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**REPORT OF ANALYSIS OF THE CASE STUDY ON THE DRINKING WATER SUPPLY IN
THE RABAT-CASABLANCA COASTAL AREA**

Final report

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INTRODUCTION

The Rabat-Casablanca coastal area has a total population of some 4,900,000 inhabitants, or nearly 45% of the total urban population of the Kingdom of Morocco. The population connected to the drinking water supply is estimated at nearly 4,475,000 or almost 90% of the total population of the area.

This area, in which more than 70% of the country's economic activity is concentrated, is situated in a region where the available water resources are low; the annual average provided by the *wadis* of the region barely exceeds 100 million m³, or a little under 20 m³ per inhabitant per year.

Since the 1930s, to supply water to this area has meant creating an underground water transfer system from the water table (*nappe*) of Fourart which is nearly 140 Km north of the town of Casablanca.

From the 1950s onwards, the drinking water supply to the coastal area was significantly disrupted because of the rapid growth in demand for water due to major economic and social development, the democratisation of access to water and accelerating urbanisation, all of which decided the public authorities to undertake a regional master plan. This crisis in the drinking water supply to the coastal area led to the launch of the first master plan for the coastal area, and the application of emergency measures to ease the water deficit. These emergency measures, which principally concerned the mobilisation of water from the Bouregreg basin, formed the first transfer of water for drinking purposes.

Since then, the drinking water supply to this area has required the creation of a major hydraulic infrastructure, consisting of a large dam, 350 Km of conduits with a throughput of the order of 12 m³/s, 36 reservoirs and water towers to store a total of nearly 800,000 m³, almost 5,294 Km of piping and of the order of 250,000 connections.

By the year 2000, this major hydraulic infrastructure produced something in the order of 270 million m³, or a net output of 150 litres per inhabitant per day. Out of this volume, nearly 170 million m³ were consumed and nearly 100 million m³ were wasted.

Planning studies made during the 1980s estimated the demand for drinking water in this area in 2020 would be nearly 890 million m³. To satisfy this demand for water means programming large engineering works to collect and transfer water, with a cost calculated at more than 8 billion dirhams.

The efforts deployed in managing the demand for water – mainly by introducing progressive pricing, making users aware of water saving, and adopting delegated management to private enterprise – have succeeded in shifting the water demand in the area noticeably.

This reduction in the demand for water obtained by introducing firm management of demand has enabled the engineering works, judged to be technically complex and costly, to be delayed by more than 20 years.

The aim of this report is to demonstrate the problems in providing drinking water for an area comprising several large urban areas, the increased performance in producing and distributing drinking water, the various steps taken in pricing, administration and technology to achieve rational use of water, and the impact that all these measures have had on controlling the demand for water.

ORGANISATION OF THE WATER INDUSTRY IN MOROCCO

The main departments involved in the drinking water industry are:

- the Ministry of Works which supervises the ONEP is responsible for managing the public distribution system, planning water resources, evaluating water resources and designing and building hydraulic structures;
- the Ministry of the Interior supervises the local authorities who are responsible for drinking water and sanitation;
- the Ministry of Health which is responsible for monitoring the quality of drinking water, and public health education and awareness;
- the ONEP (National Drinking Water Office) is responsible for planning the drinking water supply, designing, laying and managing water mains and controlling pollution of any water resource likely to be used for human consumption. It is responsible for the actual distribution and sanitation on behalf of local authorities at their request, by specific agreement;
- the private sector is essentially involved in the distribution of drinking water to the coastal area of Rabat-Casablanca and Tangiers-Tétouan.
- the Higher Water and Climate Council is responsible for laying down the broad guidelines of the national water policy, deliberating on any questions relating to development plans for water resources and to the legislation on water;
- the catchment area agencies, administered by a management committee consisting of all those responsible for water management, are charged with for organising and leading water management at the catchment-area level.

THE DEMAND FOR WATER

The demand for water in the Rabat-Casablanca coastal area which has been the subject of several studies has been evaluated as part of the master plan for managing water resources in the basins of the Sebou, the Bouregreg and the Oum Er Rbia. The objectives and parameters adopted in evaluating this demand for water may be summarised as follows:

- rate of connection of nearly 87% by 2020;
- average rate of growth of the domestic allocation of the order of 1.4%;
- rate of growth of industrial consumption of 4 to 7% during the period 1982-2020;
- overall yield of the order of 74% by 2020.

