Water demand management in the context of water services

Tunisia

waterport
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Action 1.1 – Capacity Building on Water Demand Management in Jordan and Tunisia

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watersum.rec.org
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Water demand management in the context of water services Tunisia
Introduction

This report summarises the water demand management (WDM) findings of the inception period of the “Water Resources Management Good Practices and Knowledge Transfer” (WATER POrT) component of the project “Sustainable Use of Transboundary Water Resources and Water Security Management” (WATER SUM).

Based on site visits, interviews, a literature review and inputs provided by the national expert from Tunisia, the country’s water sector is analysed from the perspective of WDM. In addition to providing a brief overview of the hydrological situation and the institutional and legal framework under which the water sector operates, the authors cover WDM policies that have already been implemented in the urban drinking water service sector and in the field of irrigation, and assess the scope for additional measures as well as barriers to their implementation.

The report ends with an evaluation of the possible directions to be pursued in the field of WDM. It highlights good WDM practices in Tunisia that could serve as examples for other countries in the Middle East and North Africa (MENA), and it identifies prospective WDM measures that could be introduced in Tunisia, as well as barriers to their effective implementation.

Institutional structure and regulatory background

As shown in Figure 1, there are many institutional stakeholders involved in water management, most of them part of, or under the supervision of, the Ministry of Agriculture, Hydraulic Resources and Fishing. Others are under the umbrella of other ministries, such as the Ministry of Environment and Sustainable Development, the Ministry of Equipment, Housing and Land Planning, and the Ministry of Public Health.

Internal structure of the Ministry of Agriculture, Hydraulic Resources and Fishing

The organisational structure of the Ministry of Agriculture, Hydraulic Resources and Fishing is established by Decree No. 2001-420 of February 13, 2001.

The principal structures within the ministry that have tasks related directly or indirectly to water management are summarised below.

The main tasks of the General Department of Rural Engineering and Water Use (DGGREE) in relation to the water sector are to:

- rationalise the use of water, develop non-conventional water sources for use in agriculture, promote water users’ associations (WUAs) and study and implement instruments for WDM in the agricultural sector; and
- coordinate drinking water programmes in urban and rural areas, develop programmes for drinking water provision in rural areas, and monitor and assess the related projects.

The mission of the General Department of Water Resources (DGRE) is mainly to:

- set up and manage networks for measurements and monitoring in relation to the various components of the country’s water resources;
- develop principles and methods for the management and development of water resources, according to supply and demand;
Institutional structure and regulatory background

promote research and experimentation activities in order to ensure the development of conventional and non-conventional water resources; and

develop the bases of water resources mobilisation plans and their development.

The mission of the General Department of Great Hydraulic Works (DGGTH) is mainly to:

elaborate hydraulic studies;

elaborate studies on surface water control;

elaborate studies on water mobilisation;

elaborate studies of great hydraulic works for surface water mobilisation, such as dams;

construct dams, hill dams and great hydraulic works; and

control and ensure dam maintenance.
The Office of Planning and Hydraulic Balance (BPEH) is linked to the Office of the Minister of Agriculture. Its main mission is to:

- establish conventional and non-conventional water resources;
- determine the water needs of the various socioeconomic sectors;
- compile information on available and exploitable water resources;
- gather and analyse various water demands; and
- propose plans and programmes for the allocation of water resources to the various users based on offer and demand.

The main tasks of the General Department for the Development and Conservation of Agricultural Land (DGACTA) are to:

- develop plans and guidance for better soil and natural resources conservation, vegetation, water and agricultural land;
- propose, develop and promote measures to ensure the better use of natural resources;
- ensure coordination between all stakeholders in water and soil conservation;
- assess water and soil conservation management; and
- involve all operators in conservation efforts.

The regional agricultural development offices (CRDAs) are public administrative establishments, created by Law No. 89-44 of March 8, 1989, as amended by Law No. 94-116 of October 31, 1994, and placed under the supervision of the Ministry of Agriculture, Hydraulic Resources and Fishing. There are 24 CRDAs, one in each governorate, in charge of implementing the government’s agricultural policy. Their mission in relation to the water sector is mainly to:

- ensure the application of legislative measures and regulations related to its field of competence, in particular with regard to administrative water policy;
- ensure water and soil conservation, as well as watershed management;
- ensure the management of the hydraulic public domain;
- undertake actions related to hydraulic equipment and hydro-agricultural development programmes and projects, other than the national works determined by the Ministry of Agriculture; and
- manage hydro-agricultural infrastructure within public perimeters, ensure its maintenance and organise water supply for irrigation.

Public establishments in charge of water and sanitation

Besides the internal structures within the ministry, the state has created two public enterprises with legal personality and financial autonomy, which specialise in drinking water supply and sanitation, as well as another public utility in charge of raw water transportation, used partially in the process of drinking water supply.

The national drinking water utility (SONEDE) was created under the terms of Law No. 68-22 of July 2, 1968, as amended by Law No. 76-21 of January 21, 1976. This public establishment has an industrial and commercial nature, and is placed under the supervision of the Ministry of Agriculture, Hydraulic Resources and Fishing. Its mission is mainly to:

- produce, treat and transport water;
- supply water to all approved consumers throughout the territory of Tunisia within the framework of its monopoly, recognised by the law of establishment;
- manage, extend, renew and maintain the distribution network; and
- undertake development tasks, such as studies, works and supply.
The National Office for Sanitation (ONAS) was created under the terms of Law No. 37-74 of August 3, 1974, as amended by Law No. 93-41 of April 19, 1993. A public establishment of an industrial and commercial nature, it is placed under the supervision of the Ministry of Environment. Its main tasks are to:

- prepare master plans for urban sanitation, feasibility studies, exploratory studies and studies of implementation related to wastewater networks, sewage treatment and pumping plants;
- carry out sanitation projects and control projects carried out by other actors, such as property developers;
- operate and maintain sanitation networks and facilities in zones under its responsibility; and
- provide technical assistance to local governments and other public and private agencies in addressing water pollution.

