SECTION B:
OVERVIEW OF IRRIGATED AGRICULTURE IN NAMIBIA

Contents

B1 INTRODUCTION

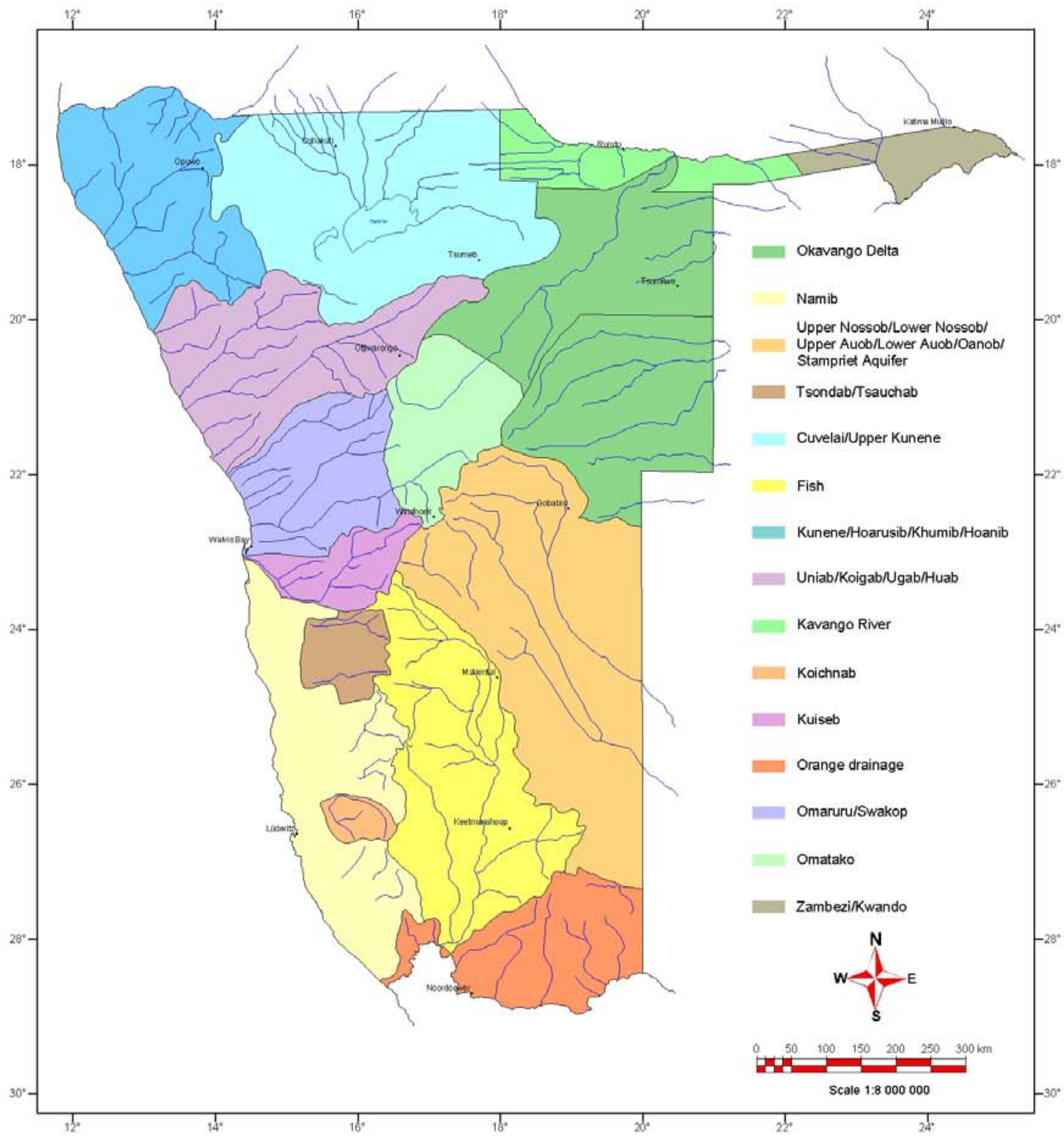
Water is a very scarce and therefore precious resource in Namibia. Irrigation places a high demand on water resources and under the circumstances prevailing in Namibia, the need to investigate and consider the impact of irrigation development on the environment becomes obvious. Additional to that water abstraction, distribution and irrigation infrastructure is in most cases, an expensive exercise because of factors such as topography, locality of water and soils, and marginal suitability of some soils for irrigation.

The Namibia Water Sector Review (NWSR) is currently working together with the Department of Water Affairs (DWA) to divide the country into *water basin management areas* and to appoint *water committees* which will eventually be responsible for managing and controlling all water affairs in their specific *area,* together with government. However, the water basin management area approach is at planning stage only, and still requires regional consultation, piloting and formal approval. A preliminary map indicating currently proposed management areas is shown on the next page.

In order to give more back ground and hopefully to sensitize the reader, section B2 gives an overview of the water resources available and the extent to which they are utilized for irrigation as well as the development that can be expected in the area. This discussion is by water source, and not by water basin management area, as these have not yet been finalized. Section B3 highlights a number of the existing developments, specifically pointing out problems that were experienced. This hopefully will lead to a better understanding and application of the guidelines as indicated under **Section D.**

A list of existing irrigation developments in Namibia is also given under **Section E5.** For a specific project application, this list should be checked to find out what other developments exist in the area which could provide useful relevant information.

