (1) The Minister, after following the consultative process referred to in Section 44, may list, by notice in the Gazette, activities which may not be undertaken without an environmental clearance certificate. Section 27. (2) Activities listed; water use and disposal, resource removal, industrial processes.

2.12 Inland Fisheries Resources Act, 2003 (Act no. 1 of 2003) Commencement of the Act on 6 June 2003. Inland Fisheries Resources Regulations: Inland Fisheries Resources Act, 2003 (Act no. 1 of 2003).

The issues discussed here is not of much importance for the ORM LOM project but should be noted:

- Method of fishing. Section 15. A person shall not use-(c) any net in the Orange River.
- Application for recreational licence. Section 24. The Minister shall for the purpose of an application for recreational licence provide forms which substantially corresponds with Annexure C.
- Fees for recreational licences. Section 28. (a) Namibians N$ 20.00 monthly and (b) Non-Namibians N$ 240.00 monthly.
- Fishing gear restriction. Section 29. A recreational licence holder is not allowed to use more than 2 rods and 2 lines with 2 hooks attached.
- Bag limit. Section 30. (1) A recreational licence holder is not allowed to fish more than 10 fish in the aggregate of any species in one day.
- Size limit. Section 31. Any angler shall not possess;

2.13 Development Forestry Policy for Namibia (2001) and The Forest Act No 12 of 2001.

Biodiversity conservation is central to this policy that aims to “reconcile rural development with biodiversity conservation by empowering farmers and local communities to manage forest resources on a sustainable basis”. The Forest Act No 12 of 2001, defines ‘forest produce” broadly as anything which grows or is naturally found in a forest including, any living organism…..

This act is centred on sustainable management of forests, and “the purpose for which forest resources are managed and developed, including the planting of trees where necessary, in Namibia, is to conserve soil and water resources, maintain biological diversity.”(section 2. 10). The act provides for the protection of the environment and of importance to this review is the clause for the protection of riparian vegetation that in effect also legislates against soil erosion and resultant siltation.

Forestry Act no 72 of 1968 states that it is an offence “to harm, injure or remove any living tree, bush or shrub within 100m of any river, stream or watercourse”.

3 BACKGROUND TO RIVER ECOLOGY

3.1 Baseline

The Orange River (called the Senqu River in Lesotho, and Gariep in South Africa) originates in the Lesotho Highlands some 3 300 m above sea level, where the average annual precipitation can exceed 1 800 mm, with a corresponding average annual potential evaporation of 1 100 mm. The river stretches 2 300 km from the source to its mouth (Oranjemund/Alexander Bay) on the Namibia South Africa border, where the average annual precipitation drops to below 50 mm, while the average annual potential evaporation rises to over 3,000 mm.

The last 600 km of the Orange River forms the border between South Africa and Namibia. Rainfall is highly variable in the western areas which also have the highest evaporation rates. As a result of these harsh arid conditions the western parts of the lower Orange Basin contains three desert systems; the Succulent Karoo, the Nama Karoo and the Southern Kalahari. Water in the lower Orange River is therefore very important and can almost be seen as a linear oasis for the area.

The Orange River basin is the largest river basin in southern Africa, south of the Zambezi, with a total catchment area in the order of 1 000 000 km², of which almost 600 000 km² lies within the Republic of South Africa with the remainder in Lesotho, Botswana and Namibia. The effective catchment area is difficult to determine, since it includes many pan areas and also several large ephemeral tributaries, such as the Molopo and Nossob in Botswana, that rarely contribute to flows in the main river.

The total population of the Orange River Basin is estimated at approximately 19 million (2005 figures). The development in the basin ranges from indigenous traditional lifestyle to modern development. Human migration and settlement patterns have left its mark on the basin ecology. The largest primary contributions to the economy are made by mining and irrigated agriculture. In the west mining activities take place along the Orange River, along the coast and centred around Alexander Bay and Oranjemund. Extensive irrigation occurs at locations along the Orange River. Agriculture employs more than 25% of the basin population, many of whom reside in rural areas and the rest are employed in the industrial sector.

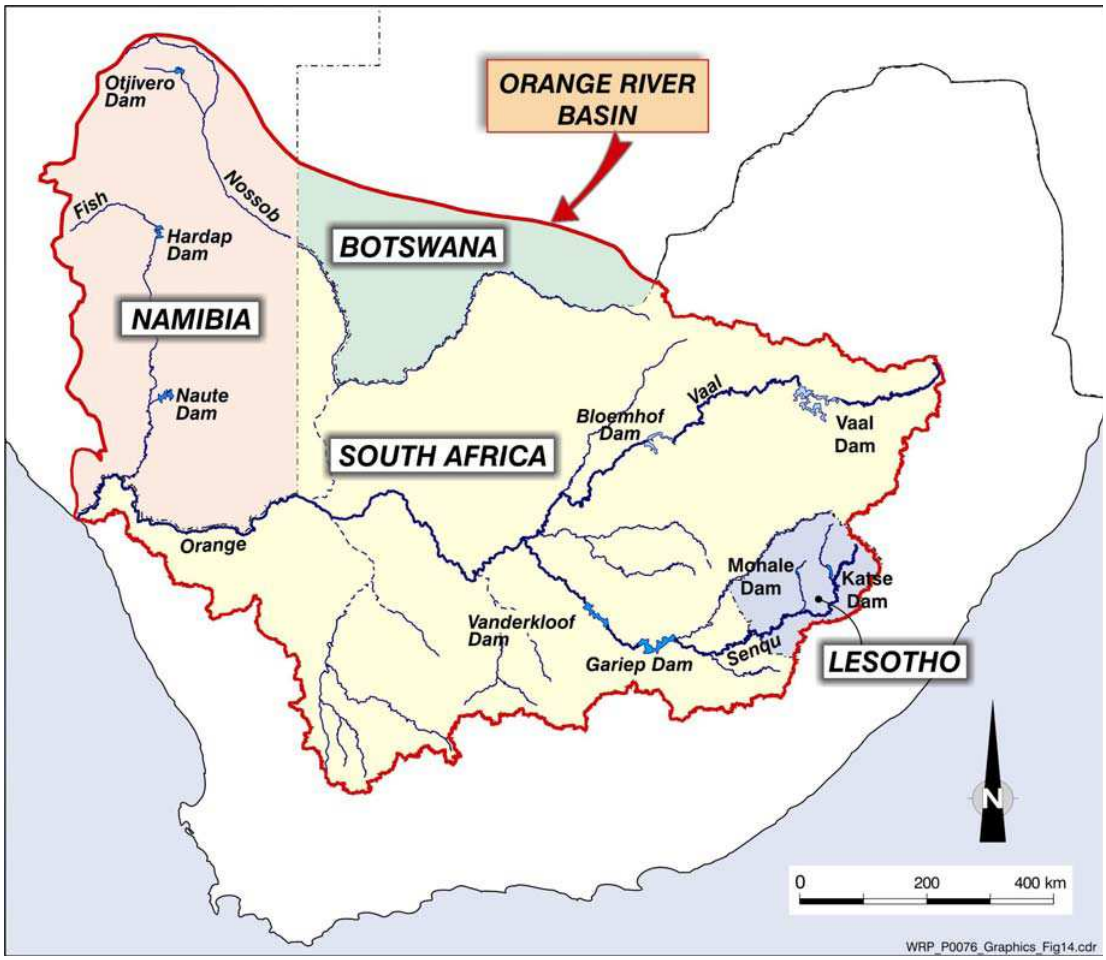

Figure 2 Orange River Basin from the Orange IWRMP 2007 GTZ

It has been estimated that the natural runoff of the Orange Senqu River basin is in the order of 11 500 million m³/annum of which approximately 4 000 million m³/annum originates in the Lesotho Highlands. About 6 700 million m3/annum originates from the areas contributing to the Vaal, Caledon, Kraai and Middle Orange Rivers and approximately 900 million m³/annum from the contributing catchment downstream of the Orange/Vaal confluence, which includes part of Namibia.

The Orange Senqu River has become highly regulated by virtue of more than 20 major dams and numerous weirs within its catchment. Abstraction and regulation of the Orange River has resulted in changed flow patterns, from a pronounced seasonal flow (a ratio of 82:18 summer to winter flow) to a nearly even flow distribution (a ratio of 59:41 summer to winter flow) throughout the year. The two major dams, the Gariep Dam and the Vanderkloof Dam also release water in winter mainly, for hydro-electricity. This means that the Orange River Mouth now remains open almost permanently and the status of the mouth changes from an estuary to a river mouth.

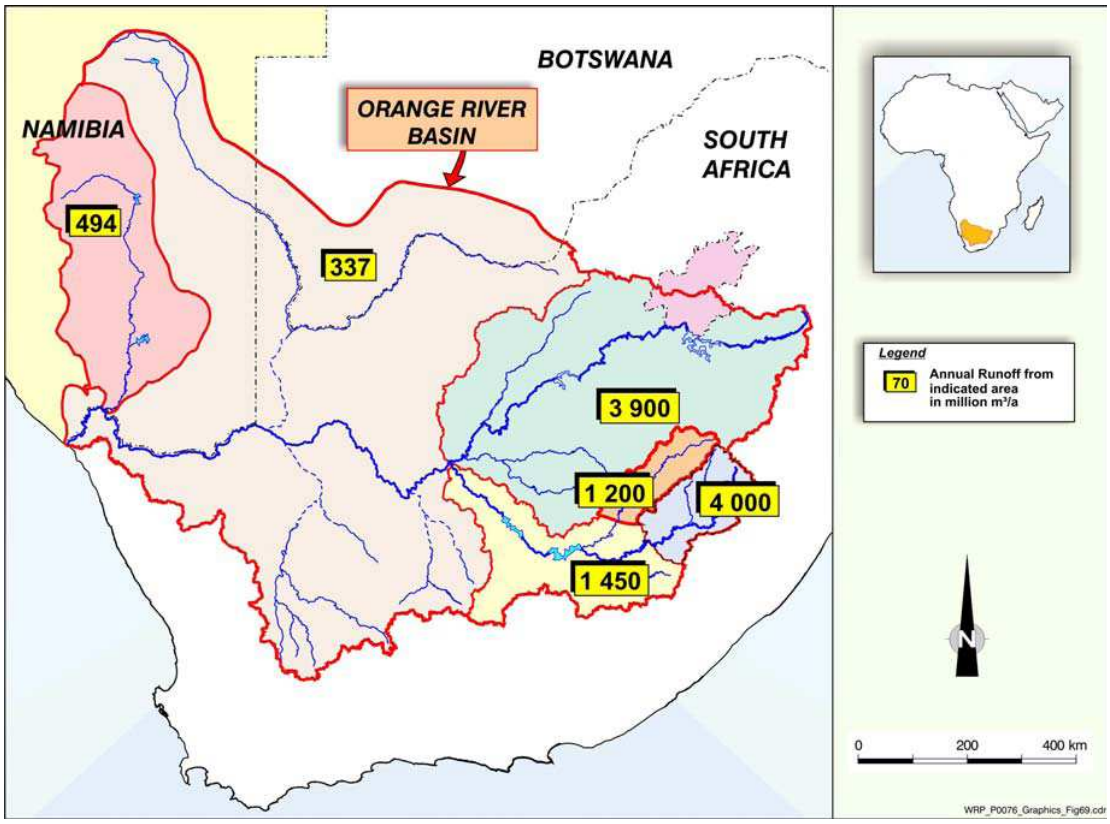

Figure 3 ***Natural Mean Annual Runoff (MAR) for the Orange-Senqu River is 11 500 Mm³/annum at the estuary. Of this the following rivers contribute per annum: Vaal River 4 000 Mm³/annum, Senqu River 4 000 Mm³/annum, Orange River 2 500 Mm³/annum, and the Fish River in Namibia 480 Mm³/an num (PWC on LORMS 2005).***

The figures indicated in Figure 2 refer to the natural runoff which would have occurred, had there been no developments in the catchment. The actual runoff reaching the river mouth (estimated to be in the order of 5 500 Mm³/annum) is considerably less than the natural value (over 11 500 Mm³/annum). The difference is due mainly to the extensive water utilisation in the Vaal River basin, most of which is for domestic and industrial purposes.