In accordance with Decree No. 75-492 of July 26, 1975 (modified by Decree No. 2002-524 of February 27, 2002), SONEDE is authorised to invoice and collect sanitation water treatment levies (tariffs) on behalf of ONAS. The two enterprises have also made an agreement specifying practical implementation arrangements. The water bills issued and distributed by SONEDE are thus divided into two parts — one for drinking water consumption and another for sanitation.

The North Water Supply Channel Company (SECA du Nord) was created under the terms of Law No. 84-26 of May 11, 1984. This public establishment of an industrial and commercial nature is placed under the supervision of the Ministry of Agriculture, Hydraulic Resources and Fishing. Its main mission is to:

- ensure the operation, management and maintenance of canals and piped water supply used for transporting waters in the North as well as from the Ichkeul and Sidi Salem dams to the place of use; and
- distribute and sell water to the various bodies in charge of water distribution to final users.

The main volume of surface water used by SONEDE (85 percent in 2015) is supplied by SECA du Nord (330.2 million m³ in 2015) via its various infrastructure elements (see Table 1). This volume increased in the five years up to 2015 due to the declining level of groundwater, which is the other main traditional source of water for SONEDE. The relationship between the two enterprises is defined in an agreement that states the volumes of raw water transferred and the terms of payment.

Inventory of laws and regulations

The main legislative texts and regulations relating to water and sanitation are listed below.

- Article 44 of the Tunisian Constitution, approved on January 27, 2014, states that: “The right to water shall be guaranteed. The conservation and rational use of water is a duty of the state and of society.”
- The Water Code, promulgated by Law No. 16-75 of March 31, 1975, as amended and supplemented by subsequent texts.
- Law No. 95-70 of July 17, 1995, on water and soil conservation.
- Law No. 68-22 of July 2, 1968, authorising the creation of the national drinking water utility (SONEDE), as amended by Law No. 76-21 of January 21, 1976.
- Law No. 74-37 of August 3, 1974, authorising the creation of the National Office for Sanitation (ONAS), as amended by Law No. 93-41 of April 19, 1993.
- Law No. 84-26 of November 5, 1984, authorising the creation of the North Water Supply Canal Company (SECA du Nord).
Institutional structure and regulatory background

- Decree No. 75-492 of July 26, 1975, giving SONede responsibility for sanitation water treatment fees billing and collection on behalf of ONAS (modified by Decree No. 2002-524 of February 27, 2002).
- Decree No. 73-515 of October 30, 1973, approving the regulation on water subscriptions, as modified by subsequent decrees.
- Decree No. 94-2050 of October 3, 1994, establishing the conditions for connection to the public sanitation networks in the areas of intervention of ONAS, as modified by Decree No. 2001-1534 of June 25, 2001.
- Decree No. 2002-335 of February 14, 2002, establishing the point at which water consumption is subject to a technical diagnosis, periodic and mandatory equipment, work and production methods related to the use of water, conditions of appointment of experts, and the nature of the diagnoses and their periodicity.
- Decree No. 2006-2112 of July 31, 2006, approving the specifications for the production and use of water from non-conventional water resources.
- Decision of the Minister of Agriculture, Hydraulic Resources and Fishing and the Minister of Finance of May 19, 2016, modifying the decision of July 13, 2010, establishing the price of drinking water, the fixed and additional charges for water subscriptions, and the rates of contribution relating to connections to water meters.
- Decision of the Minister of Economy and Finance and the Minister of Equipment, Sustainable Development and Regional Planning of January 19, 2015, establishing the amount for sanitation fees.
- Decision of the Minister of Economy and Finances and the Minister of Agriculture of November 3, 2014, establishing the amount for fees for the use of water and sand from the hydraulic public domain.
- Decision of the Minister of Agriculture, Hydraulic Resources and Fishing of July 22, 2006, appointing experts (auditors) for the technical, periodic and mandatory diagnosis of equipment, work and production methods related to water use, supplemented by the Decision of the Minister of Agriculture and Environment of August 15, 2011.

### TABLE 1

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>North Waters GEG</td>
<td>122.3</td>
<td>131.7</td>
<td>153.5</td>
<td>147.4</td>
<td>164.0</td>
<td>173.6</td>
<td>5.9%</td>
</tr>
<tr>
<td>Masri</td>
<td>4.8</td>
<td>7.1</td>
<td>8.1</td>
<td>7.8</td>
<td>7.0</td>
<td>10.1</td>
<td>43.7%</td>
</tr>
<tr>
<td>Belli SP</td>
<td>93.3</td>
<td>95.4</td>
<td>97.3</td>
<td>106.5</td>
<td>112.0</td>
<td>116.6</td>
<td>4.1</td>
</tr>
<tr>
<td>Sajenane and Joumine</td>
<td>17.5</td>
<td>19.6</td>
<td>22.3</td>
<td>23.3</td>
<td>24.0</td>
<td>24.6</td>
<td>2.4%</td>
</tr>
<tr>
<td>Nebhana and Lebna</td>
<td>1.5</td>
<td>2.2</td>
<td>4.2</td>
<td>4.9</td>
<td>4.5</td>
<td>5.3</td>
<td>17.8%</td>
</tr>
<tr>
<td>Total water purchased</td>
<td>239.4</td>
<td>256.0</td>
<td>285.4</td>
<td>289.8</td>
<td>311.5</td>
<td>330.2</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

Source: SONede Statistics Report 2015
In relation to WDM, a series of principles and mechanisms have been introduced through the Water Code amendment, passed in 2001. Law No. 2001-116 of November 26, 2001, amended Chapter VI-A on water saving, introducing the following principles:

- Water is a national asset.
- Sustainability.
- Water saving is a means of developing and rationalising water resources use.
- Work carried out to develop water saving and to protect and improve the quality of national water resources is in the public interest (Article 86).

