Ex Post-Evaluation Brief
Namibia: Wastewater Recovery Windhoek

Programme/Client	Wastewater Recovery Windhoek BMZ ID 1996 65 852	
Programme executing agency	City of Windhoek	
Year of sample/ex post evaluation report: 2009*/2011		
	Appraisal (planned)	Ex post-evaluation (actual)
Investment costs (total)	EUR 12.88 million	EUR 17.7 million
Counterpart contribution (company) (from guarantees)	EUR 3.32 million ---	EUR 6.80 million EUR 1.70 million
Funding, of which budget funds (BMZ)	EUR 9.56 million	EUR 9.56 million

* random sample

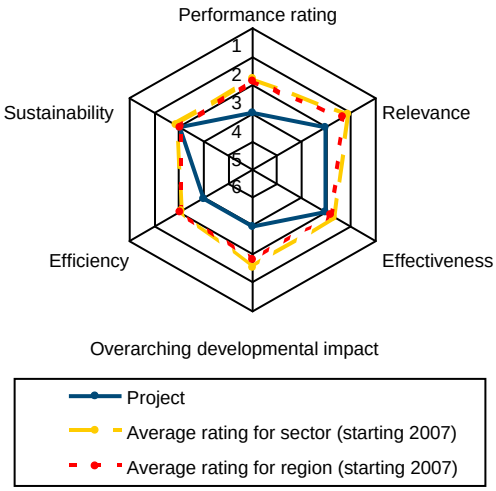
Project description: To alleviate the general shortage of water resources, the capital Windhoek was to be supplied with water largely independent of rainfall by mixing treated sewage with surface water from the Goreangab Reservoir and then purified in the recovery plant for drinking water. For this, a plant capacity of 21,000 m³/day was installed and the whole facility equipped to meet hygiene requirements. Complementary staff support comprised advice in privatising operation (drafting and monitoring the operator contract), critical guidance in improving the capacity of the water laboratory and operations optimisation.

Objective: The overall objective was to contribute to economic and social development in the city of Windhoek and to the conservation of scarce water resources. This was to be achieved – by 2010 at the latest – by means of continuously supplying drinking water with reduced dependency on rainfall (project objective), to be measured by (1) an annual consumption of at least 5.1 million m³ of wastewater for drinking water purposes, and/or (2) a 67% utilisation of the plant's capacity, (3) drinking water quality according to WHO standards and (4) stable per capita consumption rates. The target group comprised all consumers in the city of Windhoek, including previously disadvantaged groups in the old and new suburban neighbourhoods.

Overall rating: 4

Start-up problems continued for 7 years up to 2009; since then, the recovery plant has delivered approx. 5.5 million m³ of drinking water a year, meeting 26% of the annual water demand in Windhoek. Since 2007, overall groundwater extraction fell below the natural recharge rate (<1.7 million m³/year), which enabled the aquifer's recovery. However, the conceptual design did not adequately take into account the overall water resource situation: due to increased organic pollution (triggered by high population growth and/or informal settlements in watersheds as well as sub-standard treatment plants), parts of the drinking water reservoirs are no longer usable. The long-term sustainability of the environmental impact and the supply system itself is therefore in doubt.

Rating by DAC criteria



EVALUATION SUMMARY

Overall rating: The project is assessed as unsatisfactory, as

- the project facility only delivers the anticipated results seven years after start-up (and only thanks to additional efforts in system rationalisation by the project executing agency and the private operator) and

- the availability of usable water resources for Windhoek is increasingly precarious due to increasing pollution as a result of population growth and continuous high consumption rates

Despite evident beneficial results, the adverse effects predominate, with limited achievement of objectives. The contribution to groundwater resource conservation has so far been very limited. **Rating: 4**

Relevance: At project appraisal, the core problem was identified only in part. In principle, protection of groundwater reserves from overuse through wastewater recovery as well as increasing independence from rainfall remain valid today; although constituting necessary elements, they cannot be considered as sufficient in terms of integrated and sustainable water resource management. Other key concerns in this context were already evident at project start: For one thing, appropriate precautions should have been taken (e.g. demarcation of protection zones or similar) against the population influx, the spread of unofficial settlements and the resultant degradation of watersheds (above all Goreangab Reservoir); for another, no effective demand management was undertaken to reduce high per capita consumption rates.

The technology selected conformed with existing local methods in part. Two newly introduced treatment stages were, however, unfamiliar to the executing agency, which is why the decision was taken to assign those tasks to a private operator. Due to continuing deterioration of untreated water quality (Goreangab Reservoir, see above), the process for the technology selected and/or the initially planned purification method had to be upgraded to bring the plant near its scheduled capacity.

The intervention's objective corresponded to the previous and current priorities of the partner country: Wastewater recovery and groundwater recharge are still relevant today for reducing dependency on rainfall in times of crisis. That does not, however, mean that the core problem in this particular case was correctly addressed (see above). There is still a great need for integrated water resource management and the enactment and implementation of the necessary regulations.