Large volumes of water are also used to support the extensive irrigation (estimated to be in the order of 1 800 Mm³/annum) and some mining demands (approximately 40 Mm³/ annum) occurring along the Orange River downstream of the Orange/Vaal confluence, as well as some irrigation in the Lower Vaal catchment and Eastern Cape area supplied through the Orange/Fish Canal. In addition to the water demands mentioned above, evaporation losses from the Orange River and the associated riparian vegetation account for between 500 Mm³/a and 1 000 Mm³/a depending upon the flow of water (and consequently the surface area) in the river (PWC on LORMS 2005).

The water demands along the lower Orange River are currently supplied with water from Vanderkloof Dam some 1 380 km upstream. Water must be released well in advance, since the water takes 2 to 6 weeks to reach the mouth (some 1 380 km away). The problem of supplying water from the Vanderkloof Dam (1380 km upstream from the mouth) to the lower Orange River

is demonstrated in that a 100m³/s release from the dam takes 22 days to reach the mouth while a 30m³/s release takes 40 days to reach the mouth.

The water flowing into the Orange River from the Fish River in Namibia (approximately 140 km from the river mouth) only occurs when water is released from Naute Dam or Hardap Dam during flood situations. Any water flowing into the Orange River from the Namibian Fish River will therefore add to the water already released from Vanderkloof Dam since it is currently not possible to stop or store the water once it has been released.

3.2 Water availability

The estimated total available water resources in Namibia are 660 Mm³/annum. Of this the estimated long term safe yield of groundwater is 300 Mm³/annum. Ephemeral surface water when fully developed at 95% assurance of supply is 200 Mm³/annum. The presently installed abstraction of perennial surface water is 150 Mm³/annum and that of unconventional water is 10 Mm³/annum. In 2000 Namibia was using approximately 300 Mm³/annum (Christelis et.al. 2001). In the meantime unconventional water resources for instance the desalination at Wlotzkasbaken (30 Mm³/annum) for the uranium mines should be added.

Along the common border with South Africa irrigation constitutes 81 % of the total water consumption. Currently there is rapid growth in irrigation development on the Namibian side of the river because the Namibian Government is actively encouraging irrigation development. Irrigation takes place at Noordoewer (280 ha using 4.2 Mm³/a) and Aussenkehr (1000 ha using 15 Mm³/a). Other existing irrigation projects are Stolsenfeldt (300 ha using 4.5 Mm³/a), Hakiesdoorn (300 ha using 4.5 M m³/a) and Silverstroom (100 ha using 1.5 Mm³/a) (Liebenberg pers.com.).

Several new developments which have already been identified as possible future demand centres for water along the Lower Orange River are Tandjieskoppe (1000 ha using 30.0 Mm³/a), and Sendelingsdrif (400 ha using 9.5 Mm³/a). In Namibia there are also Rosh Pinah Town, and Mine and Scorpion lead and zinc mine supplied by NamWater (7.5 Mm³/a). The Namdeb mines at Daberas have a permit for about 3.0 Mm³/annum but use only 1.2Mm³/a. Therefore the current water consumption of Namibia is 35 Mm³/annum from a river with a natural MAR of 11 500 Mm³/annum. Future irrigation at Tandjieskoppe and Sendelingsdrif will need an additional 40 Mm³/annum (Liebenberg. 2010 Pers.com.).

It is also very important for the Department of Water Affairs and Forestry in Namibia to communicate the water use patterns of its users a year in advance to DWA South Africa to enable them to do the releases from Vanderkloof Dam.

Currently Namibian water consumption along the lower Orange River, mainly for irrigation is about 35 Mm³/annum. When the entire planned irrigation schemes come into operation, the long term requirements will be 200 Mm³/annum.

3.3 Water quality

The water quality in the Orange-Senqu Basin is highly variable due to a combination of natural and anthropogenic factors. The catchment includes the main urban and industrial areas of South Africa, the main gold mining areas, part of the coal fields and some of the country's power stations and significant areas of dry land and irrigation agriculture. Although the arid western part of the catchment is less developed, irrigation agriculture occurs extensively along the lower reaches of the river.

Deterioration of the quality of the water resources (both surface and groundwater) in the basin is mainly attributable to the following land-use impacts:

- Discharge from waste water treatment works in the numerous small towns and urbanised areas within the Basin, many of which are not in compliance with the waste water discharge standards and licence conditions;
- Mining pollution from the point sources e.g. direct discharge from mine dewatering and effluent disposal; and non-point diffuse pollution from the runoff and seepage from mining waste dumps;
- Runoff and seepage from developed and informal urban areas;
- Runoff from agricultural lands and irrigation return flow;
- Industrial pollution originating from direct discharge to the water course and storm water runoff and seepage from polluted industrial sites; and
- Overgrazing and poor management practices, especially on steep slopes and in marginal agricultural areas.

The key water quality issues, identified during the TDA/SAP workshops (UNDP, 2008), are: eutrophication, microbiological organisms and water-borne pathogens, salinity, heavy metals, persistent organic pollutants (POPs), and to a lesser extent, temperature changes.

For the ORM LOM project area, salinity, eutrophication and microbiological and wWater-borne pathogens are important.

Salinity (Electrical Conductivity in mille Siemens per meter) (EC (mSm^{-1})) or Total Dissolved Salts (mg/l)):

All water contains some naturally occurring ions as a consequence of the dissolution of minerals in rocks, soils and decomposing plant material (Du Preez et. al 2000). The saltiness of natural waters depends on the geological and climatic environments through which the rivers flow. With the Lesotho Highland water projects high quality water from the upper reaches are diverted to the Vaal River area. Currently salinity in the Orange River from Lesotho to the confluence with the Vaal River is normal (150 mg/l).

The salinity increases downstream of the confluence of the Vaal and Orange Rivers but the water quality still remains good. The lower Orange River flows through a low rainfall and high evaporation area and therefore salts will during floods accumulate naturally on the soils next to the river. Through the years this natural process created a situation where the soils on the riverbanks contain lots of salts due to years of evaporation. In the lower Orange River the major contribution to salt load is irrigation return flows due to over irrigation to wash out the salts. Salinity quality data for locations in the lower Orange River from Noordoewer to Oranjemund, for the period 1989 to 2004, were as follows:

Table 1 Salinity quality data (DWA RSA: 1989-2004)

Town	TDS mg/l	Average TDS mg/l
Noordoewer	230 to 330	300
Rosh Pinah	180 to 560	320
Daberas	290 to 400	330
Auchas	240 to 300	270
Oranjemund	330	330

The Pre-Feasibility Study into Measures to Improve the Management of the lower Orange River (2005) predicted that the TDS value will increase from 310 mg/l value of 2002 to 410 mg/l in 2030 at Noordoewer or the UNDP 2008 report predict a increase from the 326 mg/l value of 1995 to 514 mg/l in 2030 at Oranjemund. The data from NamWater at Rosh Pinah confirms the wide range of TDS values occurring through the year and between years (**Annexure 1**).

Lower Orange River water is suitable for human consumption, industry and agriculture. With the increase in irrigation downstream of Noordoewer and the poor irrigation soils the salinity can increase at a higher rate.

Eutrophication:

This occurs because of nutrient enrichment, principally from nitrogen and phosphorus, which stimulate extensive plant growth. The turbid waters experienced in the lower Orange River limit sunlight penetration, with enough nutrients and no light there will therefore be limited algal growth. In the lower Orange River due to salinity increase during low flows and with the tendency of the clay particles in the water to adhere to plant roots, the water becomes clearer. This increase in light penetration, together with an increase in nutrients, extensive algae growth with the resultant algae blooms will occur.

As one moves downstream of the Vaal River confluence, nutrient levels increase because of the Vaalharts irrigation scheme. There are periods when water quality deteriorates to such an extent that the Upington Municipal Water Works find it difficult to maintain their drinking water quality standards. The main problem is irrigation return flow from the Vaalharts irrigation scheme with resulting blue-green algae, *Microcystis* and *Anabaena* blooms. In 2000 the toxic algae *Cylindrospermopsin* was recorded in the Orange River for the first time. The cell toxin produced by *Cylindrospermopsis* is a non specific toxin that causes gastro-enteritis. Both *Microcystis* algae and *Cylindrospermopsis* algae may also at times produce allergic type symptoms as the only symptoms, the two most common being a skin rash and bronchospasm.

The occurrence of **microbiological organisms and water-borne pathogens** is closely linked to the problem of eutrophication. The micro-organisms which can potentially give rise to diarrhoea are, Entero-viruses, Salmonella bacteria, Shigella bacteria, Gardia and Cryptosporidium. This could influence tourism activity on and along the river with issues such as swimmer's itch. In the /Ai/Ais Richtersveld Transfrontier Park (ARTP) the dissolved oxygen concentration in the river is more than 70% saturation, the pH of 8.2 is acceptable and the E.coli count of less than 100 counts per 100 ml is acceptable for full contact recreational use (DWA South Africa standards).

The general water quality of the lower Orange River is acceptable for agricultural, domestic, recreational and industrial use (ARTP. JMB Draft LORMP.2008).