Among the key measures, this amendment:

- encourages the use and production of non-conventional water resources by the private sector (Article 88). The volume of desalinated water produced by the private sector is currently estimated at 10 million m³ per year. Some hotels have built small desalination plants to cover their own consumption, especially for the irrigation of green areas;
- establishes the technical, periodic and mandatory diagnosis of water systems (Article 89);
- includes provisions on a rationing system (Article 90);
- includes measures against water wastage (Article 91); and
- encourages water recycling by industry (Article 95).

At the same time, Decree No. 2001-2606 of November 9, 2001, amending Article 19 of the Water Code, introduced an important institutional reform via the establishment of the National Water Council, replacing the National Water Committee. The functions and composition of the council were strengthened to give this structure the necessary efficiency to play its full role.

The main prerogatives of this council in terms of water demand are to:

- suggest general principles for mobilisation and the enhancement of resource utilisation;
- contribute to programme development and resource mobilisation plans and measures to optimise their use; and
- present proposals for the development of a national water-saving policy.

All the texts described above have entered into force and are applicable. However, some implementing regulations are still pending, such as the text on drinking water standards. On the other hand, some provisions and regulations have not been fully implemented, especially since 2011 — in particular the provisions regarding the protection of public domain waters and water disconnection for non-payment of bills. According to Decree No. 73-515, Article 26, in the case of non-payment the contract can be terminated and the water supply cut off, although in reality such a measure is rarely applied.

A water law reform was initiated in 2009. A draft Water Code was submitted by the Ministry of Agriculture, Hydraulic Resources and Fishing to the Presidency of the Government at the end of 2014 and approved by the Council of Ministers in February 2016.

The hydrological situation and water balance

Surface water

Hydrological studies have evaluated the average intake of surface water in the Tunisian river system at approximately 2,630 million m³ per year, with significant variation across the years. This volume corresponds to potentially mobilised surface water resources with adequate hydraulic structures. These resources are divided between the major river basins of the country as follows:
• Medjerda: 1,000 million m³ per year;
• Far North: 585 million m³ per year;
• Ichkeul and Bizerte: 375 million m³ per year;
• Cap Bon and Meliane: 230 million m³ per year;
• Sahel and Centre (Zeroud-Merguellil, Sahel and Sfax): 320 million m³ per year; and
• South (Chotts Basin and Djefara): 120 million m³ per year.

Calculated across the three main regions of the country, the situation is as follows:

• North: 2,190 million m³ per year, of which 1,796 million m³ have a lower salinity below 1.5 g/l;
• Centre: 320 million m³ per year, of which 153 million m³ have a lower salinity below 1.5 g/l; and
• South: 120 million m³ per year, of which 5 million m³ have a lower salinity below 1.5 g/l.

The North apparently not only has more surface water, but a bigger share of this water is of good quality (82 percent in the North versus 4 percent in the South).

Tunisia shares a certain number of watercourses with its western neighbour, Algeria. The exchange of surface water between the two countries is about 300 million m³ per year to the benefit of Tunisia, and about 150 million m³ to the benefit of Algeria.

The most important cross-border river, and the only perennially flowing river in the country, is the Medjerda River, which flows for 460 km to the Gulf of Tunis. Its rate of discharge varies between 2 m³/s in the summer and 1,200 m³/s in the winter (in exceptional cases, during a flood, even reaching 2,000 m³/s), with an annual average flow of about 29 m³/s.

Despite the scarcity of surface water in the region, and the crucial role of the Medjerda, there is no binding convention or treaty between Tunisia and Algeria regarding shared watercourses. However, bearing in mind that agreements on land and sea borders are relatively recent, this situation should not be considered unusual. Nevertheless, the situation clearly highlights the vulnerability of water supply in Tunisia.

At the same time, there is continuous collaboration between the relevant institutions in the two countries, even at ministerial level.

In Tunisia, average annual rainfall is 220 mm, representing the equivalent of 36,000 million m³ per year of rain throughout the country. Following infiltration and evaporation, some of this precipitation becomes surface water, adjusted for cross-border flows. Surface water resources show a very high inter-annual variability, with a minimum of 780 million m³ per year, as observed in 1993–1994, and a maximum of 11,000 million m³ per year, as observed in 1969–1970, and a long-term annual figure of 2,630 million m³. Rainfall distribution in Tunisia is illustrated in Figure 2.
Groundwater

Groundwater resources that can be mobilised are estimated at around 2.1 billion m$^3$ per year, including:

- 1,486 million m$^3$ per year of renewable resources, representing 69.6 percent; and
- 650 million m$^3$ per year of non-renewable resources, or resources that are renewable on a small scale, representing 30.4 percent.

More recent figures are shown in Table 2, divided into the three main regions of the country. Renewable groundwater sources are more available in the North and to some extent in the Centre, while the South can be supplied mainly from non-renewable deep aquifers.

Good-quality groundwater is found in only 8 percent of shallow aquifers and 20 percent of deep aquifers. If we accept that saline water containing up to 3 g/l can be used in the agricultural sector and for the production of drinking water, then approximately 36 percent of groundwater resources are unsuitable for these two sectors, which account for most of the water demand. Even though the South enjoys relatively large groundwater resources, their use is limited due to problems with quality.