The project conformed with the general goals and guidelines of BMZ and the priorities of German Development Cooperation with Namibia at the time. Cooperation with other donors, particularly the European Investment Bank (EIB), was well coordinated; in the

course of crafting a cofinancing arrangement, this also resulted in synchronised loan conditions. Altogether, relevance is assessed as satisfactory (Sub-Rating: 3).

Effectiveness: The project objective was the continuous medium-term supply of the population of the city of Windhoek with drinking water (until about 2008-2010), largely independent of rainfall. The following indicators were applied to measure achievement of this objective:

- Stable per capita consumption rates (by user group: high income ≤ 210 l/cd; medium ≤ 100 l/cd; low ≤ 60 l/cd)
  Status: exceeded by between 50% and 300% - not met

- Minimum capacity utilisation of recovery plant of 67% and/or > 5 million m^3/year
  Status: 7 years after start-up, i.e. continuously met as of 2009

- Outflow drinking water quality meets WHO standards
  Status: requirements largely adhered to - met (with close control and possible necessary cut-offs in the case of insufficient outflow quality)

- Quality of untreated water inflow in keeping with specifications in operator contract - new indicator
  Status: met only in part (Gorangeab Reservoir no longer usable)

Thanks to the ongoing commitment of the executing agency and operator, the set targets for drinking water delivery and quality have been predominantly met since 2009 – after remedying various operating problems that arose in the first 7 years. The other indicators, however, have not been satisfactorily met. Since 2009, about 26% of total consumption has been supplied through the wastewater recovery plant.

Altogether, the effectiveness, which cannot ultimately be attributed to the project alone, is assessed as satisfactory (Sub-Rating: 3).

Efficiency: The investment costs of the facility have increased by 24% from EUR 12.9 million to EUR 16.03 million (discounting for corrective works, which were partly financed from guarantees at about EUR 1.7 million). This was caused by (a) the conceptual change (construction instead of rehabilitation of the old wastewater recovery plant) with additional adjustments to design in the further course of implementation, (b) restricted competition among suppliers, especially for membrane filtration systems, and (c) implementation problems on the construction firm's side. Altogether, the investment costs amount to EUR 200 per additionally supplied resident and/or EUR 42 per supplied resident overall (without accounting for guarantee contributions). At EUR 0.70/m^3, dynamic operating costs are approx. 50% over the estimate at project appraisal, primarily due to the considerable increase in costs of energy and chemicals since then.

These costs make up only a part of total system costs (i.e. without secondary and tertiary networks and other water treatment facilities for delivering the remaining 74% of water demand). They seem adequate in comparison with industrialised countries. Considering (a) the above causes for cost increases, (b) the socio-economic conditions with extremely uneven income distribution and (c) very high specific per capita consumption, it is doubtful whether they can rate as reasonable.

Due to the design and the need to mix the recovered sewage with drinking water, only 76% of the planned project facility capacity can be utilised. This comparatively 'high' utilisation in operation so far was not reached until 2009. Due to operational problems, however, average capacity utilisation during 2003-2008 only amounted to 50%.

With effective demand management, a more cost-effective solution could have been found for saving water to adequately meet water demand and for protecting groundwater. Apart from the unofficial settlements in all other parts of the city (about 280,000 inhabitants), water savings of about 45 l/cd (without losses) would have sufficed to replace the capacity of the treatment plant. Specific household consumption would then still have averaged 143-261 l/cd in the target residential areas. In other words, approx. 45% to 75% of the additional water provided through the treatment plant since 1996 has served to meet higher specific consumption in wealthier residential areas.

The executing agency covers operating costs and earns a large part of its capital costs. Nevertheless, it incurs losses of EUR 2.8 million (2010) that are even likely to increase due to collection inefficiency (no information available). Pending necessary investments cannot be funded out of own resources, and the grant amount from the national budget cannot be raised substantially. The private plant operator, WINGOC, charges its services solely to the executing agency. It earns a profit and operates very efficiently.

Due to unsatisfactory production and in part also allocative efficiency, the overall efficiency of the project is assessed as unsatisfactory (Sub-Rating: 4).

Overarching developmental impact: In terms of overarching impacts, contributions were expected to Windhoek's economic and/or social development and to the conservation of scarce groundwater resources.

Classic water-borne diseases, such as diarrhoea, do not occur according to authoritative sources. However, the water quality in the whole system (i.e. not just related to the recovery plant) exceeds specific thresholds, notably for the parameters turbidity, aggressiveness, chloride, sodium, bromate and nitrate. This poses considerable health hazards: Bromate is regarded as potentially carcinogenic; nitrate is dangerous for small children and can cause respiratory problems or even suffocation. The actual potential hazard cannot, however, be estimated with the available data.