Water Basin Management Areas



B2 WATER RESOURCES, UTILIZATION, FUTURE DEVELOPMENT & EXPECTED DEVELOPMENT

The sources known at this stage that are or can be utilized for irrigation can be listed as follows:

1.1 Karst Dolomite aquifer in the Tsumeb-Grootfontein area
1.2 Stampriet Basin aquifer
1.3 Khowarib aquifer
1.4 Hardap dam
1.5 Naute dam
1.6 Oanob dam
1.7 The proposed Brukkaros dam
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1.10 Kavango River
1.11 Kwando River/Linyanti/Chobe river system
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1.1 Karst dolomite aquifer

The aerial extent of the Karst Area is about 982 000 ha of which 595 000 ha (61%) is underlain by carbonate rocks, which is seen as the main recharge area of the Karst Aquifers. The recharge ranges between 0 and 4% of the rainfall, being dependent on the amount and intensity of the rainfall as well as the extent of karstification of the carbonate rocks. Recharge is greater where structural features such as faults, fractures and contact zones are present along which water can freely percolate. Where such structures are absent, the carbonate rocks are inclined to be relatively impervious, allowing only a limited volume of water to percolate very slowly through micro fractures and pore spaces resulting in a very low recharge.

The available ground water in such a karstic terrain is therefore a function of the volume and distribution of solutional cavities in the carbonate rocks. Some areas are more favourably karstified, so the density and size of fracturing is variable. The aquifer characteristics are variable in every dimension. Because of the limited extent of such cavities the ground water potential is also limited and therefore great care must be taken not to over exploit the ground water resources.

The average recharge of the Karst Aquifers has been taken at 2% of the mean annual rainfall of 500 mm, recharging the carbonate rocks. This results in a total annual recharge of about 60 Mm^3/annum. The recently completed geohydrological investigations by the Bundes Anstallt für Geowissenschaft und Rohstoffe (BGR) showed lower recharge conditions.

The BGR investigations showed that it is fallacy to assume that continuous annual recharge takes place and amounts to a certain percentage (2%) of the long-term mean annual rainfall. Model calculations based on such an assumption lead to hydrographs that are unrealistic and not comparable with any recorded hydrographs. The BGR investigation modelled part of the Karst Area (which co-incides with area D, E and part of area B in **FIGURE 1**), which showed a gradually changing recharge rate, depending on the current rainfall in relation to the rainfall of the previous seasons. The study arrived at the following recharge conditions:

- The recharge rate amounts to **2%** of the long-term mean annual rainfall after a sequence of rainy seasons in each of which the long-term mean annual rainfall is exceeded.

- The recharge rate amounts to **1%** of the long-term mean annual rainfall after a single rainy season in which the long-term mean annual rainfall is exceeded.

- The recharge rate amounts to **0%** if the rainfall does not exceed the long-term mean annual rainfall.

The current drought situation, which has continued from 1979 (more than two decades), means that no sustainable long-term recharge rate can be worked out. As a short-term mean recharge rate, which was roughly valid during the last decade (including the single season 1988/89), a value close to zero must be accepted. Since 1979 the ground water table has declined, caused in the main by natural depletion of ground water flow out of the area and partly by abstraction within the area. The BGR studies conclude with the following:

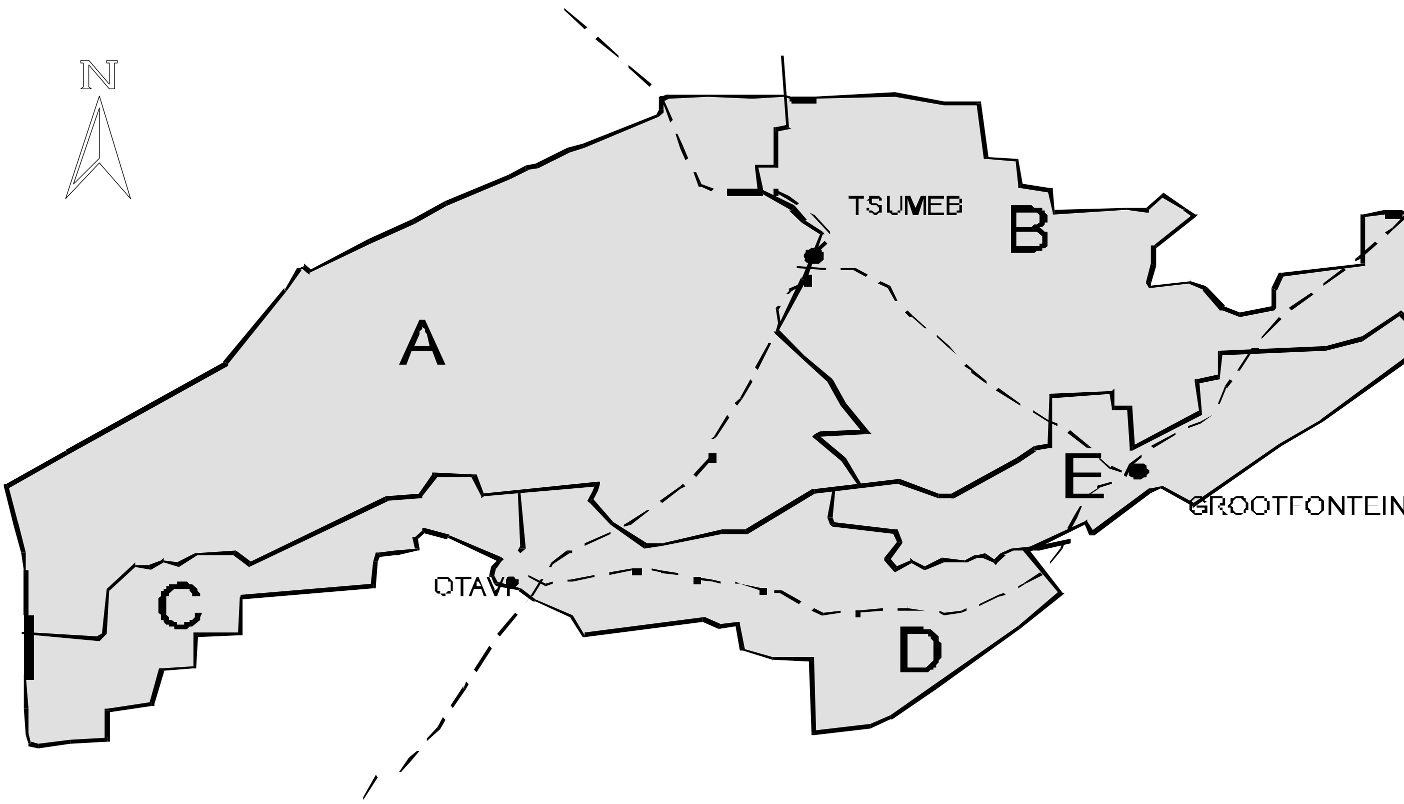
- Any further ground water abstraction that might be necessary during drought conditions will increase the process of aquifer depletion.

☞ - **The results derived from the KARST_01 and the KARST_02 model show that no sustainable yield figures can be established. This means that no large-scale ground water development is feasible on a long-term, sustainable basis.**

- Emergency ground water abstraction will cause further water-table decline on a regional scale and it will reduce the ground water flux into the Omatako drainage area. The pumping levels, and therefore the yields of existing production wells and farm wells will be affected. It is possible that some wells will have to be abandoned because the water level falls beyond the bottom of the well.

- It is expected that there will be a detrimental impact on the environment, particularly on deep-rooting vegetation. The water requirements of shallow-rooting plants such as grass and bushes is met by the moisture in the upper layer of soil, which is replenished by seasonal rainfall. Ecologically valuable features of the environment, such as the seepage and spring areas at syncline D, will be seriously, and perhaps permanently, affected.

Figure 1 Catchments in the Karst Area



The results from the BGR studies indicate a worse situation than previously assumed, regarding conservation conditions in the Karst Area, when the criteria for allocating abstraction permits for irrigation purposes were established in 1992 (See Reference 5). The total annual recharge was at that time calculated at 60 Mm^3/annum based on 2% of the mean annual rainfall of 500 mm recharging the carbonate rocks in the Karst Area. Based on this, 50% or 30 Mm^3/a was allocated for irrigation purposes (See **TABLE 1**).

Now that the results of the BGR investigations are known these volumes can definitely not be increased as recharge appears to be much less and more erratic than initially assumed. The BGR studies mention that since 1979 ground water has been mined from the Karst Aquifers.

Table 1 Utilisation of the Karst Aquifers

					Permits Issued		Still
Catch-ment	Area (ha)	Area with Carbonate Rocks (ha)	Assumed Recharge[1] (Mm^3/a)	Allocated to Irrigation[1] (Mm^3/a)	Domestic / Industrial (Mm^3/a)	Irrigation (Mm^3/a)	available for irrigation (Mm^3/a)
A	420 333	265 041	26.5	13.2	-	5.1	8.1
B	309 792	206 021	20.6	10.3	8.0	2.0	8.3
C	66 083	32 937	3.3	1.6	1.5	-	1.6
D	96 687	56 708	5.7	2.8	6.4	0.2	-[2]
E	89 521	34 604	3.5	1.7	2.6	-	-[2]
Total:	**982 416**	**595 311**	**59.6**	**29.6**	**18.5**	**7.3**	**18.0**

Note: [1]: Based on the 1992 calculations (See Reference 5). The BGR studies show a much lower recharge.

[2]: All available water has been set aside for Domestic, Livestock and Industrial use. Further permits for irrigation only to be considered in extreme cases.

Based on the 1992 calculations it appears that Areas A and B seem to have a reasonable volume of water available for utilisation. On the other hand these areas have not as yet been studied in great detail. Only an preliminary study was performed by the Department of Water Affairs in 1989 (See Reference 4) and the areas were not part of the BGR investigations. It is recommended that the potential for ground water abstraction in these areas be investigated. A project proposal has been compiled. The Government of Japan has indicated interest in funding the study.