Another issue related to the deep fossil groundwater in the South — the North Western Sahara Aquifer System (NWSAS) — is the fact that the resource is shared by three countries: Algeria, Libya and Tunisia, as illustrated in Figure 3. The NWSAS comprises two superimposed thick aquifer layers: the Intercalary Continental formation, which is the thicker of the two and has the greater expanse; and the Terminal Complex, which is heavily exploited in the Algero-Tunisian Chotts region and in the Gulf of Sirte in Libya.

An agreement between the three countries on the utilisation of this non-renewable common water source is extremely important, as are monitoring and enforcement to ensure that each country complies with the agreement.

For several years, these water resources faced the threat of serious damage, including salinity and discharges, due to overexploitation and the lack of coordination between Tunisia, Algeria and Libya.

At the end of the 1990s, in recognition of the threat, the three riparian countries agreed to cooperate and launched a major joint study programme. The first phase of the programme focused on hydrogeology data, an information system and a consultation mechanism.

In 2006, the ministers in charge of water resources from the three governments signed a declaration on the implementation of a joint consultation mechanism, and in 2008 the mechanism secretariat was established with the help of the Sahara and Sahel Observatory in order to develop greater cooperation on the management and protection of these considerable water reserves, which cover an area of over 1 million km$^2$.

**Table 2: Potential water resources in Tunisia (million m$^3$)**

<table>
<thead>
<tr>
<th></th>
<th>North</th>
<th>Centre</th>
<th>South</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface water</td>
<td>2,185</td>
<td>290</td>
<td>225</td>
<td>2,700</td>
</tr>
<tr>
<td>Underground water</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phreatic tables</td>
<td>388</td>
<td>237</td>
<td>115</td>
<td>740</td>
</tr>
<tr>
<td>Water tables</td>
<td>285</td>
<td>220</td>
<td>895</td>
<td>1,400</td>
</tr>
<tr>
<td>Total</td>
<td>2,858</td>
<td>747</td>
<td>1,235</td>
<td>4,840</td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture, Hydraulic Resources and Fishing, 2008
The hydrological situation and water balance

**FIGURE 3** The North Western Sahara Aquifer System (Algeria, Libya and Tunisia)

**FIGURE 4** Past and projected future water demand, by sector (million m³)

Source: Tunisian Institute for Strategic Studies, 2014

Source: http://sass.oss-online.org
Initially, the aim of this organisation was to improve knowledge of NWSAS hydrological behaviour, the risks faced, and the related socioeconomic and environmental conditions. Based on the scientific studies, simulations and recommendations, the three states decided to establish a common management of the NWSAS through defined forms and mechanisms. These mechanisms include the Council of Ministers in Charge of Water (of the three countries), a standing technical committee and national committees. The secretariat of the NWSAS is hosted at the Sahara and Sahel Observatory. The structural coordinator is appointed on a rotating basis, and the funding is shared equally by Tunisia, Algeria and Libya. Currently, the mission of the NWSAS is limited to information exchange and consultation, without any inter-governmental regulation of the use of the resource.

Balancing supply and demand

As shown in Figure 4, the biggest water user in Tunisia is the agricultural sector, followed by the domestic sector, industry and tourism. While a slight decline is predicted in the use of irrigation water, other uses are forecasted to increase over the next two decades.

Tunisia experiences less water stress than some of the other MENA countries. However, with average available water resources of around 420 m$^3$ per capita per year, it is only just able to meet total demand, and in years of drought the situation can become very difficult. Even if, in a given year, there is sufficient water in the country, its spatial and temporal allocation is not compatible with consumption patterns. It is the task of a well-developed water governance system to accumulate and store water during wet seasons (in reservoirs) and to deliver it to locations where there is substantial demand (water transfer infrastructure).

The water transfer network in Tunisia is illustrated in Figure 5. The major water transfer axis in Tunisia connects the dams of Medjerda, Ichkeul and the far North to the greater Tunis area, Cap Bon.

### Table 3: Forecast water supply and demand

<table>
<thead>
<tr>
<th>Resources (million m$^3$)</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources available for use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional waters</td>
<td>3,090</td>
<td>2,792</td>
<td>2,732</td>
</tr>
<tr>
<td>Non-conventional waters</td>
<td>210</td>
<td>314</td>
<td>389</td>
</tr>
<tr>
<td>Total</td>
<td>3,300</td>
<td>3,196</td>
<td>3,121</td>
</tr>
<tr>
<td>Global water demand for all sectors (million m$^3$)</td>
<td>2,689</td>
<td>2,721</td>
<td>2,770</td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report, 2015
The hydrological situation and water balance

Drinking water services

SONEDE services

There were 2.72 million subscribers to SONEDE in 2015, distributed as shown in Table 4, and the total number of accounts is growing, with a 3 percent increase between 2014 and 2015.

Volumes of water supplied by SONEDE in 2015 are shown in Table 5, while recent trends with respect to major sources are presented in Table 6. Surface water and groundwater are equally important inputs for SONEDE, and during the last six years reliance on surface water resources (mainly provided by SECA du Nord) increased at a higher rate than groundwater use. Overall water use by SONEDE between 2010 and 2015 grew by a cumulative 23 percent. Sustained future growth rates of this scale will pose a challenge in terms of water resources.

and the eastern coast of the country. This transfer is used to meet the growing demand for drinking water and irrigation and to improve water quality in the Medjerda dam (salinity rate of 3 to 4 g/l) by mixing it with water that has a lower salinity from the Ichkeul dam and the far North (1 g/l).