For the ORM LOM project area it will mean that, in the far future, the mines can use the river water for process water, but for drinking water will most probably have to use alluvial groundwater. If there is a need for water quality monitoring, I recommend doing EC (electrical conductivity).

3.4 River Landscape

The geology, geomorphology and slope of a river will directly influence the river landscapes. According to the ARTP JMB draft document of 2008, the characteristic of the lower Orange River landscape at Sendelingsdrif is perennial pool to perennial pool sandy, and the riparian vegetation is Nano (interspersed) to Xeric (sparse) (Details can be seen in **Annexure 2** (ARTP JMB LORMP draft 2008).

The riverine woodlands at Sendelingsdrif are dominated by *Tamarix usneoides* (tamarisk) forming a thicket near the river and reaching up to 4 m high. Here the woodlands are dense with cover values up to 75 %, but become gradually more open towards the plains. *Euclea pseudebenus* (False ebony), *Rhus lancea, Ziziphus mucronata* and *Acacia karoo* (Sweet thorn) are interspersed with the tamarisks and become more frequent at the fringe of woodlands. Following the banks of the Orange River the woodlands form a belt of varying width at their widest about 30 m. A zone with scattered trees of *Euclea pseudebenus* and the shrubs *Ectadium latifolium*, *Sisydinte spartea* and *Zygophyllum microcarpum* adjoins inland and forms a transition to the adjoining sandy terrace and drainage lines (EnviroScience June 1998 Namdeb Sendelingsdrif Preliminary E.I.A.).

The ORM LOM project activities will be more than 245m from the current river bank, therefore no harm to the riparian vegetation is envisaged (ORM LOM Draft Scoping Report- Project Description).

3.5 Geology and Hydrogeology

The lower Orange River landscapes were created by erosion and depositions under mainly arid conditions 15-18 million years ago. Sea level changes during that time created two distinct levels of gravel terraces which rise above the current flood line of the river. Metamorphic rocks of the Namakwa group form the underlying bedrock. The Pre-Proto-Orange River gravels occur in two forms in older high-level terraces, Pre-Proto 1 at Sendelingsdrif about 80 m above present river level, and the Pre-Proto 2 in steep-sided scours below the base of the Proto Orange River terrace deposits. The Oligocene Pre-Proto Orange River cut a relatively wide pre-proto strath in its basement and scours of variable depth into its strath before any deposition took place.

The scours are between a few tens of metres and 600 m long and a few tens of metres and 250 m wide. The maximum depth of the pre-proto scours is approximately 90 m which is the difference in elevation of the bases of the Pre-Proto 1 terrace deposits and the Pre-Proto 2 scour-fill deposits. The best diamond grades and above average stone sizes occur in compound gravels associated with oversized clasts in the plunge pools of the scours, in bedrock-attached push bars (clasts smaller than in the plunge pools), in the boulder-rich tail of the push bar and in

stratigraphically higher gravels where the oversized clasts or bedrock highs cause flow turbulence(R.McG.Miller, 2008).

From the Sendelingsdrif project area towards the north-west and west (sea) three hydrology features, dry rivers and two hydrogeological features with a very low and limited potential for groundwater can be distinguished (details can be seen in **Annexure 3**, Hydrogeological Map of Namibia, December 2001). The main rock type of hydrogeological units is metamorphic rocks, including quartzite and marble bands (Christelis et al, Hydrogeological Map of Namibia, December 2001).

The NamWater pipeline and the road from the Orange River towards Rosh Pinah town run along one of these hydrological features (valley) which, according to the Hydrogeological map of Namibia; "the hydrogeological and groundwater potential of rock bodies is very low and limited and the main rock type of hydrogeological units is non-porous sandstone, conglomerate, quartzite with the aquifer type aquitard". In a higher rainfall area it would be a saturated, but poorly permeable bed, formation, or group of formation that does not yield water freely to a well or spring. The information received from Namdeb also describes these features and indicates that two of the features are secondary aquifers (fractured aquifer) with low potential for groundwater.

In the Note for the Record from Namdeb, NTFR004 (Min Res. Internal Docs# 94524) and at the public consultation meeting held in Windhoek on Tuesday 1 June 2010, the occurrence of groundwater at SD4 scour was mentioned and also that groundwater is expected in both zones 6 and 7 (This information from Namdeb and the details can be seen in **Annexure 4**). Because the drainage from these hydrological and the hydrogeological features is towards the Orange River the water in the scour can be from a secondary aquifer.

If one looks at the shape of most of the mines along the lower Orange River, they are shaped like an ox bow. This is an indication that the deposits are located within the old river; therefore if there is water in those areas it most probably is river water or old river water. The water must be analysed and disposal thereof should be discussed with DWAF.

Alluvial bearing water, primary aquifers (porous aquifers) closer to the Orange River is most probably ground water fed by the river.

The soil group in the Sendelingsdrif project area (Geo Pollution Technologies, 2007) belongs to Regosols, with the dominant soil cover being Eutric Regosols. The geology of the area consists of alluvium, sand, gravel and calcrete. Most of these geological features are from the Quaternary Age. Groundwater is present in the area and originates from the Orange River. Although no permits are required for groundwater usage in the area, it remains the property of the Government of Namibia.

According to the Department of Water Affairs (DWA) database, no boreholes exist within a 5km radius from the site. However, a borehole situated about 2.5km southeast of the site was identified during a field visit (Geo Pollution Technologies, 2007). Currently potable water to the exploration plant is sourced from this hole.

Pumping test should be done on this borehole to determine its potential yield. If the water is sufficient and of good quality, this water can then be used for drinking water. Another alternative

is to drill a borehole closer to the river and if the water quality is acceptable to use that for drinking water.

3.6 Aquatic invertebrates

According to a PWC, 2005 report the aquatic and riparian ecosystems of the LOR evolved in response to the natural seasonal flow pattern, inclusive of the flood regime. This regime has however increasingly been modified, principally due to the construction of large dams. It is anticipated that the aquatic ecosystem has and will continue to respond to this change over time. Invertebrate populations appear to be rather homogenous through the entire length of the river. This is likely to be due to the natural unpredictable, erratic nature of the flow regime. Freshwater shrimp (*Caradina nilotica*) and freshwater mussel (*Corbicula africana*) are found in the river

3.7 Freshwater fish

The lower Orange River downstream of the Augrabies Falls (natural barrier) is very important with regard to fish species, with 12 of the 15 indigenous freshwater fish of the Orange River found in the part of the river. These include one unique Red Data listed endemic and other unique and vulnerable indigenous species. The Carp (*Cyprinus carpio*) is an alien species and Mozambique tilapia (*Oreochromus mossambicus*) is an introduced indigenous species. The red data species are Namaqua Barb (*Barbus hospes*), Largemouth Yellow fish (*Barbus kimberleyensis*) and Rock Catfish (*Austroglanis sclateri*).

Under the guise of subsistence or recreational fishing, illegal commercial fishing activities are currently taking place at Aussenkehr, using longlines and gillnetting. Due to the mine development at Sendelingsdrif project area, the increased recreational activity from the inhabitants of Rosh Pinah town and increased tourism because of the entry port at Sendelingsdrif, the possibility exists that the same can happen here. A possible security problem can occur with fisherman meandering into the ORM LOM project area.

3.8 Orange River Mouth

The Orange River Mouth (ORM) is of major conservation significance, particularly because of its wetland habitats and the biota it supports. The mouth itself and approximately 10 kilometres of the river, was listed as a Wetland of International Importance (Ramsar Convention) in 1991. It became the first Transfrontier Ramsar site in southern Africa when Namibia ratified the Convention in 1995.

In terms of the Ramsar Convention the ORM fulfilled the following criteria:

- It is an example of a specific type of wetland, rare or unusual in the appropriate bio geographical region;
- It supports an appreciable number of rare, vulnerable or endangered species or subspecies of plant and animal, or an appreciable number of any one or more of these species;
- It regularly supports substantial numbers of individuals from particular groups of waterfowl, indicative of wetland values, productivity or diversity; and

- It regularly supports 1% or more of the individuals in a population of one species or subspecies of waterfowl.

Although it is a Ramsar site, the ORM did not have any formal protected status and was managed on an *ad hoc* basis by the two mining companies (Namdeb and Alexkor) operating in the area. Due to anthropogenic impacts, the South African portion of the ORM Ramsar site was subsequently placed on the Montreux Record on 26 September 1995. Following the placement of the ORM on the Montreux Record, proposals for the establishment of a statutory protected conservation area at the ORM were made during 1995.

Various discussions were held between the conservation authorities of South Africa and Namibia, the communities of Alexander Bay and Oranjemund, the Alexkor and Namdeb mine management, the Richtersveld Municipality and the Richtersveld community. This culminated in the proclamation of the ORMNR as a protected area in South Africa in 2009.

3.9 New Developments in Orange and Fish Rivers

Several proposed irrigation projects for communal and commercial irrigation are envisaged, including Tandjieskoppe (1 000 ha@ 30.0 Mm^3/a) and Sendelingsdrif (400 ha @ 9.5 Mm^3/a) along the northern riverbank.

The proposed Neckartal Dam will be constructed in the Fish River near Snyfontein in the Berseba Constituency of the Karas Region. The dam wall will be located on the farm Neckartal 1 and the dam basin is located in Namaland on communal land of the Berseba Traditional Authority. Although the area is sparsely populated, a limited number of households are located within the possible area of inundation and resettlement of these individuals will be required.

The proposed dam has a catchment area of 45 365 km^2 with an average annual runoff of 397 Mm^3/a. The dam wall will be a roller compacted concrete structure with an anticipated wall height of 66 m and wall crest length of 480 m. The storage volume is expected to be approximately 846 million m^3 and the full supply area may cover 39 km^2. Depending on finance, the dam construction will start in 2011 and finished by 2013. The Neckartal Dam is approximately 190 km from the Fish Orange River confluence. Because of its closer proximity to the lower Orange River this dam will most probably make the life of the ORM LOM management easier because of a possible warning when releases from that dam occur.

Joint project between Namibia and South Africa for the construction of two gauging structures in the lower Orange River common border areas. The one low flow measuring weir in the Orange River will be downstream of the Fish Orange River confluence. This project can have an influence on the ORM LOM project because during construction more people will be in the area. Construction will be done by DWA South Africa. Construction will commence in 2010 (DWA Scoping report 2009).

In Lesotho there is considerable development planned for the Lesotho Lowlands area and also the potential for further transfers from the Lesotho Highlands Water Project.

3.10 /Ai-/Ais Richtersveld Trans Frontier Conservation Park (TFCP)

In June 2002 the Governments of the Republic of Namibia and the Republic of South Africa entered into an Agreement, by means of a Memorandum of Understanding, to initiate and actively participate in a process that will result in an agreement to establish a Transfrontier Conservation Park. The Transfrontier Conservation Park (TFCP) will include the /Ai-/Ais Hot Springs Game Park in Namibia and the Richtersveld National Park in South Africa. The /Ai/Ais Hot Springs Game Park borders 73 km onto the Orange River. The Fish River, a very important tributary of the Orange River, flows through this park.