This demand for water, forecast at nearly 1145 million m³ by 2020, has formed the basis of the programme of hydraulic constructions aimed at meeting the need for water in the Rabat-Casablanca coastal area.

In order to satisfy this demand for water, the master plan for the management of water resources, approved by the Higher Water and Climate Council in 1991, recommended the building of three dams with a total capacity of 2400 million m³ to provide a regular flow of nearly 400 million m³, and the completion of a major project for conveying the water nearly 200 Km. The total cost of this work is in the region of 8 billion dirhams including nearly 5.7 billion dirhams for the transfer of water. This heavy investment represents nearly three times the total annual budget allocated for the entire water industry (drinking water, irrigation,

construction of dams, etc.); in other words, it would be difficult for the national budget to support.

The timetable for carrying out this work, arrived at in the master water resources development plan, recommended that it should be carried out as follows: raise the SMBA dam in 1997, build the Ouljet Boukhmiss dam in 2000; build the Tiddas dam in 2004 and carry out the water transfer project from 2007 onwards).

CHANGES IN THE WATER SUPPLY SITUATION

Overall, the demand for water in the various centres and towns of the Rabat-Casablanca coastal area has been practically stable since 1990. It has moved from a 4.5 to 5% growth rate recorded during the 1980s to a net regression of the order of 10% observed in the last two years.

The production of drinking water throughout this area rose to 270 Mm³ in 2000 as against 245 Mm³ in 1989 and 258 Mm³ in 1995, showing a mean annual growth rate of the order of 1.0%. This production has been reducing since 1998, the date when management was delegated to Greater Casablanca, by something like 10 million m³ between 1998 and 2000.

Unit production per inhabitant has shown a net regression, falling from 178 litres / inhabitant / day in 1989 to 150 litres /inhabitant / day in 2000, at a time when the population rose by nearly 50% – an annual growth rate of nearly 3.8%. Table 1 below summarises the changes in total production and unit production from 1989 to 2000.

Table 1. Changes in total production and unit production from 1989 to 2000

YEARS	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total production in 10⁶ m³	245	251	269	277	266	261	258	256	267	273	274	269
Unit production (litres per inhabitant per day)	178	177	185	185	173	166	160	115	159	159	156	150
Population Million inhabitants	3.7	3.8	3.97	4.08	4.20	4.32	4.41	4.5	4.60	4.7	4.79	4.9

Changes in total consumption

Total consumption, divided according to use into four main categories, has been marked by a considerable drop in consumption per head in the course of the last decade. The consumption "all uses combined" in relation to the total population did in fact fall from 124 litres /inhabitant/ day in 1989 to 100 litres/ inhabitant/ day in 2000. The unit consumption of the connected population who account for the majority of total consumption (of the order of 70%) fell from 111 litres/ inhabitant/ day in 1989 to 76 litres/ inhabitant/ day in 2000, a reduction of nearly 30%. (Table 2)

Table 2. Changes in total consumption from 1989 to 2000

YEARS	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Net unit consumption (l/person/day)	124	120	130	125	118	115	112	111	112	103	102	100
Unit consumption of the connected population (l/ person /day)	111	98	109	95	92	88	91	88	87	83	78	76
Administrative consumption (l/ person /day)	17	22	21	25	23	23	20	18	18	18	16.5	16.5

Changes in efficiency of distribution

Since 1998, drinking water in the Rabat-Casablanca coastal area has been distributed by private (LYDEC) and municipalities (REDAL). The overall efficiency of the area in the last ten years has hovered around 70%. In 2001, three years after the introduction of the private sector into drinking-water management, this rate has been improved by around 2 to 3%, giving water saving of the order of 10 million m³ (Table 3).