As shown in Table 3 and Figure 6, demand is expected to grow in the future, and according to the forecast of the Office of Planning and Hydraulic Balance (BPEH) it will be met from the growing share of non-conventional sources over the next decade. A seawater desalination plant is currently under construction in Jerba, for example, with a capacity of 50,000 m³ per day. Two other plants are planned, one in Zarat (Gabès) with a capacity of 50,000 m³ and another in Sfax with a capacity of 100,000 m³, to meet the growing needs of the population in the south of the country. Wastewater reuse is also an option.

As Figure 6 shows, the gap between supply and demand is expected to become smaller, despite the increased use of non-conventional water supply sources. In this context, WDM, by scaling down demand, can give water managers some room for manoeuvre.
**TABLE 4** Structure of SONEDE consumers: Number of connections in 2014 and 2015

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number</td>
<td>%</td>
<td>Number</td>
</tr>
<tr>
<td>Domestic connected</td>
<td>2,512,455</td>
<td>95.2</td>
<td>2,592,396</td>
</tr>
<tr>
<td>- individual metering</td>
<td>2,520,838</td>
<td>99.9</td>
<td>2,590,829</td>
</tr>
<tr>
<td>- bulk metering</td>
<td>1,617</td>
<td>0.1</td>
<td>1,567</td>
</tr>
<tr>
<td>Domestic unconnected</td>
<td>892</td>
<td>0.03</td>
<td>847</td>
</tr>
<tr>
<td>Collective</td>
<td>107,051</td>
<td>4.1</td>
<td>109,309</td>
</tr>
<tr>
<td>Industry</td>
<td>14,668</td>
<td>0.6</td>
<td>14,785</td>
</tr>
<tr>
<td>Tourism</td>
<td>1,444</td>
<td>0.1</td>
<td>1,434</td>
</tr>
<tr>
<td>Various</td>
<td>1,393</td>
<td>0.1</td>
<td>1,375</td>
</tr>
<tr>
<td>Total</td>
<td>2,637,903</td>
<td>100</td>
<td>2,720,146</td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report 2015

**TABLE 5** Water production and delivery by SONEDE in 2015 (million m³)

<table>
<thead>
<tr>
<th>Source of water</th>
<th>SECA du Nord</th>
<th>Dams managed by SONEDE</th>
<th>Groundwater</th>
<th>Desalination</th>
<th>Deferrisation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water input</td>
<td>330.2</td>
<td>57.6</td>
<td>283.7</td>
<td></td>
<td></td>
<td>671.5</td>
</tr>
<tr>
<td>Produced water</td>
<td>372.5</td>
<td></td>
<td>248.0</td>
<td>18.0</td>
<td>8.0</td>
<td>646.5</td>
</tr>
<tr>
<td>Distributed water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>580.9</td>
</tr>
<tr>
<td>Water consumed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>447.7</td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report 2015

In 2015, of the 447.7 million m³ of consumed drinking water, 434.8 million m³ were billed, leaving 12.9 million m³ that were consumed but not billed, representing 2.9 percent of the total volume consumed. Over half of this non-billed amount (53.6 percent, or 6.9 million m³) was registered in the south of the country.

According to SONEDE, and with respect to the SONEDE drinking water network, in 2015 illegal consumption throughout the country was around 3.71 million m³, which is less than 1 percent of total consumption.
The distribution of billed water among consumer categories is shown in Table 7. The main driver of overall consumption is the domestic sector, as it represents over 76 percent of total consumption. Domestic consumption increased between 2014 and 2015, while drinking water use in industry and tourism declined, the latter due to the general decline in the tourism sector in 2015.

In 2015, the average quarterly domestic consumption of drinking water was 32.1 m$^3$ per connection, with a slightly higher figure in urban areas (32.2 m$^3$) than in rural areas (31.5 m$^3$). While household water consumption stood at around 100 l per person per day in urban areas (and 89.3 l per person per day in rural areas), the respective figure for the tourism sector was far higher, at 791 l per day per occupied bed.

### Table 6  Trends in water volumes at SONEDE by source (2010–2015)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Surface water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>million m$^3$</td>
<td>301.3</td>
<td>319.2</td>
<td>344.7</td>
<td>356.2</td>
<td>374.3</td>
<td>387.3</td>
<td>3.6%</td>
</tr>
<tr>
<td>%</td>
<td>55.5</td>
<td>55.6</td>
<td>57.3</td>
<td>56.7</td>
<td>57.5</td>
<td>57.8</td>
<td></td>
</tr>
<tr>
<td><strong>Groundwater</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>million m$^3$</td>
<td>242.1</td>
<td>244.5</td>
<td>256.6</td>
<td>272.5</td>
<td>276.3</td>
<td>283.7</td>
<td>2.7%</td>
</tr>
<tr>
<td>%</td>
<td>44.5</td>
<td>43.4</td>
<td>42.7</td>
<td>43.3</td>
<td>42.5</td>
<td>42.2</td>
<td></td>
</tr>
<tr>
<td><strong>Input volume</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>million m$^3$</td>
<td>543.4</td>
<td>563.7</td>
<td>601.3</td>
<td>628.7</td>
<td>650.6</td>
<td>671.5</td>
<td>3.2%</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report 2015

### Table 7  Delivered volume of drinking water and number of connections under different consumer categories (2015)

<table>
<thead>
<tr>
<th>Category</th>
<th>Volume</th>
<th>Connections</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>million m$^3$</td>
<td>%</td>
</tr>
<tr>
<td>Domestic connected</td>
<td>330.0</td>
<td>76.6</td>
</tr>
<tr>
<td>Domestic unconnected</td>
<td>13.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Collective</td>
<td>45.9</td>
<td>10.6</td>
</tr>
<tr>
<td>Industry</td>
<td>28.2</td>
<td>6.5</td>
</tr>
<tr>
<td>Tourism</td>
<td>12.3</td>
<td>2.8</td>
</tr>
<tr>
<td>Various</td>
<td>2.3</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>434.8</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report 2015
Figure 7 illustrates the clearly rising trend in water consumption by SONEDE’s domestic consumers in the last 15 years. This increase is mainly related to urbanisation and to the subsequent growth in the number of connections (see Table 7).