On 1 August 2003, the then President Sam Nujoma of Namibia and President Thabo Mbeki of South Africa signed an international treaty establishing the /Ai-/Ais/ Richtersveld Transfrontier Park (ARTP)(For the 2005 zoning map see **Annexure 7**). The joint vision for the TFCP is "Conservation and sustainable development of the unique ecological landscapes, wilderness character and cultural heritage of the /Ai-/Ais Richtersveld Transfrontier Conservation Park through joint management and cooperation for the benefit of Namibia and South Africa".

In terms of Article 10 (4) (e) of the Memorandum of Understanding a Bilateral Technical Committee shall be responsible for preparing a draft Management and Development Plan for the TFCP. Some of the other achievements were opening a border post and pontoon at Sendelingsdrif. The lower Orange River Management Plan (LORMP), unlocking the Ecotourism Potential of the River, was commissioned by the ARTP JMB and a draft was produced in October 2008. The overall objective with the LORMP is to unlock the ecotourism potential of the river in a sustainable and equitable manner. This plan should synchronise ecotourism in the sense that a lodge should not be built on the Namibian side of the river if there is a mine development directly across the river in South Africa.

Initially there were talks about creating a joint border post (port of entry) at Sendelingsdrif in South Africa. Eventually it was decided to construct the Dreigat border post (port of entry) in Namibia. The Pontoon at Sendelingsdrif is the only means of officially crossing the Orange River in the Transfrontier Conservation Park. The Port of Entry infrastructure at Dreigat and Sendelingsdrif were constructed / upgraded and the pontoon re-commissioned with the help of some of the local mines. The pontoon is operational, border staff on both sides were appointed and a Port of Entry was declared in November 2005.

With the intended rehabilitation to be included in the ORM LOM mine plan and waste material to be back filled into the mined out area, visual impacts should be minimal.

This increase of tourism activities will have an influence on the project area as far as security is concerned.

3.11 River-based Tourism Operations (Tourism)

Currently the whitewater rafting, canoeing and kayaking industry utilises the lower Orange River extensively for commercial and private river operations. During long weekends and at Easter, thousands of users congregate on the section between Noordoewer and Aussenkehr. The use by private individuals is currently largely uncontrolled and thereby creates a problem for the commercial users. Adequate camping and ablution facilities are currently a problem.

The dissolved oxygen concentration in the river is more than 70% saturation, the pH 8.2 is relatively high but acceptable and the E.coli count of less than 100 counts fu/100 ml is

acceptable for full contact recreational use (DWA South Africa standards). The general water quality of the lower Orange River is acceptable for agricultural, domestic, recreational and industrial use (Draft LORMP.2008).

The use of the section below Sendelingsdrif is limited due to the gradual gradient, low flow and western wind (Draft LORMP.2008).

Ecotourism requires undisturbed and pristine environments. Mining as a land use has visual impact on the pristine landscapes. The sparse vegetation on the banks of the lower Orange River and with the mines usually on the upper terrace of the river, it is not easy to hide a mine behind the vegetation. At Sendelingsdrif, on the South African side, the Ochta Mine definitely has a visible impact on the tourism experience.

3.12 Border Demarcation

On 1 July 1890 at the Berlin Conference a treaty between Germany and the United Kingdom was signed, defining the border (Article III); as

> "To the south by a line commencing at the mouth of the Orange River, and ascending the north bank of that river to the point of its intersection by the 20th degree east longitude".

This agreement delimited the boundary; it did not demarcate it (Gerhard Erasmus, 1989).

On 18 December 1995 the Surveyor General of Namibia and the Chief Surveyor General of South Africa certified that the demarcation of the Orange River Boundary

> "has been carried out in accordance with Article 1 (3) of the Agreement between the Government of the Republic of Namibia and the Government of the Republic of South Africa regarding the delimitation and demarcation of the boundary of the Orange River".

This is not so simple - paper is patient. This demarcation still needs to be agreed upon by the various role players and affected and interested parties. The river needs to be properly surveyed; one cannot just draw a line on a map. Each stretch needs to be agreed upon by the Local Authorities, by GRN Officials and the different population groups who use the islands. Only then the border can be demarcated.

Currently the border is still the same as decided in 1890.

4 KEY ISSUES IDENTIFICATION

4.1 Analysis of Institutional Arrangements and Legal Situation

The Orange-Senqu River is a river of international importance and special care should be taken to treat it as such. Namibia, as a SADC member and signatory to various treaties and protocols, should ensure that its people adhere to same.

Namibia has a right to a good quality and a certain quantity of water from the Orange-Senqu River. Certain Institutional arrangements i.e. SADC, ORASECOM and PWC were put in place and the various Commissioners and Government Officials should ensure that Namibia's rights are protected. As far as the border issue is concerned, the PWC must do the demarcation by surveying the river.

As far as the legal issues are concerned the ORM LOM project should ensure the following:

- According to the Water Supply and Sanitation Policy; The overall principles for water supply priorities places domestic use first and then makes provision for economic activities.
- Until the new Water Act is finally commenced the legal position is still governed by the Water Act 54 of 1956.
- New Water Act. Section82. The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for each type of work or activity are complied with.
- New Water Act. Section98. A person must not cause or allow any groundwater to run to waste from a borehole, well, shaft, mine or other excavation, except: (b) when the water interferes or threatens to interfere with mining operations or performance of any other underground work; or
- MET Act Section 27. (2) Activities listed; water use and disposal, resource removal, industrial processes.
- Inland Fisheries Act Section 15. A person shall not use - (c) any net in the Orange River.
- Forestry Act no 72 of 1968 states that it is an offence "to harm, injure or remove any living tree, bush or shrub within 100m of any river, stream or watercourse".

4.2 Analysis of the Baseline Situation

The water demands along the lower Orange River are currently supplied with water from Vanderkloof Dam some 1 380 km upstream. Water must be released well in advance since the water takes 2 to 6 weeks to reach the mouth. It is also very important for the DWAF in Namibia to communicate the water use patterns of its users a year in advance to DWA South Africa to enable them to properly plan the releases from Vanderkloof Dam. Therefore if the Sendelingsdrif

mine is going to use water and require more water for Daberas it must ensure that its water abstraction permits are in order.

Currently Namibia is using about 35 M m³/annum from the lower Orange River, while the long term requirements will be 200 M m³/annum. Namibia as a watercourse state (riparian state) to the Orange-Senqu River has been abstracting water from the river long before any construction of dams in South Africa took place. Namibia has a right to the water of the river; therefore the ORM LOM project should be allowed to have ample water for its operation. Water shall therefore be available for the mine. Since the ORM LOM project area is downstream of the Fish/Orange River confluence, water availability and good quality of water should not be of concern.

For the ORM LOM project area salinity, eutrophication and microbiological and water-borne pathogens can influence the drinking water quality negatively. Because of the algal blooms and the possible microbial and water-borne pathogens, treated drinking water or groundwater – if available - will have to be supplied for mining operations staff. The general water quality of the lower Orange River is, however, acceptable for agricultural, domestic, recreational and industrial use.

To be informed about algal blooms in the river, the Sendelingsdrif ORM LOM project will need to register with DWA Upington.

Since the Sendelingsdrif deposits are located within an ox-bow shape of a very old river, the water in those areas is most probably river water or very old river water. Disposal of the water back into the river from the mining area needs to be discussed with DWA.

If the ORM LOM project wants to use the borehole at Sendelingsdrif, if it needs to be test pumped to determine the potential yield. The groundwater and fountains in the area originate from the hydrogeological features in the area that are secondary aquifers.

If there is a need for water quality monitoring – I recommend doing EC (EC x 6.7 = TDS).

The possibility exists that under the guise of subsistence or recreational fishing, illegal commercial fishing activities can take place at the Orange River, using longlines and gillnetting. This can have an additional strain on the security at the ORM LOM project area.

The ORM LOM project at Sendelingsdrif will not have any influence on the Orange River mouth.

The Neckartal Dam will have an influence on the lower Orange River because of a decrease in floods. On the other hand because of its closer proximity to the lower Orange River, this dam will most probably make the life of the ORM LOM management easier because of a possible better warning system during floods in the Fish River catchment and from the Neckartal Dam when releases from that dam occur, than that from Hardap Dam.

A scoping report was approved by MET in 2009 to construct a low flow measuring weir in the Orange River downstream of the Fish Orange River confluence. This project can have an influence on the ORM LOM project because during construction more people will be in the area. Construction will be done by DWA South Africa. Construction can commence in 2010. (DWA Scoping report 2009).

The possibility that under the guise of subsistence or recreational fishing, illegal commercial fishing activities can take place at the Orange River, using longlines and gillnetting.

The use of the section below Sendelingsdrif for whitewater rafting is limited due to the gradual gradient, low flow and western wind (Draft LORMP.2008).

Currently the border is still the same as decided in 1890.

In Lesotho there is considerable development planned for the Lesotho Lowlands area and also the potential for further transfers from the Lesotho Highlands Water Project.

4.3 Issues raised during public meetings

The Orange/Fish River Basin Management Committee Chairperson raised the following issue: "The organization is generally concerned about the use of water in the upper and lower Orange and Fish River basin. We are also concerned about how the extension will impact on the environment and social aspect of the people living in those areas".

Since the mining activities will be conducted between 245m and 800m from the river bank, the riparian vegetation should not be impacted. A water pipeline will be constructed to abstract water from the river for road maintenance. this impact will be negligible. The maximum amount of water used by Daberas when in full operation was approximately 2.0Mm³/a, which is also small. By implementing efficient water use methods and reusing the process water the project is limiting its water use and should therefore not have an impact on the river.

The ORM LOM project is situated approximately 90km west of Oranjemund and is in the proclaimed Sperrgebiet National Park (SNP). The use of water in the upper and lower Orange and Fish River basins and the change in flow regime are also of concern to the project. The mean annual flows have been reduced by about 50% from 11 000 Mm³/a to about 5 000 Mm³/a. The total flow volumes have a high degree of constancy and the seasonal patterns have changed. The Orange River is the lifeline for the region and is also an international river.

As mentioned, institutional arrangements like SADC, ORASECOM and PWC have been established and have an important protective role to play. The various Commissioners and Government Officials should ensure that the environment and Namibia's rights to the water of the Orange River are protected. The **Revised SADC Protocol on Shared Watercourses** was signed by the SADC leaders on 7 August 2000. The Revised SADC protocol contains the fundamental principles of international water law, i.e. Article 3 (7), equitable and reasonable utilisation, Article 3 (10), obligation to prevent significant harm and Article 4(1) (b), notification of planned measures. Therefore the availability of water for the project is not an issue.