☛ **No further irrigation development in this area is therefore recommended.**

1.2 Stampriet basin aquifer

A survey was carried out throughout the Stampriet Artesian Basin in the late eighties to investigate the management aspects regarding the development and use of the groundwater resources and, in the long-term, to evaluate the stored groundwater reserves and annual recharge. The latter has not as yet been established, but regarding the use of the groundwater resources, it was found that a total volume of 9.5 Mm^3/annum was abstracted. Further details are listed in **TabLE 2**.

Table 2 **Abstraction and Use of Groundwater in the Stampriet Artesian Basin**

ABSTRACTION from:	(Mm^3/annum)	Utilisation for:	(Mm^3/annum)
Artesian Aquifers:	6.9	Domestic purposes:	1.4
Kalahari Aquifers:	2.6	Live stock watering:	1.1
		Irrigation:	7.0
Total:	**9.5**	**Total:**	**9.5**

☛ **From the above one can conclude that the volumes of water available from the larger regional groundwater resources are limited and that recharge is very low, resulting in mining of the groundwater resources, which is not a long-term sustainable option. Although irrigation is possible using water abstracted from the larger regional groundwater resources, water supply on this basis would not be sustainable.**

Other, smaller groundwater aquifers do exist throughout the country. Available volumes of water from those aquifers are extremely limited, but can be used by the people in the area for small scale irrigation of their vegetable growing gardens.

Apart from the limited quantities of groundwater resources in Namibia the water quality of the groundwater resources is also of concern. Groundwater tends to contain elevated concentrations of dissolved solids and is usually not compatible with the soils available for irrigation. This then inevitably results in salinity problems of the irrigated soil.

When compared to the volumes of water flowing down the perennial border rivers one can conclude that the main emphasis on further development of irrigation should be along the perennial rivers in the south and north of Namibia.

1.3 Khowarib aquifer

Khowarib, Warmquelle and Sesfontein are the main settlements in the area and situated along the Hoanib River. A number of fountains are found in the river basin and all three settlements developed around larger fountains or a concentration of a number of fountains.

The area is semi-desert. On the surface the impression is that abundant water is available. Historically the water was used mainly for irrigation purposes. At present however the settlements are growing larger and the competition for water is increasing. Sesfontein is already outgrowing its water resources and a shortage of water for irrigation is already being experienced.

In the Khowarib/Warmquelle area an underground aquifer was investigated which showed potential for limited irrigation extension. A pump height of 40 metres, no electricity and the remoteness of the area will result in very high development costs. With regard to underground investigations, one has to realise and accept that certain unknown factors will always be present adding to the risk that the environment can suffer irreversible damage. Any development must thus be undertaken with great care to ensure sustainability.

☞ **The additional water that may be available from the aquifer in the Khowarib/Ogongo area may sustain only a further 20 hectares under irrigation.**

1.4 Hardap dam

The dam has a capacity of 240 x 10^6 m^3 and can, with a 95 % safe yield of 40 x 10^6 m^3 per annum in the medium term. The dam was completed in 1962. The irrigation potential is fully developed and 2 000 hectares below the dam receive water under gravity.

☞ **The dam is fully utilised and no significant expansion in irrigated land is expected.**
The dam wall can not be further raised.

1.5 Naute dam

The dam has a capacity of 80 x 10^6 m^3 with a 95 % safe yield of 12 x 10^6 m^3 per annum for irrigation in the medium term. Approximately half of the dam's rrigation development potential has been realised.

☞ **Development of a further 300 hectares can be expected in near future.**

1.6 Oanob dam

The Oanob Dam is situated ± 7 km west of Rehoboth in the Oanob River. The dam has a capacity of 35 x 10^6 m^3 water but only 2 x 10^6 m^3/yr is available for irrigation purposes up to the year 2010. After 2010, the available quantity of water for irrigation purposes will decrease due to an increase in the domestic water demand from the town. This increased usage from the town will however result in an increase in the effluent from the town which can be mixed with the water from the dam to sustain a small irrigation scheme. The acceptability of this is however questionable. Another constraint is the distance of the water abstraction point from the available soils. This will result in a very expensive supply line and thus high cost per hectare developed.

☛ **In the long term, an opportunity for sustainable irrigation development for approximately 80 hectares exists. Production of food crops is not recommended.**

1.7 Proposed Brukaros dam

The proposed Brukaros Dam is situated just east of the Brukkaros mountain in the Fish River. The dam itself will be relatively small (30 x 10^6 m³) but it has a safe yield of 22 x 10^6 m³ per annum. This is enough water to irrigate 1 000 ha. The soils of the area have a high saline content, are also shallow and of low production potential. A feasibility study has been completed recently which recommended the development under certain conditions. Preliminary figures indicate that the project will never be feasible if it has to repay all capital costs. If the capital cost of the dam as well as some other development costs are ignored and high value crops are grown commercially, then it may become feasible after year 15.