Table 8 provides an overview of key operating figures for SONEDE for an extended period covering approximately the last five decades. The number of desalination plants jumped from four to 11 between 2010 and 2014, indicating that water availability in the South is becoming critical.
Drinking water services

The global network performance of SONEDE is 70.7 percent — that is, almost 30 percent of the water is lost between water production and final delivery. This indicator has been worsening since 2000, suggesting that funds for network reconstruction and maintenance are insufficient. Most water loss takes place within the distribution network, where efficiency is 76.7 percent: in other words, about 23 percent of the incoming water is lost during transportation. There is substantial variation behind this national average figure: between a minimum of 52.5 percent in the district of Tataouine and a maximum of 91.2 percent in the district of Grombalia.

According to SONEDE, more than 90 percent of the population served by its network consumes drinking water of a quality that conforms to the Tunisian standard (NT 09.14). In 2015, the number of samples used by SONEDE for bacteriological analyses reached 48,690 (see Table 9). The average percentage of unsuitable cases for the whole of Tunisia remains below the limit required by the Tunisian standard (NT 09.14) and the 5 percent threshold tolerated by the WHO.

TABLE 9  Results of drinking water sample analysis in Tunisia

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of samples taken</td>
<td>47569</td>
<td>48251</td>
<td>48251</td>
<td>47898</td>
<td>48526</td>
<td>48690</td>
</tr>
<tr>
<td>Clean cases (%)</td>
<td>99.1</td>
<td>99.0</td>
<td>98.5</td>
<td>98.2</td>
<td>98.2</td>
<td>97.8</td>
</tr>
<tr>
<td>Dirty cases (%)</td>
<td>0.9</td>
<td>1.0</td>
<td>1.5</td>
<td>1.8</td>
<td>1.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Number of samples for 10³ subscribers</td>
<td>21</td>
<td>21</td>
<td>20</td>
<td>19</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

Source: SONEDE Statistics Report 2015
SONEDE tariffs

Article 24 of Decree No. 73-515 of October 30, 1973, approving the regulation on water subscriptions, states that “the price of water and ancillary fees are fixed by a ministerial decision”. The latest Decision of the Minister of Agriculture, Hydraulic Resources and Fishing and the Minister of Finance is dated May/June 2016.

The tariff system, which is the same throughout the country, is divided into fixed and variable tariffs. Fixed tariffs are independent of consumption, while variable tariffs depend on the level of consumption.

With respect to variable tariffs, most consumers pay a progressive tariff, where the amount paid per cubic metre increases in line with consumption. The progressive rate is applicable for all uses and comprises seven bands of consumption, as illustrated in Figure 8.

The rates range from TND 0.2/m³ for the first (or “social”) block (20 m³ per quarter) to TND 1.315/m³ for high-end consumption (>500 m³ per quarter). A uniform variable tariff is only applicable to the tourism industry and for non-connected domestic users (communities and public standpipes). Non-connected domestic users pay a price equivalent to the first band of consumption, while the tourism industry is aligned to the last (highest) band, regardless of the volume of water consumed.

In addition, every subscriber must pay a fixed charge every quarter, depending on the diameter of the meter.

Sanitation tariffs are paid through SONEDE to ONAS. However, these tariffs should also be examined, since drinking water and sanitation services are provided together and consumers consider them in combination when making decisions about the level of their water consumption.

Water treatment levy rates are paid by consumers connected to the sewerage network. These rates depend on user categories, according to the decision of the Minister of Economy and Finances and the Minister of Equipment, Sustainable Development and Regional Planning. As of January 19, 2015, there are five price categories, as outlined on page 20.
### TABLE 10  Tariffs for domestic consumption, based on consumption band

<table>
<thead>
<tr>
<th>Consumption (million m³)</th>
<th>Consumption band</th>
<th>Usage charge (TND)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>variable</td>
</tr>
<tr>
<td>0–20</td>
<td>0–20</td>
<td>22</td>
</tr>
<tr>
<td>21–40</td>
<td>0–20</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>21–40</td>
<td>195</td>
</tr>
<tr>
<td>41–70</td>
<td>0–20</td>
<td>207</td>
</tr>
<tr>
<td></td>
<td>21–70</td>
<td>326</td>
</tr>
<tr>
<td>71–100</td>
<td>0–70</td>
<td>326</td>
</tr>
<tr>
<td></td>
<td>71–100</td>
<td>540</td>
</tr>
<tr>
<td>101–150</td>
<td>0–70</td>
<td>343</td>
</tr>
<tr>
<td></td>
<td>71–150</td>
<td>561</td>
</tr>
<tr>
<td>+151</td>
<td>0–70</td>
<td>343</td>
</tr>
<tr>
<td></td>
<td>71+</td>
<td>693</td>
</tr>
</tbody>
</table>

Source: Decision of the Minister of Economy and Finance and the Minister of Equipment, Sustainable Development and Regional Planning of January 19, 2015, establishing the amount for sanitation fees