According to the UNDP Project Document (2008), the Orange-Senqu River Basin wide sector water requirements, expressed as a percentage of total water use are as follows: 58% for irrigation, 27% for river losses, 4% for urban, (19million people) industrial and mining, 9% for environmental requirements and 2% for distribution losses. From a river with an historic mean annual runoff of 11 000Mm³/a, the use of 4% for the urban, (19million people) industrial and mining purposes is very small. By implementing efficient water use methods and reusing the processed water, the project is limiting its water use and should therefore not have an impact on the river.

5 IMPACT ASSESSMENT

5.1 Methodology used for impact assessment

The following impact assessment methodology was provided by the CSIR for use by all specialists on the Team.

Sensitivity of the Affected Environment
In the description of the affected environment, the specialist must provide an indication of the sensitivity of the affected environment. Sensitivity, in this instance, refers to the `ability' of an affected environment to tolerate disturbance (given existing cumulative impacts). For example, if very little disturbance results in the permanent loss of the biodiversity of a habitat, the affected environment could be categorized as having a low tolerance to disturbance and can consequently be described as being a 'high sensitivity' habitat. If, on the other hand, a habitat is able to withstand significant disturbance without a marked impact on its biodiversity the affected environment could be categorized as having a high tolerance to disturbance (i.e. 'low sensitivity' habitat).

Identification of Risk Sources
The sources of risk that are identified should be specific to the specialists' area of expertise.

All potential impacts that result from the proposed project should be evaluated for the full life-cycle of the project, namely, construction, operations and decommissioning phases. The method used to determine significance ratings for the EIA shall use the following convention:

Nature of impact

This assesses the type of effect that the proposed activity will have on the relevant components of the environment and includes "what will be affected and how".

Extent

Indicates whether the impact shall be:
Site specific – restricted to within 1000 m of the disturbance,
Local – limited to within 10 km of the disturbance or to the Mining Licence Area,
Regional – within the confines of the southern Namibian region, or
International - extending across the Namibian/RSA boundary.

Duration

Classifies the lifetime of the impact as being:
Short term – days to <1 month,
Medium term – months to <1 year,
Long term – years to <10years, or
Very long/permanent term - generations of affected biota.

Intensity (or Magnitude)

Establishes whether the impact is destructive or innocuous and whether or not it exceeds set standards. It is described as either:

Low – where natural environmental functions and processes are negligibly affected,

Medium – where the environment continues to function but in a noticeably modified manner, or

High – where environmental functions and processes are altered such that they temporarily or permanently cease and/or exceed legal standards/requirements.

Probability

This considers the likelihood of the disturbance occurring and is described as:

Improbable – low likelihood,

Probable – distinct possibility,

Highly probable – most likely, or

Definite – disturbance will occur.

Degree of confidence in predictions

This will be based on specialist knowledge and availability of information. These are classed as low, medium and high.

To determine the significance of potential impacts will require the application of a balanced combination of duration, extent and intensity/magnitude, modified by probability, cumulative effects and degree of confidence.

***Significance** shall be described as follows:*

Low - Where the impact will have a negligible influence on the marine environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time.

Medium - Where the impact could have an influence on the environment, which will require modification of the project design and/or other mitigation measures. This would be allocated to impacts of moderate severity/magnitude, locally to regionally, and in the short term.

High - Where the impact could have a significant influence on the environment and, in the event of a negative impact, the activity(ies) causing it should not be permitted without intervention of substantial mitigation and management, and pro-active rehabilitation commitments (i.e. there could be a 'no-go' implication for the project). This would be allocated to impacts of high magnitude, locally for longer than a month, and/or of high magnitude regionally and beyond

.

Mitigation and enhancement measures

Where negative impacts are identified, mitigation objectives must be set, and practical, attainable mitigation measures must be recommended that will minimise or eliminate the impacts. Where mitigation is not feasible, this must be stated and reasons given.

Where positive impacts are identified, actions to enhance the benefit should be recommended.

Monitoring

Monitoring requirements with quantifiable standards to assess the effectiveness of mitigation actions should be recommended. These must indicate what actions are required, by whom, and the timing and frequency thereof. If further investigations must be undertaken and monitoring programmes implemented before, during and after mining operations, these must be recommended.

Assessment of impacts

A clear statement shall identify a potential environmental impact from proposed project must be made by the specialist. Assessment of the data shall, where possible, be based on accepted scientific techniques. Failing this, the specialist shall make a professional judgment based on expertise and experience. The impact evaluation must consider cumulative effects that are associated with the project and other activities are either developed or in the process of being developed in the region.

5.2 Impact of Institutional Arrangements and Legal Situation

5.2.1 Impact description: Availability of Water

Namibia as a riparian state has a right to a good quality and a certain quantity of water from the Orange-Senqu River. A DWAF/Namibia Water Resources Planning Model under the LORMS 2005 study (PWC 2005) indicates that there is already a significant deficit of water in the lower Orange River. The UNDP 2008 study indicates that, because of users, the mean annual flow has been reduced by about 50% to 5.800 Mm^3/a and the flow regime has changed.

5.2.1.1 Impact assessment: Availability of Water

The ORM LOM project will use on average about 2.0 Mm^3/a, therefore it will hardly be influenced by upstream users or influence downstream users.

AVAILABILITY OF WATER			
	Construction	***Operations***	***Decommissioning***
Extent	n/a		n/a
Duration	n/a		n/a
Intensity	n/a		n/a
Probability	n/a	Improbable	n/a
Status of Impact	n/a		n/a
Degree of Confidence	n/a		n/a
Significance (without mitigation)	n/a		n/a
Significance (with mitigation)	n/a		n/a

5.2.1.2 Impact mitigation: Availability of water

In September 1992 a bilateral agreement was signed between the Government of the Republic of South Africa and the Government of the Republic of Namibia on the Establishment of a Permanent Water Commission on the lower Orange River. Some of the first tasks were the Pre-Feasibility Study into Measures to Improve the Management of the Lower Orange River and to provide for future developments along the border between Namibia and South Africa. In the meantime other institutional arrangements, i.e. SADC and ORASECOM were established. It is also important to note that the Revised SADC protocol contains the fundamental principles of international water law, i.e. Article 3 (7), equitable and reasonable utilisation, Article 3 (10), obligation to prevent significant harm and Article 4(1) (b), notification of planned measures. Therefore the availability of water of good quality for the project is not an issue. The various Commissioners and Government Officials should ensure that Namibia's rights to the water are protected.

5.3. Downstream impact of the ORM LOM Project on water quality and quantity

In spite of irrigation along the lower Orange River, the overall water quality of the river is still good, with an increase in salinity due to evaporation towards the river mouth. The ORM LOM project area (Daberas Mine and Hostel) is currently using 150 000 m³/month and the Sendelingsdrif area 20 000 m³/month). This amount (2.0 Mm³/a) is insignificant in comparison to possible irrigation use of 205 Mm³/a by South Africa and Namibia along the lower Orange River in 2010.

5.3.3.1 Impact assessment: Downstream impact of the ORM LOM Project on water quality and quantity

Water requirements for the proposed mining activities are not expected to reduce the flow in the Orange River. The processes used in recovering the diamonds are not expected to influence the downstream water quality.

If the undersized discharge is deposited into a fine tailings residue deposit dam at Daberas, and the treatment facility rejects are discarded on a dump site in close proximity, no water from the ORM LOM project will be returning to the river. The ORM LOM project will therefore have no influence on the water quality and quantity downstream of the area.

DOWNSTREAM IMPACT OF THE ORM LOM PROJECT ON WATER QUALITY AND QUANTITY

	Construction	***Operations***	***Decommissioning***
Extent	n/a	site specific	n/a
Duration	n/a	n/a	n/a
Intensity	n/a	low	n/a
Probability	n/a	low	n/a
Status of Impact	n/a	low	n/a
Degree of Confidence	n/a	high	n/a
Significance (without mitigation)	n/a		n/a
Significance (with mitigation)	n/a		n/a

5.3.3.2 Impact mitigation Downstream impact of the ORM LOM Project on water quality and quantity

It is proposed that the ORM LOM project should monitor electrical conductivity (EC) at the Daberas pump intake once a month.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 The Orange-Senqu River is a river of international importance and special care should be taken to treat it as such. Namibia being a SADC member and signatory to various treaties and protocols should ensure that its people adhere to these. Namibia has a right to a good quality and a certain quantity of water from the Orange-Senqu River. Certain Institutional arrangements i.e. SADC, ORASECOM and PWC were put in place and the various Commissioners and Government Officials should ensure that Namibia's rights are protected.

6.2 Namibia as a watercourse state (riparian state) to the Orange-Senqu River has been abstracting water from the river long before any construction of dams in South Africa took place. Namibia has a right to water from the river; therefore the ORM LOM project should have ample water of good quality for its operation. However, treated drinking water will have to be supplied to the ORM LOM project area. A pumping test should be done on the borehole at Sendelingsdrif to determine its potential yield. If the water is sufficient and of good quality this water can then be used as drinking water. Another alternative is to drill a borehole closer to the river and if the water quality is acceptable use that for drinking water. Alternatively treated river water can be used. The Regional Office of the RSA DWA in Upington or DWA Head Office in Kimberley should be informed about any concerns of the ORM LOM project and the need to be informed well in advance about possible algal blooms in the river.

6.3 The ORM LOM project must ensure that their water abstraction permits are in order; they must also inform DWAF Namibia well in advance to ensure the necessary releases from Vanderkloof Dam.

6.4.

6.5 The Sendelingsdrif deposits are located within an ox-bow shape of a very old river; therefore the water in the mine areas is most probably river water or very old river water. This water should be used for road maintenance. If it is too much, permission from the DWAF is needed to dispose of it back into the Orange River.

6.7

6.7 The ORM LOM project activities will take place approximately 245m from the current river bank; therefore no harm to the riparian vegetation is envisaged.

6.8 The ORM LOM project will not have any influence on the Orange River mouth. If there is a need for water quality monitoring, EC is recommended. This can be done monthly at the Daberas pump station. It is recommended that a spot with easy access is chosen. Further monitoring actions are described in the Appendix.

6.9 The ORM LOM should be aware that the possibility exists of increased illegal fishing. This could add additional strain on security at the ORM LOM project area.

6.10 The DWAF of Namibia should be informed about the ORM LOM project's concern regarding floods from the Fish River and their need to be informed well in advance.