Table 3. Changes in efficiency of distribution from 1989 to 2000 (In %)

YEARS	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Greater Casa.	70	78	69	66	68	68	68	72	72	64	65.5	69
Rabat	77	82	79	82	75	80	80	82	77	77	76	74
Salé	83	71	77	68	72	77	75	69	73	71	97	97
Overall efficiency (transfer and distribution)	67.4	70.2	67	68	69	70	71	69	65	65	65	67

The considerable fall in the demand for water can be explained essentially by the steps taken, aimed at rationalising the use of drinking water. The main ones are:

- progressive pricing which, while favouring access to drinking water among low-income social groups, acts as an incentive against wastage;
- campaigns to raise awareness of the need to economise water;
- the installation of a system of payment by vouchers for public bodies. This category of subscribers used to pay for water consumption by internal administrative accounting procedures which were typically cumbersome and took no account of water saving.
- providing staff accommodation with meters and withdrawing shared meters;
- the introduction of the private sector in the distribution of the water.

PRICING

Pricing is the most dissuasive factor, which has contributed significantly to saving water and conserving water resources in the Rabat-Casablanca coastal area. In effect, the introduction of progressive pricing and large rises in the price of water, which had practically stagnated

before the 1980s, led to major reductions in the demand for water. The consumption bands currently applied are:

- Band 1: (introduced in 1980): 0 to 24 m³ per quarter. The prices for this band have risen about 15 times during the period 1982-2000. They practically quadrupled in this time;
- Band 2: (introduced in 1980): 24 to 60 m³ per quarter. The prices for this band have risen about 15 times during the period 1982-2000. They practically rose fivefold in this time;
- Band 3: (introduced in 1980): 60 to 90 m³ per quarter. The prices for this band have risen about 15 times during the period 1982-2000. They practically rose sevenfold in this time;
- Band 4: (introduced in 1998): more than 90 m³ per quarter.

Likewise, payment for sanitation has been introduced into the area since 1995. An additional 2 Dh/m³ are paid by subscribers for waste water treatment. This increase of the price of the water has contributed indirectly to the reduction of demand for water.

But the main pricing reform was introduced when management was delegated to the level of the coastal area. This reform brought in price revisions automatically through a revision formula whose parameters were laid down as part of the contract.

This price readjustment which proved effective in controlling the demand for water has been accompanied by an outreach programme to facilitate access to drinking water for low-income urban populations. This programme, whose objective is to provide easy payment facilities, has led to a substantial reduction in the supply of water through stand-pipes and a reduction in water wastage.

AWARENESS OF WATER SAVING

Public awareness plays a very important role in reducing wastage. From a survey carried out by the ONEP, it appears that subscribers who noticed the adverts consumed less than others. In addition, the impact of awareness programmes on young people has a considerable influence on household consumption, which led the ONEP to insist on raising the awareness of this category.

Children and young people were targeted by specific campaigns in schools, holiday camps, girls' homes, youth centres, shows and fairs by means of displays, exhibitions, competitions and the distribution of documents suited to different age groups.

For this, large-scale campaigns are launched annually in close collaboration with the Ministries of National Education, Youth and Sport, Health, Local Government and with the broader community (voluntary associations, NGOs, etc.).

The private companies which distribute water in the coastal area also make an effective contribution to raising the awareness of users towards water saving.

INSTITUTIONAL REFORM

The distribution of drinking water falls on local authorities who may, under the local government charter, either carry it out directly, or manage it by means of a Distribution Board, or entrust it to

the ONEP to manage, or to the private sector in the form of a concession or delegated management.

Until 1998, this distribution was handled in the Rabat-Casablanca coastal area by two state-owned distribution companies: the RAD for Greater Casablanca and the RED for the towns of Rabat and Salé.

Because of the substantial investments needed to distribute drinking water properly and to develop waste-water systems, the urban councils in this area delegated the management of drinking water and electricity distribution, and the management of the waste-water systems to the private sector. The aim is to:

- take advantage of investments financed by optimised external resources;
- take advantage of long-term vision and detailed planning which take into account the development of the town;
- provide a service in constant improvement, and bring the distribution systems up to international standards;
- take advantage of the knowledge and technological transfers developed by specialist companies in management and distribution of drinking water and waste-water disposal.