### TABLE 11  Fees for industrial water use

<table>
<thead>
<tr>
<th>Usage</th>
<th>Usage fee (TND)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>variable</td>
</tr>
<tr>
<td>Industrial, with a release meeting discharge standards into the public sewerage system</td>
<td>970</td>
</tr>
<tr>
<td>Industrial, with a release meeting discharge standards into the natural environment</td>
<td>705</td>
</tr>
<tr>
<td>Industrial, with a release exceeding discharge standards into the public sewerage system</td>
<td>970 + (Q*470)</td>
</tr>
<tr>
<td>Industrial and polluting activities not connected to the public sewerage system</td>
<td>705</td>
</tr>
</tbody>
</table>

Source: Decision of the Minister of Economy and Finance and the Minister of Equipment, Sustainable Development and Regional Planning of January 19, 2015, establishing the amount for sanitation fees
1. Domestic use. This category is based on a progressive rate comprising six consumption bands calculated on the basis of drinking water consumption. Consumers that fall into higher consumption bands not only face a higher tariff, but also have to pay a higher tariff for their initial consumption (the first 20 or the first 70 m³). The consumption values in Table 10 are quarterly values.

2. Tourism use. A uniform tariff applicable to the tourism industry is fixed at TND 1.235/m³.

3. Industrial use. This category is divided into four different tariffs according to the level of pollution generated, in line with the polluter pays principle (Table 11).

4. Commercial, professional and other uses. This category is divided into three different tariffs, according to the level of pollution generated (Table 12).

5. Administrative use. This category is divided into two tariffs — for non-polluting and polluting, with discharge into the public sewerage network exceeding discharge standards (Table 13).

In 2015, 71.5 percent of domestic users consumed a volume of water lower than 40 m³ quarterly, and paid a maximum quarterly amount of TND 24 to SONEDE (also including the sewage fee and 18 percent VAT).
Services provided by the General Department of Rural Engineering and Water Exploitation

Although SONEDE legally has a monopoly on the distribution of drinking water throughout Tunisia, in rural areas, which are far from the public drinking water distribution network and where settlements are dispersed, the Ministry of Agriculture, Hydraulic Resources and Fishing has instructed the General Department of Rural Engineering and Water Exploitation to provide drinking water services through the water users’ associations (WUAs). Currently, more than 232,000 families are served via the water systems managed by the WUAs. About 1,260 WUAs (out of a total of 3,000) offer drinking water services as well as irrigation water services.

The overall drinking water supply rate in Tunisia is 97.6 percent (2015), an average based on a rate of 100 percent in urban areas and 92.6 percent in rural areas, of which 41.4 percent is provided by the DGGREE.

The price of water charged by the WUAs varies between TND 0.5 and 1.25/m³, depending on the costs directly borne by the consumers (wages, water transportation, profit margin of the water sellers etc.), which is above the water price paid by SONEDE customers. In rare cases, the price paid by WUA users reaches TND 5/m³. Users supplied by the WUAs also face problems related to water quality and the continuity of service, especially during the summer, as well as difficulties accessing some water points, which may be at some distance from their dwellings.

Irrigation water use

Water demand for irrigation is estimated at 2.15 million m³ per year, representing 79 percent of total water demand.

The irrigation potential in the country is estimated at 560,000 ha, in light of the water resources allocated to agriculture. Between 2001 and 2011, the area equipped for irrigation increased from 394,000 ha to 459,570 ha (ONAGRI 2011), an annual average increase of 1.4 percent. The projected change in the area of irrigated land is shown in Figure 9.

Public perimeters cover 243,170 ha (ONAGRI 2011), of which:

- 140,000 ha are fed from water collected in dams (large hill dams and dams);
- 77,000 ha are irrigated by drilling (underground sources) (BPEH, 2014);
Irrigation water use

- 9,500 ha from treated wastewater (GWP 2009, quoted by Aquastat); and
- 16,670 ha from unknown sources.

On 216,400 ha of private perimeters, irrigation is carried out by the operators themselves (ONAGRI 2011), of which:
- 150,000 ha are fed from shallow groundwater;
- 30,000 ha are fed from private deep wells (BPEH 2014); and
- 36,400 ha not known, although certainly including pumping in wadis and more.

The area actually irrigated during the crop year 2010–2011 was evaluated at 379,990 ha, made up of 188,560 ha of public irrigated perimeters and 191,430 ha of private irrigated areas.

At another level, and in order to improve the efficiency of individual irrigation systems, the Tunisian Government has adopted the National Irrigation Water-Saving Programme, which is promoted by a decision to increase investment subsidies for modern irrigation equipment. The total grant for water saving is approximately TND 553 million since 1995. The total area equipped with water-saving systems has reached 375,000 ha, about 90 percent of the total irrigated perimeters. As illustrated in Figure 10, the amount of water used per hectare dropped between 2010 and 2015 and is expected to fall further by 2030.

Different pricing methods are currently applied to public irrigated perimeters in Tunisia. The most widespread is the simple monomial tariff applied in about two-thirds of cases.

There are also three other pricing methods: binomial pricing, which aims to ensure that operation and maintenance costs are fully covered without discouraging the efficient use of water; preferential pricing, established in 1998; and trinomial pricing, which is not yet applied. It should be noted that the ministry has recently initiated a study to evaluate the different pricing methods.

According to the Tunisian Institute for Strategic Studies (2014), the area equipped for irrigation with treated wastewater is 8,075 ha, of which only 3,789 ha are actually irrigated with an annual 18 million m³, while the total volume of wastewater treated in Tunisia is 144 million m³ per year. This leaves room for the enhanced utilisation of treated wastewater in irrigation. As Table 14 shows, there are other uses for treated wastewater, especially groundwater recharge, which increases the utilisation rate.
**Evaluation of current and prospective WDM measures**

In this final section of the assessment report, we review existing WDM practices that can serve as good examples for other MENA countries. We also introduce prospective WDM measures that Tunisia could pursue to improve the sustainability of its water balance. We also explore some of the barriers to the effective implementation of these measures.