☛ **The area offers a possibility for the development of 1 000 hectares. The conditions however are not very favourable and high capital investment is required. Because of the poor soils and expensive water, the production of high value crops, preferably for the export market is recommended.**

1.8 Orange River

The Orange River forms the southern border of Namibia with South Africa over a distance of approximately 600 km. Negotiations regarding Namibia's allocation of the water are still in progress by the Permanent Water Commission, where Namibia and South Africa are represented, but it can be safely assumed that enough water (± 155x10^6 m³/annum) is available and sufficient to develop the limited areas on the Namibian side. The flow in the river is almost entirely regulated by upstream dams in South Africa. A total area of approximately 7 000 hectares scattered along the river seem to be suitable for irrigation development while approximately 2 000 are developed at this stage. However factors such as distance from markets, inaccessibility of some regions, and the fact that some areas such as Daberas might be mined will play a role in project viability.

Soils on the Namibian side are not only limited, but in the majority of cases, they have a low agricultural potential. Several studies have been carried out to identify those with the highest potential. The climatic conditions are very harsh with very high temperatures, low humidity and virtually no rainfall but the production of fruit and especially table grapes offer exceptional opportunities for out of season overseas marketing.

☞ **Rapid expansion of irrigation development along the Orange River is taking place and can be expected to continue for the short and medium term while a very attractive market for export table grapes exists.**

1.9 Kunene River

The only irrigable land, except for very small patches, available directly along the river is the Marien Fluss some 250 kilometres down stream from the Ruacana Falls and 170 kilometres north west of Opuwo. Development of this remote and isolated area, however, will only become an option once hydro power development in the lower Kunene becomes a reality.

At present water is pumped from the river at Calueque in Angola into a canal, built in the late sixties, to feed water into the North Central Region of Namibia and also nearer to suitable soils. Provision was made in the planning of the canal for the abstraction of 2,1 cumec for irrigation which can sustain approximately 1 200 hectares. This actually offers the only opportunity at this stage to utilize the river for irrigation. Water cost is therefore high.

Approximately 5 kilometres after the canal crosses the border, an abstraction system for 2.1 cumec was installed in 1998 to extract water for the Etunda irrigation scheme. This scheme is 50 % developed and extracts 1.05 cumec maximum demand at this stage.

Any water that is abstracted from the river above the hydroelectric power station at the Ruacana Falls means direct competition and therefore the economic value (including for example, the socio-economic value) of water becomes an important factor to be considered.

☞ **Expansion of irrigation development at the Etunda Irrigation Scheme can be expected in the short and medium term and new development in the Marien Fluss in the long term, where an extensive area can be developed with the availability of water will probably be the final limiting factor.**

1.10 Kavango River

The flow in the Kavango River upstream of the Cuito River confluence drops to very low levels during dry years. Heavy abstraction may cause serious damage to the ecology. The investigations regarding the abstraction of water from this section of the river for Windhoek via the North Eastern Water Carrier (NEWC) is already seen as problematic. The calculated abstraction for this purpose is 0.57 cumec which is the equivalent of only

400 hectares under irrigation. At present approximately 600 hectares are already irrigated from this section. The flow from the Cuito River, which flows into the Kavango further down stream, is more reliable and the flow below the confluence of the two rivers is much more favourable for irrigation.

Large scale water abstraction from the river will have to be negotiated and agreed with other basin countries.

Below the confluence of the Cuito, approximately 750 hectares are developed and irrigated. A further potential of 3 000 hectares exists of which the Dikuyu and Kangongo sites seem to be favourites.

☞ **It seems therefore apparent that any new large scale irrigation development from the section of the Kavango River upstream of the Cuito River confluence is not to be recommended.**

☞ **Gradual development of irrigation schemes below the Cuito to a total area of approximately 4 000 hectares can be expected in the medium term.**

1.11 Kwando/Linyanti/Chobe river system

The present flow in the river is as low as 8 cumec. Where floods up to 100 cumec were regular events some decades ago, maximum floods between 10 and 20 cumecs occurred during the past twenty years. The Linyanti river, which is the final outflow of the Kwando system which used to feed into the Liambezi – Chobe system, has dried up over some twenty kilometres up to Sangwali.

☞ **It is therefore clear that no significant irrigation development can occur along this river. Even medium scale abstraction from the system may lead to serious negative effects.**

1.12 Zambezi River

The Zambezi River is the richest water source that Namibia has. It offers possibilities for large scale irrigation up to 30 000 hectares. The whole area along the river is very flat. The area around Katima Mulilo is 15 to 20 metres above the water level while the patches of higher ground in the flood plains further down stream are not more than 5 metres above normal river flow level.

The **advantages** of large scale irrigation in this area can be summarised as follows: reasonable soils, high quality water, densely populated area offering labour and marketing, sub-tropical climate, low static pump heights, tarred road and airfield, area suitable for settlement of small scale farmers, high rainfall area where rain fed crop production is also practised, high crop production area makes it easier to establish and support agro industries.

The **disadvantages** are: insecure tenure in communal land, large scale irrigation development will require the displacement and resettlement of people as well as agreement with local authorities; transport of surplus production out of the area over long distances (approximately 1300 kilometres to Windhoek or to Walvis Bay). Local processing and value adding will therefore be essential, electricity supply is from Zambia at present and the capacity is limited and sporadic. Only Katima is provided with electricity with very limited distribution to sites nearby. Nampower however is busy with a regional development plan to extend the national grid (132kV line from Victoria Falls (Livingstone) via Zambia to Katima) into this area. Negotiations and agreements with other basin countries will have to be taken into account in any event.