The private sector, namely the company LYDEC for the town of Greater Casablanca and REDAL for the towns of Rabat, Salé and Temara, uses its own capital and loan funds to cover the investment necessary for civil engineering projects, then maintains the service by accepting all the operating costs and risks, and finally hands the installations over free of charge to the public authority at the end of the concession.

The 30-year delegated management contract involves:

For the town of Greater Casablanca

- an investment of 30 billion dirhams of which 10 billion are provided by LYDEC. The drinking water sector will benefit from 21 billion dirhams of which 16 billion dirhams for waste water disposal;
- an improvement of 5% in the efficiency of distribution of drinking water during the first five years of the contract;
- an improvement of nearly 15% in the efficiency of distribution of drinking water during the first fifteen years of the contract .

For the towns of Rabat, Salé and Témara

- an investment of 13.745 billion dirhams. The drinking water sector will benefit from 9.517 billion dirhams of which 5.763 billion dirhams for waste water disposal;
- efficiency of 83% from year ten;
- efficiency of 85.5% from year twenty;
- 15,000 connections to low-income families in the first five years and connection to the network of all urban areas, served by stand-pipes;
- rate of service of 93.52% by the fifth year, 96.7% by the tenth year and approaching 100% from the twentieth year onwards;

The adoption of the delegated management throughout the Casablanca-Rabat coastal area has made a beneficial impact on the management of drinking water, since the sector has enjoyed major investment. This in turn has led to an improvement of 5.5% in the efficiency of drinking water distribution, providing a saving in drinking water of the order of 20 million m³ in the space of some 3 years.

TECHNICAL IMPROVEMENTS RELATING TO THE PREVENTION OF LOSS

The technical causes of water loss occur generally either in faulty metering, or through losses in the pipes and connections. These last two categories are leakage in the literal sense of the term. The volumes involved depend on the size and complexity of the installations.

Metering

Meters are the point of departure for any evaluation of malfunction in a drinking water supply system. Checking them, using qualified staff and suitable monitoring equipment, firstly enables losses to be accurately defined and located, and then enables improvements in efficiency to be defined more closely.

The replacement of jammed or defective meters was a major feature in the retrieval of water loss. Nearly 200,000 meters were exchanged or installed in Casablanca and Mohammédia during the years 1999 and 2000.

Detection of leaks

Leaks constitute the major part of water loss from a system. Reducing them can bring about substantial savings by bringing down the costs of exploitation directly linked to the volumes produced. Searching for leaks constitutes the best diagnosis of how a system is functioning and thus allows the weak points of the distribution to be identified and improvement works to be carried out.

Experience has shown that the systematic search for leaks is a long and costly process, given that this search needs to be maintained permanently to preserve the performance of the distribution system at its optimum.

Connections not provided with meters

Wastage of water is often found in public buildings and in connections not provided with meters such as fire hydrants, hose-pipe taps and certain public stand-pipes.

In addition, fire hydrants which are currently non-metered connections represent improper and uncontrolled points of use.

As for public bodies, several lines of action have been taken to help them to rationalise their consumption of water. The main ones are the system of payment by vouchers and individual connections being made obligatory in staff accommodation.

Now, budget forecasts for the consumption of water have to appear in the accounts of each public body, which then has to take the appropriate steps to avoid wastage and keep within the annual budget provision.