The aquifer has been able to regenerate in the last 10 years – thanks to heavy rainfall, active groundwater recharging by the executing agency and to a smaller extent also as a result of the project. Since 2007, less than 1 million m³ of groundwater a year has been withdrawn, with the natural annual regeneration rate reaching 1.7 million m³. Where surplus water is available, the drinking water from the recovery plant will also be used for recharging groundwater, which will then make a much larger contribution to its regeneration. Here, however, prime attention must also be paid to issues of inflow quality and possibly critical concentrations of individual substances (see above) to prevent the pollution of the sensitive aquifer.

Municipal sewage and residential waste still cause serious pollution of the Goreangab Reservoir and – during heavier rainfall – also the Swakoppoort Reservoir: being the largest by volume (63 million m³), it also serves other surrounding towns. Operations at all three treatment plants run by the executing agency are regularly disrupted due to malfunction, and the agency is not in a financial position to adequately and timely invest into the necessary operational improvements. About 100,000 inhabitants in informal settlements would also have to be resettled to allow for demarcating the necessary water conservation zones.

Wastewater recovery for drinking water treatment in semi-arid areas was and still is a pilot technology; in the present case, however it calls for capital-intensive and (esp. in the long term) cost-intensive approaches, which by themselves cannot resolve the above-mentioned critical water resource situation. Despite its innovative design and its (limited) contribution to groundwater protection, the project's overarching developmental impacts are assessed as unsatisfactory due to the deteriorating quality of surface water, health hazards and the dangers for future supply security (Sub-Rating: 4).

Sustainability: The plant is operated efficiently and effectively. However, there are risks to sustainable operation due to the outflow quality of the Gammams treatment plant. This central treatment plant for wastewater recovery currently operates at its capacity limit and must be rehabilitated and enlarged to meet the necessary outflow quality standard. Otherwise it is at risk of being shut down more frequently or having to cope with operational problems.

In the next three years, a development programme of the Namibian Government will improve water supply and sewage disposal in the informal settlements with an investment of N$ 300 million (about EUR 30 million). This can only help improve outflow quality (and the resource situation described above), if both the Gammams and the other two treatment plants are rehabilitated and extended by then.

The sustainability of overall water supply in Windhoek will also depend heavily on efforts for a proactive, integrated water resource conservation approach. The end-of-pipe solution adopted to date will not be effective in the long term. Both integrated water resource

management (IWRM) and the strategic development of new water reserves are critical success factors.

As the project has already been in operation for 10 years and short-term sustainability appears assured, overall sustainability is assessed as satisfactory. At the time of evaluation, the responsible agencies are presumably aware of the need for additional measures and are expected to take appropriate steps (Sub-Rating 3).

Notes on the methods used to evaluate project success (project rating)

Projects (and programmes) are evaluated on a six-point scale, the criteria being relevance, effectiveness, efficiency and overarching developmental impact. The ratings are also used to arrive at a final assessment of a project's overall developmental efficacy. The scale is as follows:

1	Very good result that clearly exceeds expectations
2	Good result, fully in line with expectations and without any significant shortcomings
3	Satisfactory result – project falls short of expectations but the positive results dominate
4	Unsatisfactory result – significantly below expectations, with negative results dominating despite discernible positive results
5	Clearly inadequate result – despite some positive partial results, the negative results clearly dominate
6	The project has no impact or the situation has actually deteriorated

Ratings 1-3 denote a positive or successful assessment while ratings 4-6 denote a not positive or unsuccessful assessment

Sustainability is evaluated according to the following four-point scale:

Sustainability level 1 (very good sustainability) The developmental efficacy of the project (positive to date) is very likely to continue undiminished or even increase.

Sustainability level 2 (good sustainability): The developmental efficacy of the project (positive to date) is very likely to decline only minimally but remain positive overall. (This is what can normally be expected).

Sustainability level 3 (satisfactory sustainability): The developmental efficacy of the project (positive to date) is very likely to decline significantly but remain positive overall. This rating is also assigned if the sustainability of a project is considered inadequate up to the time of the ex post evaluation but is very likely to evolve positively so that the project will ultimately achieve positive developmental efficacy.

Sustainability level 4 (inadequate sustainability): The developmental efficacy of the project is inadequate up to the time of the ex post evaluation and is very unlikely to improve. This rating is also assigned if the sustainability that has been positively evaluated to date is very likely to deteriorate severely and no longer meet the level 3 criteria.

The overall rating on the six-point scale is compiled from a weighting of all five individual criteria as appropriate to the project in question. Ratings 1-3 of the overall rating denote a "successful" project while ratings 4-6 denote an "unsuccessful" project. It should be noted that a project can generally be considered developmentally "successful" only if the achievement of the project objective ("effectiveness"), the impact on the overall objective ("overarching developmental impact") and the sustainability are rated at least "satisfactory" (rating 3).