Very little irrigation activity is taking place at this stage. The approximately 200 ha development at Katima Farm next to the Zambian border, and the 36 ha at Isisi, approximately 30 kilometres down stream of Katima, are worth mentioning.

☞ **Rapid irrigation development over large areas, up to 20 000 hectares can be expected in the short and medium term.**

B3 EXISTING DEVELOPMENT AND PROBLEMS EXPERIENCED

3.1 A list of irrigation developments and estimated potential in Namibia

See list under Section E5.

3.2 Information on some of the larger schemes

3.2.1 283 ha development at Noordoewer and 1 000 ha development on the farm Aussenkehr, drawing water from the Orange River

The Noordoewer irrigation scheme was established during the 1930's and consists of commercial plots served by an integrated canal system both on the South African side as well as the Namibian side (Noordoewer/Vioolsdrift Joint Irrigation Scheme). The present irrigated area on the Namibian and South African side is approximately 283 and 500 hectares respectively, but the greater part of the land lies below the flood level and no permanent infrastructure or crops can therefore be established. Flood irrigation is therefore mainly practised.

A large area for possible development was identified on the private farm Aussenkehr, some 50 kilometres down stream from Noordoewer. Approximately 5 000 ha seems to be available, of which approximately 1300 ha lies below the 60 metre contour above normal flow level. Of this approximately 700 ha are already developed, leaving a balance of approximately 600 ha reasonable low lying area that still could be developed. A large portion of this area however is under dispute and some parts are under diamond mining licences. The rest of the area rises as high as 300 metres above river and water will have to pumped over long distances.

A detailed soil survey of the state land between the border of the Aussenkehr farm and Noordoewer (open valley also called Tandjeskoppe) initially suggested that another 1200 hectares may be suitable for development, but a more recent investigation reduced it to only 350 ha. This underlines the fact that basically all soils in these areas are of low quality and are easily over-estimated. The water again has to be lifted a huge 180 metres.

At Noordoewer a further 760 ha of open state land was identified as suitable for irrigation development. The pumping height is up to 70 metres.

The **advantages** of developing these areas are that the basic infrastructure such as roads and electricity reticulation already exists. The main **disadvantage** is that the markets are ± 800 km away (Windhoek and Cape Town), however the area lies adjacent to the main road between the Republic of South Africa and the Republic of Namibia with heavy traffic going both ways. A unique advantage of the area is its warm winters where the occurrence of frost is rare. This makes the area very suitable for high value crops for export to out-of-season markets.

The **disadvantages** are that pumping heights are very high and soils are not only of lower potential but also of a complex nature requiring a high level of management. Marketing of a variety of products, especially those with a short shelf life like most of the vegetables, is a problem - the nearest market is ± 800 km away (Cape Town or Windhoek) while the local market is non-existent. Except for the workers of the two irrigation farms there are no people living in the area.

- ☞ **Rapid irrigation development is taking place along the Orange River, both on the Namibian and South African side, for the production of table grapes for the European and USA markets. The demand for irrigation on this river is already very high and an increase in related problems can be expected in future.**

- ☞ **While Namibia has no storage dams, irrigation development is dependent on flow regulation from dams in South Africa.**

- ☞ **Deterioration of water quality during low flow conditions is occurring more and more and during 1998 a phenomenon of green slimy water appeared over a long distance moving slowly down stream. Only after the first flood was it washed away.**

- ☞ **Poor selection of suitable soil for development at places on the Aussenkehr Farm led to drainage and salination problems.**

- ☞ **Uncontrolled squatting of seasonal workers at Aussenkehr Farm, numbering up to 2 500, is a cause for concern in terms of health risks as well as the stripping of riverine vegetation for fire wood.**

3.2.2 Etunda irrigation scheme drawing water from the Kunene River

Etunda was designed on the basis that equivalent areas (150 ha) for settlement and commercial farming should be provided in order to use the larger commercial active units, adjacent to the settlement areas as a pulling force for the small farmer to exercise commercial farming on the small holder plot - e.g. the commercial venture to carry most of the overhead costs, create/find/develop markets, organise transport etc., and the small farmer will have the opportunity as immediate neighbour, to "hook" onto the system. <u>Furthermore, the larger commercial units will remain Government property to allow Government to direct and guide the project.</u>

In the planning stage of the project it was realised that the production of low value crops in the long term is not viable and that an alternative for the short to medium term is necessary. The production of industrial tomatoes and the erection of a tomato paste factory was therefore investigated and included in the planning. This was never realised and marketing of a more conventional crop like maize is gradually becoming a problem as production increases. At present the project is developed to 50% of its potential.

The **advantage** of expanding the project to its full potential of 1 200 ha. is that a large portion of the infrastructure has now been built and can support the full development. The area earmarked for development is unpopulated and no resettlement is required. Expansion of the project will also have a benefit of scale for marketing purposes and will enhance the training of more settler farmers. The project has proved itself and no serious constraints, except for management, were encountered up to now. A fairly large airport is also only 20 kilometres away at Ruacana if export of exotic crops is considered.