6.11 With the construction of a low flow measuring weir in the Orange River downstream of the Fish Orange River confluence, more people will be in the area and this could also add additional strain on the security at the ORM LOM project area.

6.12 It is further recommended that the ORM LOM project should take note of the following:

- As far as the border issue is concerned, the PWC must do the demarcation by surveying the river. This should not influence the ORM LOM project.
- The overall water supply priorities are, in the first place for domestic use and in the second place provision of water for economic activities.
- Until the new Water Act is finally commenced, the legal position is still governed by the Water Act 54 of 1956, inherited from South Africa.
- New Water Act, Section 82: The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for each type of work or activity are complied with.
- New Water Act, Section 98: A person must not cause or allow any groundwater to run to waste from a borehole, well, shaft, mine or other excavation, except (b) when the water interferes or threatens to interfere with mining operations or performance of any other underground work; or
- Ministry of Environment and Tourism Act Environmental Assessment Section 27: (1) Activities which need an environmental clearance certificate (2) Activities listed are water use and disposal, resource removal and industrial processes.
- Inland Fisheries Act, Section 15: A person shall not use-(c) any net in the Orange River.
- The Forestry Act no 72 of 1968 states that it is an offence "to harm, injure or remove any living tree, bush or shrub within 100m of any river, stream or watercourse".

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APPENDIX

Table Monitoring of Recommended Mitigation Actions

No.	Mitigation Recommendation	Monitoring Responsibility	Action Required	Monitoring Method	Frequency
1.					
2.					
3.					

ANNEXURES

Annexure 1

TDS data for Rosh Pinah RAW Water (NamWater)

DS Number	Date Sample Taken	Conductivity in m S/m	TDS calculated
DS28424	16/03/2010	35.2	235.84
DS27807	30/11/2009	29	194.3
DS27187	07/09/2009	67.5	452.25
DS26472	08/06/2009	55.5	371.85
DS25987	09/03/2009	38.6	258.62
DS25377	01/12/2008	76.9	515.23
DS24693	10/09/2008	71.5	479.05
DS24056	20/06/2008	54.8	367.16
DS22605	28/11/2007	72.8	487.76
DS22088	10/09/2007	77.7	520.59
DS21513	18/06/2007	48.9	327.63
DS20936	04/04/2007	50.4	337.68
DS19522	11/09/2006	25.4	170.18
DS19169	02/06/2006	26.5	177.55
DS18840	13/03/2006	64.2	430.14
DS18504	28/11/2005	62.4	418.08
DS18121	12/09/2005	76.2	510.54
DS17663	10/06/2005	63	422.1
DS17251	04/03/2005	55.2	369.84
DS16672	29/11/2004	55.3	370.51
DS16023	22/09/2004	74.7	500.49
DS15454	16/06/2004	78.6	526.62
DS15136	06/04/2004	44.6	298.82

DS15029	07/03/2004	57.9	387.93
DS14618	29/11/2003	54.8	367.16
DS13945	14/09/2003	61	408.7
DS13435	15/06/2003	47.9	320.93
DS6376	17/05/2000	48.8	326.96
DS4581	12/08/1999	52.5	351.75
DS3724	11/02/1999	56.4	377.88
DS3192	06/11/1998	31.4	210.38
DS3015	12/10/1998	27.1	181.57

This data from NamWater at Rosh Pinah confirms the wide range of TDS values occurring through the year and between years. To do any predictions regarding water quality in a river is not advisable because of the self cleaning effect of a river. One should rather look at trends. This 10 year data base from NamWater are not showing any trends yet.

Annexure 2

River Landscape according to ARTP JMB 2008.

Lower Orange River Management Plan.

Unlocking the Ecotourism Potential of the River.

Perennial Pool **Perennial Pool Sandy**

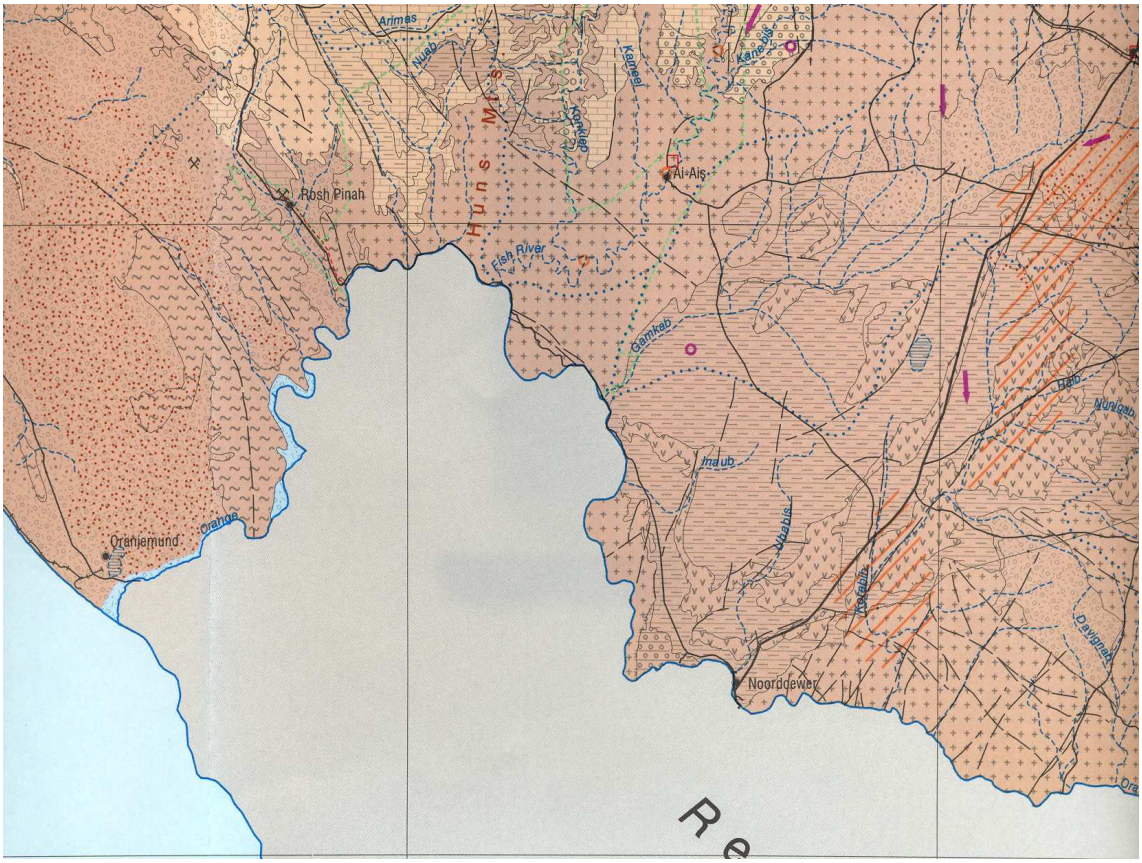
Images of Representative River Landscapes

Nano – interspersed (left foreground) **Xeric – sparse (right foreground)**

Images of Representative Riparian Vegetation

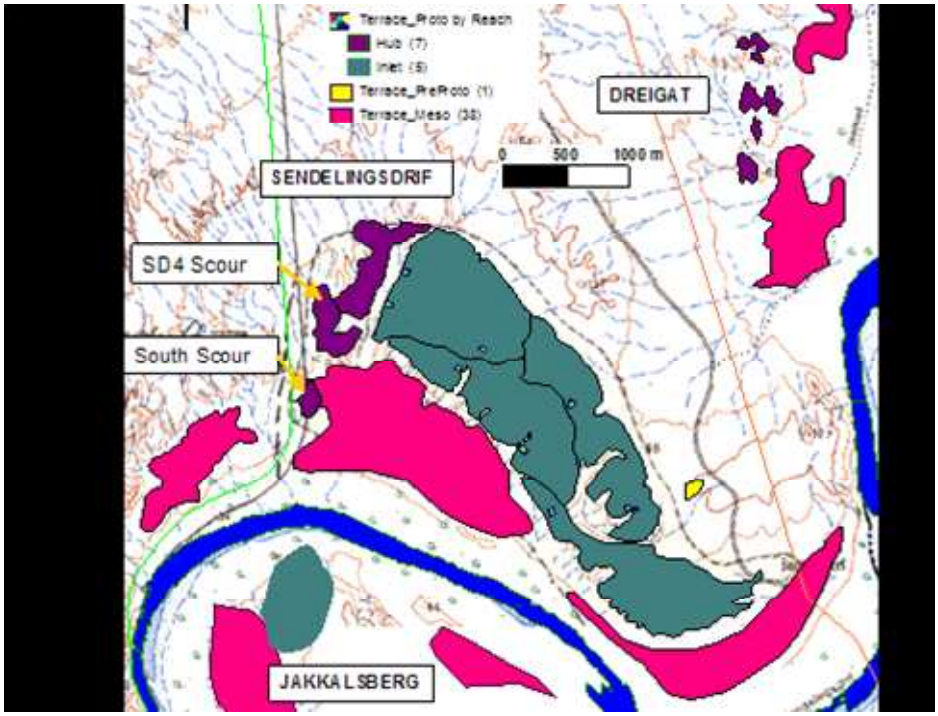
Annexure 3

Map of Hydrogeological and Hydrological features south-west of Rosh Pinah along lower Orange River according to Groundwater in Namibia (December 2001).



According to the Hydrogeological Map of Namibia (2001) the two hydrogeological features south west of Rosh Pinah indicted by the ˜ symbol: "The main rock type of hydrogeological units is; metamorphic rocks, including quartzite and marble bands with very low and limited potential for groundwater".

Annexure 4
SD4 Scour that contains water (Namdeb 2010)



The SD4 scour contains groundwater which is most probably due to the drainage of a secondary aquifer towards the Orange River from the hydrological feature as can be seen on the map. The ox-bow shape of the Sendelingsdrif deposit can be seen. This is an indication of a previous river channel.

Annexure 5
Water Resource Management Act extractions

2 The objective of this Act is to ensure that the water resources of Namibia are managed, developed, used, conserved and protected in a manner consistent with, or conducive to, the fundamental principles set out in section 3.