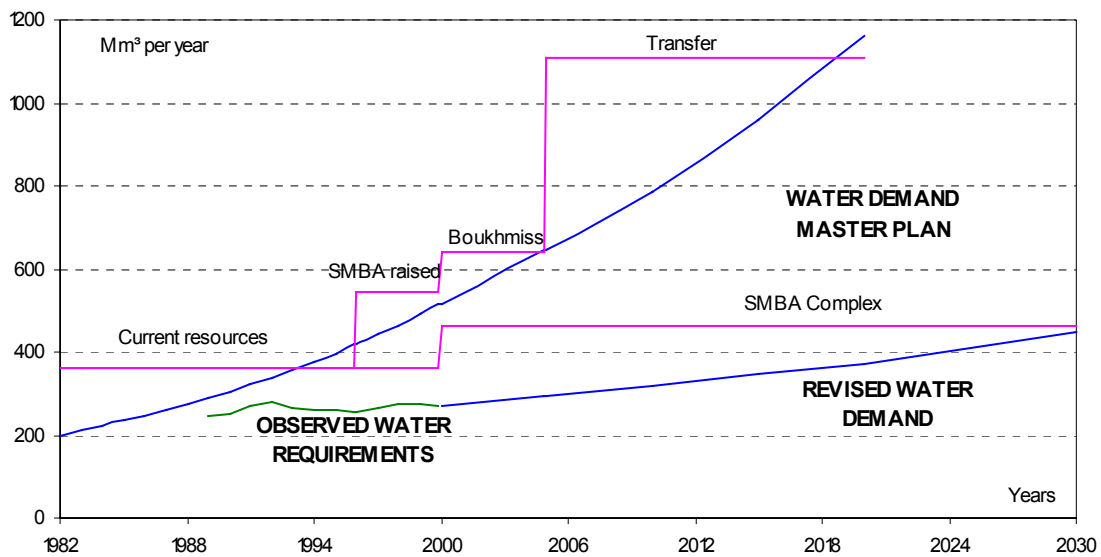
Instituting these measures has significantly reduced the consumption by public bodies in the coastal area, which contains the main public bodies in Morocco. A reduction of the order of 30% in this consumption which represents nearly 15% of the total consumption of the area has been recorded during the last seven years.

IMPACT OF THE INTEGRATED MANAGEMENT OF THE DEMAND FOR WATER

Integrating the management of water demand in the Rabat-Casablanca coastal area, particularly pricing and the recovery of costs, has significantly reduced the demand for water in this area. The forecasts for water demand are in the region of:

- 270 million m³ in 2000 instead of 409 million m³ initially forecast in the early 1980s. This substantial reduction has made it possible to delay the investment in building water retention dams;
- 380 million m³ in 2020 instead of nearly 1150 million m³ initially forecast in the early 1980s;
- 520 million m³ in 2030. This downwards revision in the demand for water makes it possible to delay the building of the large Tiddas dam and the water transfer project until beyond 2025. The timetable for carrying out this work is given in the diagram below;
- a noticeable reduction in waste water which substantially reduces the adverse impact on the environment. The adoption of delegated management which encourages the development of waste water management also benefits the protection of the environment;
- sustainable use of the hydraulic infrastructure thanks to the development of appropriate maintenance regimes;
- a reduction of the pressure on scarce and vulnerable water resources imposed by climate and pollution. Awareness of the drought observed over the last twenty years has meant revising downwards the amount of water available for drinking in the coastal area. The volume that can be collected by the dams already built or programmed in the Bouregreg basin is currently estimated at about 330 million m³ per year instead of 600 million m³ initially arrived at in the master plan for the catchment areas of the Sebou, the Oum Er Rbia and the Bouregreg. This problem alone of the scarceness of the resource demands that the management of water demand be firmly adopted, in order to control the growth in water demand. The demand for water of the order of 890 million m³ initially predicted is greater than all the water resources allocated to supply the Rabat-Casablanca coastal area, including 468 million m³ earmarked from the Sebou basin, which called for the creation of a major water transfer project.

TIMETABLE FOR CARRYING OUT CONSTRUCTION WORK



Conclusion

The supply of water to the Rabat-Casablanca coastal area, which contains nearly 40% of the urban population of Morocco and is home to some 70% of the country's economic activity, has called for the construction of major water catchment projects and will continue to do so. These are complex and costly.

The efforts to introduce water-saving measures have resulted in substantial reduction in the demand for water in this area. This control of the demand for water has proved cost-effective for the local authorities and the companies responsible for producing and distributing the water.

The principal lesson to draw from this experience is the need to firmly integrate the management of water demand into the water policy by adopting a deliberate pricing policy to stimulate sensible use and rationalisation of water. The participation of the private sector in the management and the distribution of drinking water can form a strategic orientation to benefit from the investments necessary to make a significant improvement in the drinking water service. The beneficial results achieved by the coastal area in this field have led the authorities to consider a more widespread use of delegated management in the other main urban areas with more than 300,000 inhabitants.

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