The **disadvantage** of expanding the project to its full potential is that the water cost is high and this has a negative effect on the viability of the project. Furthermore water is abstracted from the Kunene River at Calueque in Angola, which may imply a security problem. Unless suitable alternative crops can be grown, marketing will become more of a problem.

- **Lack of continuity in proper management and discipline is experienced leading to poor performance and maintenance.**

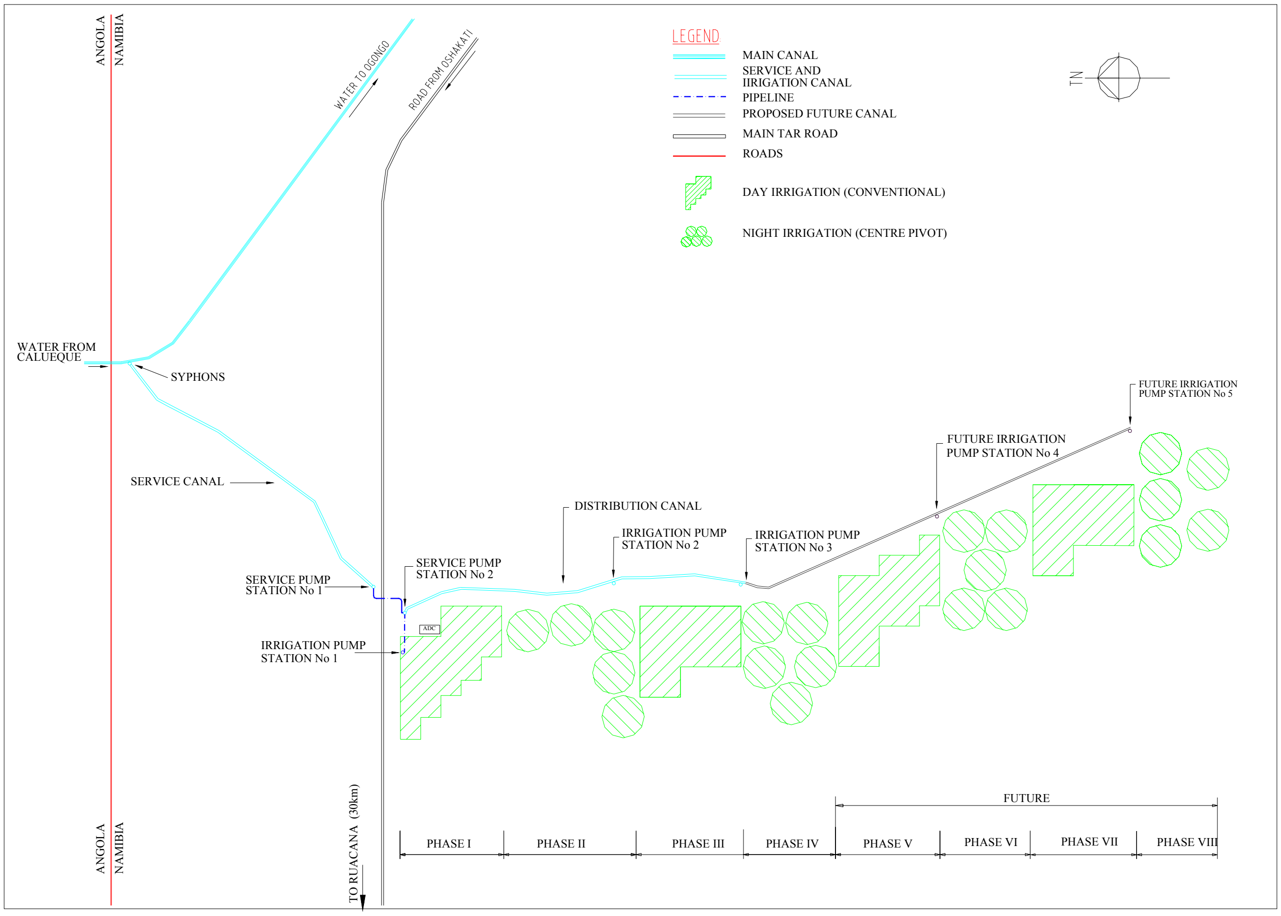
- **While the soil is very sandy, depletion of nutrients, inefficient irrigation and increase in acidity and certain negative mineral elements (such as aluminium) occur.**

- **Commitment to take the total development plan to the end, seems to endanger the future viability of the project.**

Figure 2 Layout of the Etunda Scheme

[overleaf]

Figure 2 Layout of the Etunda Scheme



3.2.3 Shadikongoro scheme drawing water from the Kavango River

Four larger schemes of similar nature and of approximate size were developed during the seventies by the Namibia Development Corporation along the Kavango River, each in one of the main tribal areas. Centre pivot irrigation systems are used. Historically these schemes were renowned for making losses and to be a constant financial burden on Government.

Since 1999, Shadikongoro was put under a new management on a share-in-profit basis for the farm manager. This of course immediately demands that the absolute correct choice for a manager is essential. Since then the project seems to be coping financially and good yields have been achieved.