3 This Act must be interpreted in a manner that is consistent with, and promotes, the following fundamental principles:

(a) Equitable access for all people to safe drinking water is an essential basic human right to support a healthy productive life;
(b) access by all people to a sufficient quantity of safe water within a reasonable distance from their place of abode to maintain life and productive activities;
(c) harmonisation of human water needs with the water requirements of environmental ecosystems and the species that depend on them, while recognizing that the water resource quality for those ecosystems must be maintained;

(d) promotion of the sustainable development of water resources based on an integrated water resources management plan which incorporates social, technical, economic, and environmental issues;

(e) availability of open and transparent information about water resources to the public;

(f) recognition of the economic value of water in the allocation of water;

(g) development of the most cost effective solutions, including conservation measures, to infrastructure for the provision of water;

(h) supporting integrated water resources management through human resources development and capacity building;

(i) promotion of water awareness and the participation of persons having interest in the decision-making process should form an integral part of any water resource development initiative;

(j) consistency of water resource management decisions within the specific mandate from the Government regarding the separation of policy, regulatory and operational functions;

(k) prevention of water pollution and implementation of the principle that a person disposing of effluent or waste has a duty of care to prevent pollution;

(l) a polluter is liable to pay all costs to clean up any intentional or accidental spill of pollutants;

(m) cognisance of Namibia's international rights and obligations in the utilisation of internationally shared water resources and the disposal of waste or effluent;

(n) cognisance of the regional diversity in water resources development and the decentralisation of responsibilities to the lowest level of Government where adequate and appropriate competency exists to manage water resources effectively.

4 The State, in its capacity as owner of the water resources of Namibia by virtue of Article 100 of the Constitution of the Republic of Namibia, has the responsibility to ensure that water resources are managed and used to the benefit of all people in furtherance of the objective of this Act.

5 The functions of the Minister in relation to the joint management of internationally shared water resources are

(a) to participate with neighbouring and other riparian states in the establishment, development and maintenance of a common database system to store and provide data and information for the protection, sustainable use and management of shared water resources;

(b) to engage in the joint management, planning and development of projects concerning shared water resources in furtherance of the objectives of the Southern African Development Community Revised Protocol on Shared Watercourses with regard to regional integration, economic growth and poverty alleviation;

(c) to establish and promote institutional relationships between river basin organisations within Namibia and international river basin organisations;

(d) to encourage the participation of Namibian stakeholders in discussions concerning the identification and formulation of the interests of Namibia in the development of internationally shared water resources;

(e) to protect the international water resource quality, including discussion with upstream states to reduce or prevent the deterioration of water quality resulting from activities in upstream states;

(f) to develop and improve human resource capacity to participate in the management of shared water resources, including negotiations, consultations and conflict resolution; and

(g) to establish mechanisms, or negotiate the revision of mechanisms, for the management, prevention and resolution of disputes relating to internationally shared water resources.

82. The Minister may, with the consent of the applicant concerned, grant a combined licence to abstract and use water and to discharge effluent if the requirements prescribed by this Act for a separate licence for each type of work or activity are complied with.

83. Unless sooner cancelled, a licence to abstract and use water, or a combined licence, remains in force for the period, not exceeding five years, as determined by the Minister and specified in the licence.

98. A person must not cause or allow any groundwater to run to waste from a borehole, well, shaft, mine or other excavation, except

(a) for the purpose of testing the capacity or quality of the supply, or to clean, sterilize, examine or repair a borehole; or

(b) when the water interferes or threatens to interfere with mining operations or performance of any other underground work; or

(c) when groundwater poses a threat to life or property.

99.(1) Except under authority of a groundwater disposal licence issued by the Minister, a person must not abstract and dispose of groundwater

(a) from a mine or other excavation to facilitate mining or other underground operations; or

(b) to dewater an area for construction purposes.

(2) An application for a groundwater disposal licence must

(a) be made in the form and manner approved by the Minister;

(b) contain or be accompanied by any information that is prescribed or required by the Minister; and

(c) be accompanied by the prescribed application fee.

(3) In determining the application, the Minister may

(a) approve the application and issue the licence to the applicant; or

(b) refuse the application.

(4) A groundwater disposal licence

(a) must be issued in the form determined by the Minister;

(b) must specify the activities authorised by the licence; and

(c) is subject to the conditions

(i) as prescribed; or

(ii) as imposed by the Minister and specified in the licence.

(5) The holder of a licence to dispose of groundwater must not dispose of water abstracted under the licence at a place or in a manner other than the place or manner specified in the licence or as approved by the Minister in writing.

100. (1) A person may in an emergency situation for the protection of human life or property, without a licence abstract water from a mine or any other place.

(2) A person abstracting water under subsection (1) must -

(a) as soon as practicable inform the Minister verbally of the emergency situation; and

(b) not later than 14 days after the emergency situation is resolved, furnish the Minister with a written report about the incident.

136. For the purpose of the protection and enhancement of water resource quality and wetland aquatic ecosystems, the Minister may by regulation prohibit or regulate the use of any wetland or dam for specified purposes or the carrying on of specified activities within any wetland or dam, except under authority of a licence issued, and in accordance with licence conditions as prescribed, including -
the commercial recreational use of wetland resources;
development on the banks of any wetland or dam; and
the removal of rocks, sand or gravel or any other material from a watercourse.

137. (1) The Minister may prescribe requirements and measures, including prohibitions, for the importation, use or control of aquatic invasive species, so as to reduce their negative impact on water resource quality and wetland aquatic ecosystems.

138. The Minister may prescribe requirements and measures for -

(a) the removal or use of riparian species, so as to protect water resources or water resource quality;

(b) the protection of any riparian species if considered of national or strategic importance or if it forms part of wetland resources.

167. (1) In this section “repealed law” means a law repealed by section
168. (2) A person who immediately before the commencement of this Act was authorised to abstract and use water under a permit in force under a repealed law, ,may continue to abstract and use water in accordance with the authorisation granted by that permit, but that person must apply to the Minister, not later than 18 months after the date of commencement of this Act, for the issue of a licence to abstract and use water under section 79 of this Act, and such application must be accompanied by a statement setting out

(a) the volume of water abstracted during each of the two years immediately preceding the application;

(b) the water resource from which the abstraction is made;

(c) the purpose for which the abstracted water is being used;

(d) the date when the abstraction commenced;

(e) the particulars in relation to effluent, if any, discharged as a result of the abstraction; and

(f) any other information as prescribed or as the Minister may require .

(3) A person who immediately before the commencement of this act was authorised to discharge effluent under a permit in force under a repealed law, may continue with the discharge of effluent in accordance with the authorisation granted by that permit, but that person must, in accordance with section 107 of this Act, apply to the Minister, not later than 18 months after the date of commencement of this Act, for the issue of a licence to discharge effluent under this Act, and such application must be accompanied by a statement setting out -

(a) the volume of effluent discharged during each of the two years preceding the application;

(b) any water resource into which the effluent is discharged;

(c) the chemical constituents and the concentration values of the effluent, as far as is known;

(d) the date when the discharge commenced; and

(e) any other information as the Minister may require.

(4) A person who immediately before the commencement of this Act operated a wastewater treatment facility or waste disposal site may continue to operate that wastewater treatment facility or waste disposal site, despite the requirements of section 104(2), but that person must, in accordance with section 107, apply to the Minister for the issue of a licence to operate that wastewater treatment facility or disposal site under this Act not later than 18 months after the date of commencement of this Act.

Annexure 6
Minerals Prospecting and Mining Act No 33 of 1992 extractions

Section 45(1) (a) The holder of the mining claim is required to keep record that include the nature of the waste, mass or volume of any waste removed from such mining claim and the manner in which it was disposed of.

Section 34 (3) and Section 48 (3) The consideration of any application for the registration of a mining claim and the mineral license by the commissioner include the conservation and protection of the natural resources in or under the land to which the application relates.

Section 57(1) (b) The Minister of the MME may give directions in writing to the mineral license holder to protect the environment.

Section 33 (2 c) (vi), 48 (1 c), 68 (f) and 79 (f) The application for the registration of mining claim, the mineral license, exclusive prospecting license or mineral deposit retention license requires the particulars of the existing environmental damage of the area to which the application relates, an estimate of the effect to which the proposed prospecting operations and mining operation may have on the environment and the proposed steps to be taken in order to minimize or prevent such effects.

Section 35 (e) (iii) and 91 (f) (iii) that the applicant should indicate appropriate measures that will be taken to minimize or prevent any pollution of the environment in the course of mining operation and to deal with any waste to safeguard the mineral resources.

Section 48 (2) (b) and 50 (f) The terms and conditions for mineral license requires the applicant to carry out an environmental impact assessment indicating the extent of any pollution of the environment before any prospecting or mining operation are being carried out and an estimate of any pollution likely to be caused.

Section 50 (g) If any pollution is likely to be cause an environmental management plan indicating the proposed steps to be taken in order to minimize or prevent to the satisfaction of the commissioner any pollution of the environment in consequence of any operation carried on. The environmental management plan should be revised from time to time as circumstances change.

Section 41 (1) (e) The general term and conditions of registration of mining claim requires the holder to take all reasonable steps necessary to secure, in accordance with any applicable law, safety, welfare and health of person employed in such mining claim area and to prevent or minimize any pollution of the environment.

Section 130 (1) (a-b) When a spill occurs on land, sea and surface or ground water as a result of mining, prospecting and reconnaissance operations which causes pollution of the environment or damage or loss to any person and the state, the license or mining claim holder is required to report such spills, pollution, loss or damage to the Minister. The license or claim holder is required to take all necessary steps to remedy such spilling, pollution, loss or damage.

Section 130 (2) If a license or claim holder fails to report the spill and take necessary steps to remedy such spilling, pollution, loss or damage within the specified time, on his own initiative and after notice directed by the Minister within a specific time, the

Minister may cause such steps to remedy the situation and recover in a competent court the cost incurred from such holder.

Section 52 (2) When in the course of any prospecting or mining operations mining or retention area, any damage is caused to the surface of any land or water source thereon, the holder of the mineral license shall be liable to pay compensation to the owner of the land or water source in relation to which such damage has been caused.

Section 128 (1) (b) If a registration of mining claim or mineral license or exclusive prospecting license or mineral deposit retention license has expired or if any area to which such license relates has been abandoned, the license holder may be required in writing to take all steps necessary to remedy to the satisfaction of the Minister any damage caused by any prospecting and mining operation carried out on the surface and environment of such holder.