**Good WDM practices**

Tunisia already has a history of successfully applying a range of WDM solutions:

- The National Irrigation Water-Saving Programme promotes an increase in the investment subsidy for modern irrigation equipment and water saving in irrigation. The per hectare use of irrigation water has declined as a result.
- There is already a modest use of treated wastewater for irrigation purposes, providing an example for similar future development on a larger scale.
- Treated wastewater is also utilised for groundwater recharge and water supply to wetlands.
- There is a low ratio of illegal drinking water use in the SONEDE network. According to SONEDE statistics, illegal water use is only about 1 percent of total water consumption. Possible reasons for this low share (technical arrangements, severe punishments, rigorous monitoring etc.) may be worth investigating in the form of a case study.
- Non-revenue water in some locations (e.g. the district of Grombalia) is far lower than the national average, suggesting that network renovation and maintenance can yield substantial benefits in terms of saved water. This aspect may also be related to the legal requirement for the periodic diagnosis of water systems.
- Steeply rising drinking water and sewage tariffs provide a strong incentive to save water.

**Prospective WDM measures**

The following is a non-comprehensive list of prospective WDM options for Tunisia identified during the inception period of the project. The development of some of these measures is made difficult by different legal, institutional and economic barriers, as discussed. Nevertheless, many of these difficulties can be addressed.

<table>
<thead>
<tr>
<th>TABLE 14</th>
<th>Volume of treated wastewater reuse, 1998–2010 (million m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production of treated wastewater</td>
<td>129</td>
</tr>
<tr>
<td>Quantities reused in public irrigated areas</td>
<td>21</td>
</tr>
<tr>
<td>Quantities reused in green spaces</td>
<td>6.5</td>
</tr>
<tr>
<td>Groundwater and wetland recharge</td>
<td>1.5</td>
</tr>
<tr>
<td>Total wastewater reused</td>
<td>29</td>
</tr>
<tr>
<td>Reuse rate (%)</td>
<td>22.5</td>
</tr>
</tbody>
</table>

Source: Tunisian Institute for Strategic Studies 2014
• **Use of wastewater for irrigation.** Some treated wastewater is already used for irrigation, but most wastewater is not utilised directly. Analysing the underlying institutional, economic and perceptual reasons for this may lead to proposals on how to enhance the utilisation of treated wastewater.

• **Investigation of illegal wells used for irrigation.** Illegal water abstraction is especially problematic in the south of Tunisia. Enhanced monitoring and dedicated enforcement are needed to curb illegal abstraction.

• **Much irrigation water use is based on a simple, one-part tariff.** Alternative tariff schemes that provide greater incentives to save water could be evaluated.

• **Network reconstruction to reduce leakage.** In some parts of Tunisia, network losses reach 40 to 50 percent. A cost-benefit analysis of network renovation and reconstruction can help to determine whether the savings associated with reduced leakage would cover the cost of the network investment. The problem is especially acute in the south, where network losses exceed the national average while the cost of producing drinking water is high. Network reconstruction can therefore potentially generate the greatest benefit in this region. Lack of capital is probably the most important barrier to large-scale network investments.

• **Drinking water tariffs.** While drinking water tariffs for most users are progressive in design, they are usually not at a level ensuring long-term cost recovery (including the renewal of assets). The consequences — in terms of changed consumption and affordability — of a gradual shift toward full cost recovery can be inspected via economic modelling.

• **Education and awareness raising.** Many water users are not aware of the scarcity of water in Tunisia and the options available to them to reduce their consumption. Awareness campaigns may help to reduce water use.

• **Disconnection for unpaid bills.** The regulation on disconnection due to unpaid bills is not currently enforced. As a result, consumers do not have a reason to reduce their water consumption, since this action does not have consequences in terms of the size of their water bill. In addition, SONEDE receives less revenue, reducing the resources available for network maintenance and modernisation.

**References**

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The regional project Sustainable Use of Transboundary Water Resources and Water Security Management (WATER SUM) addresses water-related challenges and promotes regional cooperation in the Middle East and North Africa (MENA) through two project components: Water Resources Management Good Practices and Knowledge Transfer (WATER PoRT); and Water Security (WaSe). The WATER PoRT component focuses on building skills and transferring knowledge on integrated water resources management in order to promote sustainable development and climate adaptation. The WaSe component supports the introduction of local water security action plans to help communities withstand asset scarcity and tackle environment-related conflicts.

The overall objective of the WATER SUM project is to promote and enhance the sustainability of managing water resources in beneficiary countries in the MENA region in order to halt the downward spiral of poverty and to reduce biodiversity loss and environmental degradation. The main expected impact is institutional and behavioural change in water governance and utilisation patterns. This will be achieved through the successful transfer of knowledge and skills to all participating actors in the water management arena. Additional impacts related to improving water security are also significant in terms of overall environmental security. It is therefore vital to build partnerships in order to address environmental asset scarcity, environmental risks or adverse changes, and environment-related tensions or conflicts, as this is the most effective means for delivering development and conservation targets to local communities and beyond.

The WATER SUM project brings high added value, as it provides beneficiary countries with a structured opportunity to boost their development, share new methods for improved water management, improve planning at all levels of governance, and address unemployment and poverty.

Project duration: April 2014 – April 2017
Total project budget: EUR 6 million

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The REC is an international organisation with a mission to assist in addressing environmental issues. The REC fulfils this mission by promoting cooperation among governments, non-governmental organisations, businesses and other environmental stakeholders, and by supporting the free exchange of information and public participation in environmental decision making.

The WATER SUM project is financed by the Government of Sweden and implemented by the REC.