- **Serious compaction of soil had occurred previously and required drastic and expensive measures to rectify.**

- **Incorrect water application rates by the centre pivot systems as well as the soil crust formation, led to excessive run off, resulting in poor penetration and inefficient water use.**

- **Because of poor control, weed accumulated and required huge effort to curb again.**

- **There was an abnormal increase of termites feeding on the crops.**

- **From the start there was a lack of a clear understanding between project management and the local authority. This led to continuous interference by local authority and resulted in unrest amongst the workers on more than one occasion. Eventually the farm manager was removed. The lesson to be learnt is that there should from the start of the project be a clear definition of the roles of project management and the local authority, and further, this understanding should be conveyed clearly to project employees.**

- **Final accountability seemed not to have been clearly determined and accepted.**

- **Overall an underestimation of the task of managing a farm of this magnitude and complexity on sound business principles seemed to have prevailed.**

- **Proper management in place has seemingly solved some of the problems experienced in the past.**

3.2.4 36 Hectare development at Isizi, near Kalimbeza, Caprivi

The **Isizi** area is approximately 20 kilometers down stream from Katima and in the floodplain. The average height of the ground above normal river flow level is 10 metres. The Namibia Development Corporation (NDC) conducted successful trials with rice during the early eighties but commercial production was never realised. Large scale rice production, which was primarily regarded as the responsibility of Government, did not follow for two reasons. In the first place the necessary funds could not be raised and secondly the local people seemed unable to use the "paddy system", therefore settlement of small scale farmers also did not get off the ground.

Background to the project

The Isizi project was started in the 1980's with the aim of producing rice in the Caprivi Region. The project is located approximately 30km east of Katima Mulilo at Kalimbeza Island.

Rice was produced on the flood plain adjacent the island and due to the high clay content of the soil a "paddy" model was used. The trial plantings (36 ha) showed potential and the project was identified as a potential project for foreign investment. However, at that stage there was no interest.

In order to keep the project operational it was decided to settle small scale farmers at the project. Unfortunately, the paddy system was not acceptable to them and this effort was stopped.

After independence LONRHO did a pre-feasibility study on sugar cane production in the Caprivi Region and used the Isizi project for plant material multiplication. Their activities came to an end during 1995. Since then the NDC kept the sugar cane alive for some time but then abandoned it.

The following infrastructure is available at the project:

- Flat/office facilities
- Shed
- 1 labour house
- Canal system and pumps to flood irrigate 40 ha
-

<u>Positive Factors</u>

- Basic infrastructure available
- PTO (Permission to Occupy) for this project already arranged
- Sugar cane growth showed potential

Negative Factors

- Project is cut off from the main roads during heavy rainy seasons
- Production activities to take place in a flood plain
-

Documentation Available

A study was done by Loxton, Venn and Associates regarding rice production in the area.

☛ **The major reason for this project to have come to a stand still after very valuable research work was done, was the lack of adequate funds and commitment, in this case by the Government, to take the planned development through all its stages right up to the end. This again could have been failure to determine responsibility and accountability at an early stage. For example, NDC considered themselves responsible for project implementation/research, but not for project maintenance.**

3.2.5 Hardap Scheme where 2 000 hectares of irrigation land receives water under gravity from the Hardap Dam

The scheme was developed in the early sixties. The low quality of the soil (high salt content and poor drainage) over large areas of the scheme led to the abandonment of certain areas allocated to farmers. Through the years, as knowledge and competition increased, farmers returned to these areas and solved most of the initial problems.

The Government, through the Department of Water Affairs, remained responsible for maintenance of all infrastructure and surface drainage as well as for care of the riverbed. The farmers were never involved in any maintenance programme. During 1986 a subsurface drainage system was installed in certain areas where salination of the soil reached critical levels. Even in this case no proper maintenance programme was put in place including the involvement of farmers.

Until now, farmers are paying a low tariff for water, which does not cover full operation and maintenance costs. Flood irrigation is still mainly practised although a steady move towards mechanized irrigation has taken place over the last decade. At this stage, the overall efficiency of water use by irrigators seems to be in the order of 70%, which is acceptable.

Over the years the under ground drainage system became blocked and the surface drainage canals and riverbed became infested with reeds *(Phragmites australis*) which are posing a severe problem of blocking the flow during floods. At present the natural ("original") carrying capacity of the river is reduced, because of this situation, by approximately 25 % (from 1 200 to 900 cumec). Blocking of the canals also caused a slow drainage of ground water, exacerbated by flood irrigation resulted in a rise and maintenance of a high water table.

Heavy rains caused flooding of the town of Mariental in 1972, 1997 and again in 2000. During March 2000 a flood of 2 100 cumec was released from the dam at one time, which totally inundated the floodplain. Although it is, under these circumstances, difficult to determine the extent to which the reed growth in the flood path contributed to the high water levels, it surely did aggravate the disaster.

Apart from reeds, uncontrolled growth of Prosopis trees along the banks and in the riverbed also added to the problem. Since 1991 costly efforts have been made to solve the problem of vegetation blocking the drainage system as well as the rise in ground water table.

☛ **The failure to determine responsibility and accountability, which resulted in poor management, led to enormous problems and to eventual deterioration of the project.**

☛ **Huge and costly efforts will now be required to rectify the problem.**

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