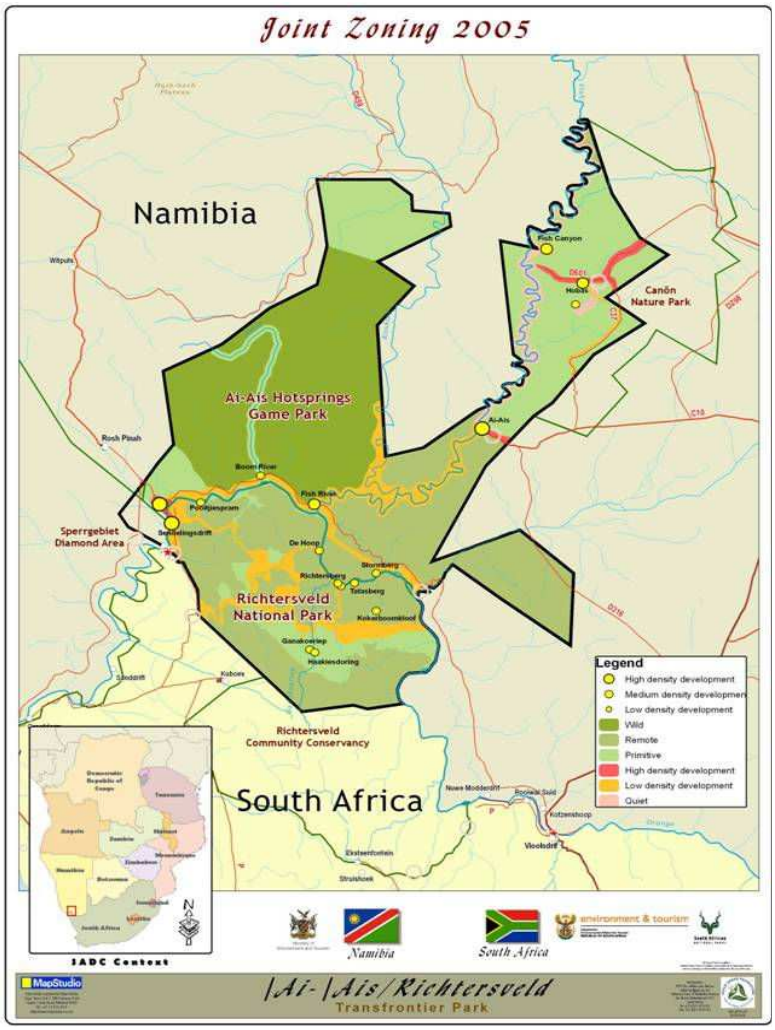
Section 128 (2) (a) If the mining claim, the mineral license, exclusive prospecting license or mineral deposit retention license holder fails to take all necessary steps to remedy any damage caused, the minister may cause such steps to be taken and recover the cost thereof from such person.

Section 43 (2) (c) The license holder is required to take all steps as may be necessary to the satisfaction of the Minister any damage caused by any prospecting and mining operations carried on the surface, environment and land in the claim area is abandoned by notice in writing.

Section 54 (2) (2a) If a prospecting, retention or mining area is abandoned, the holder of the mineral license shall demolish any accessory works constructed, except in so far as the owner of the land retains such accessory works on such condition as may be mutually be agreed upon between such owner and holder.

Section 54 (2) and Section 54 (4) Any mineral license holder who contravenes or fails to clean up and take steps to remedy any damage caused by prospecting and mining operations at an abandoned mine as provided or in the section shall be guilty of an offence and on conviction be liable to a fine not exceeding N$ 8000 or imprisonment for a period not exceeding 12 months. If the license holder of the expired mining claim, the mineral license, exclusive prospecting license or mineral deposit retention license fails to comply with the notice in writing to take necessary steps to remedy to the satisfaction of the Minister any damage caused by any prospecting and mining operation carried on the surface and environment, shall be guilty of offence and liable on a conviction to a fine not exceeding N$ 100 000 of imprisonment for a period not exceeding five years.

Annexure 7 /Ai-/Ais/ Richtersveld Transfrontier Park (ARTP)



Annexure 8

Application for a permit to abstract water

REPUBLIC OF NAMIBIA

MINISTRY OF AGRICULTURE, WATER AND FORESTRY

TECHNICAL REPORT TABLE OF CONTENTS:

APPLICATION FOR A PERMIT TO ABSTRACT WATER

The provisions of the Water Resources Management Act xxxx (Act No. xx of 2010), are intended, amongst others, to promote the sustainable use of the country's water resources. The abstraction of water from both ground and surface sources is regulated in terms of Sections 79 to 90 of this Act; drilling of boreholes, etc. is controlled by Sections 91 to 102; and waste water disposal is subject to Sections 103 to 119 and applicable to the use of water supply and irrigation or any other use to the satisfaction of the Minister.

1. OBJECTIVES OF A PERMIT TO ABSTRACT AND USE WATER

The objectives of a groundwater abstraction permit are to:

- ✓ Promote the optimal use of the available resources
- ✓ Regulate the groundwater abstraction from an aquifer
- ✓ Ensure the equitable use of the abstracted water by all affected and interested parties
- ✓ Protect the groundwater resource(s) against long term over exploitation, depletion, pollution or other quality degradation
- ✓ Ensure that proper and reliable abstraction data are made available to manage and implement future abstraction strategies for the aquifer(s)
- ✓ Implement integrated resource management principles.

The applicant is therefore required to present a brief description of the purposes for which the abstraction permit is required.

2. APPLICANT

- Name Applicant or Institution applying for an abstraction permit
- Type of Establishment
- Responsible person: full name and telephone number
- Postal Address
- E-mail Address

3. PREVIOUS PERMIT

- Type and number of permit
- Date of issue
- Date of expiry
- Allocated abstraction quantity

4. SOURCE OF WATER SUPPLY

- Type: River, Dam, etc., Borehole or Well (how many), Mine shaft, Sea
- Description of aquifer in case of borehole(s), well(s) or mine shaft(s)

5. PHYSICAL DETAILS

- Name and Registration Number of property or properties on which abstraction takes place; Region; Jurisdictional Area
- Rainfall records for abstraction area(s)
- GPS co-ordinates of abstraction and disposal points
- GPS coordinates of points of main supply or use and volumes supplied or used.

6. ABSTRACTION

- Beneficial use of abstracted water
- Rate and volume of abstraction
- Timing of abstraction
- Description of waterworks
- Water treatment

7. ABSTRACTION MANAGEMENT PLAN

The purpose of the management plan is to make sure that suitable procedures are in place to monitor and evaluate the response of the aquifer and the surrounding environment to the abstraction process and to quantify any effects of recharge. The proposed procedures shall also serve as an early warning system for over-exploitation, which may influence other users of the same groundwater resource.

1.1 Abstraction Points

Where more than one abstraction point is involved, it is important to indicate the distribution of such points on a map showing the distances between the points

if the map is not according to scale. The same map may be used to indicate the monitoring points.

The following information on each abstraction point is required in tabular form:

- ✓ Borehole or Well No. (Shaft locality and identification in case of a mine)
- ✓ Co-ordinates (in decimal degrees)
- ✓ Pump inlet depth from the surface (or from surveyed fixed point in m.a.m.s.l. in case of mine shaft)
- ✓ Rest water level from surface (describe the fixed point on surface)
- ✓ Pump water level from surface (before pumping is stopped)
- ✓ Pumping rate per hour
- ✓ Pumping hours per day; days per month; and months per year.
    - o State the method of measuring pump volumes and groundwater levels as well as frequency.

  Any other relevant information on the pumping strategy should be discussed.

2.2 Water Level Monitoring

During groundwater abstraction at any point, a cone of depression in the groundwater table id formed. It is necessary to monitor this cone of depression through the placement of strategic monitoring boreholes (piezometers) around the abstraction point(s). The placement and number of such monitoring points will depend on each specific situation. Discuss the layout of observation points and the monitoring frequency.

3.3 Groundwater Quality

It is essential that the quality of groundwater abstracted from every point be monitored on a realistically regular basis, to serve as an early warning of quality changes that may occur due to the abstraction; natural causes; or pollution. A plan must be given of groundwater quality monitoring procedures to be followed. This includes the frequency of sampling and chemical constituents to be analysed for.

4.4 Other Critical Criteria Affecting Aquifer Behaviour

The response of the aquifer to groundwater abstraction and recharge is dependant on its dimensions and geohydrological characteristics, which need to be elaborated on, or investigated if unknown. It is therefore necessary to discuss issues such as the stored volume of groundwater, the safe yield of the aquifer, recharge to the aquifer and the projected drawdown of the groundwater table at different abstraction rates.

Define critical water levels based on available drawdown or on historical (low) water levels for selected monitoring boreholes or for production boreholes where monitoring holes are not available. A Contingency Plan must be formulated to deal with the abstraction strategy when the water levels approach such critical levels in the selected boreholes.

In some cases a simulated numerical groundwater model will be essential.

5.5 Groundwater Distribution and Treatment

Since it is in the interest of the Namibia's water resources that all water be optimally utilized, sound demand management of abstracted water must be implemented.

It is required that details are presented of the distribution network of the abstracted water. All treatment and waste disposal facilities must be described in brief (details must be discussed under the appropriate sections).

Special attention must be given to innovative methods of demand management, which naturally will be different in each specific case.

6.6 Water Balance

To enable the DWA to do a proper audit of water used a water balance for the aquifer(s) concerned is needed.

7.7 Reporting

7.7.1 STATUS REPORT

- Reporting of all actions relating to the abstraction of groundwater, aquifer response, distribution and treatment of abstracted water forms an essential part of the resource management plan. A schedule must be given for the frequency of reporting with an indication of the proposed detail.

7.7.2 FUTURE DEVELOPMENT

- Expectations connected with future demand or abstraction
- Envisaged future expansion
- Kind of expansion
- The magnitude of expansion
- Quantity of wastewater increase
- By when the abstraction/amount of waste water will be increased

7.7.3 INVESTIGATIONS AND ARTIFICIAL RECHARGE

- Report on all relevant investigations already undertaken or to be undertaken to ensure the sustainable utilisation of the resource from which the water is to be abstracted.
- Should artificial recharge from other resources be considered as an option, a separate permit will be required to cover all the regulations related to such an activity. Such a permit must run concurrently with the abstraction permit.

8. WATER SUPPLY AGREEMENT

Where water is abstracted with the purpose to supply other consumers it is essential that a water supply agreement is undertaken between the relevant parties.

Such an agreement must contain issues such as:

- A demand management plan of the client
- A copy of the waste water (effluent) disposal permit of the client
- Restrictions concerning the use of the water that is supplied
- Involvement of the client to develop new water resources

9. DECOMMISSIONING

A plan must be provided for the:

- Decommissioning of all wastewater treatment plants applied for
- Decommissioning of water purification plants
- Decommissioning of mine shafts and related groundwater abstraction points
- Decommissioning of any other water supply infrastructure.

10. PUBLIC INVOLVEMENT

Where the bulk or other large scale abstraction of water is from a resource, which may have an affect on other interested and affected parties, steps must be taken to involve such parties by informing them of the intended abstraction and the effect it may have on them. Opportunity must also be given to such parties to lodge reasonable objections and recommend reasonable mitigation. It is therefore essential to describe the measures to be implemented in this regard and how the public is to be informed as the abstraction proceeds.

11. RELEVANT REGULATIONS OF COMPLIANCE

- MET Policy
- Ministry of Health and Social Services
- Ministry of Mines
- Legal Authorities
- NamWater Act
- P.T.O.
- Title Act