International Decade for Action "Water for Life" 2005-2015: Sultanate of Oman perspective

Abstract

Oman is situated in the south eastern part of Arabian peninsula, bordered by the United Arab Emirates (U.A.E) from north west, Saudi Arabia from the west, Gulf of Oman and Arabian sea from the east and south east. Oman is a leader in the Region in the fields of water resources assessment and management and has excellent record in related institutional capacity-building. Optimization and strategic management of the water sector was seen as a key dimension of the Omani Economic Diversification Strategy at the vision "2020" Conference in 1995. The agriculture sector is the dominant water-using sector accounting 87% of total consumption. Over the next twenty years, the demand for water domestic, industrial, commercial and municipal purposes is expected to increase by more than 50% as a result of population growth from 2.5 million to over 3.5 million; increase demand for food and domestic water; increased of urbanization; increased water demand within the economic diversification program. To assist in meeting the Vision 2020 strategy and maintaining the country’s water security, a National Water Resources Master Plan has been prepared. The plan adopts the widely-accepted Dublin (1992) principles and meets the requirements of the Hague Declaration (2000). The purpose of the Master Plan is to provide a sound basis for planning horizon 2020 and also takes account of the need to provide for sustainable development and security of supplies beyond this date. In 2005 the seventh five years development plan started, the same year when the International Decade for Action "Water for Life," 2005-2015, announced, which allowed Oman to review its plans and includes projects that allowed to implement the decade goals. Beyond meeting basic human needs, water supply and sanitation services, were given high priorities taking in to the account that water, as a resource, are critical to sustainable development. Water challenges will increase significantly in the coming years. Continuing population growth and rising incomes will lead to greater water consumption, as well as more waste. The urban population is growing dramatically, generating demands well beyond the capacity of already inadequate water supply supported by dramatic climate change impacts (floods and droughts).
1. Introduction

The Sultanate of Oman has undergone development since 1970 with major investment in infrastructure, education and health. Due to its location in the Arid and Semi-Arid region, water resources are very scarce. Daytime temperatures are high, generally above 30 °C and seasonally above 40 °C. The mean annual rainfall is low and highly variable, exceeding 350mm in the mountains of Northern Oman and Dhofar, but reducing to 100mm in the foothills and to less than 50mm at the coast and in the desert interior. Potential evapotranspiration varies from 1.860 mm/yr on the Salalah plain to 2.200 mm/yr in the interior.

Total replenishment of the renewable resources is estimated to be about 1.300 Mm³/yr. The annual replenishment is equivalent to about 500 m³/capita; this is approaching a condition of extreme water stress according to international indices. Oman’s reserves of “non-renewable” resources have not been fully assessed; these may serve as strategic reserve or be locally developed for strategic purpose. Nationally, the consumption of Indigenous water is 25% more than the resources currently available from renewable resources, desalination and treated wastewater. The growing economy has brought an increase in urbanization with a demand for high levels of service and quality for water supplies. Desalination has been developed to augment natural resources for township water supplies and the collection and treatment of wastewater continues to develop nationally.

The Sultanate of Oman has made major investment in water resources, development and management over the past 39 years. This has included establishment of a national monitoring network, execution of national well and aflaj inventories and major catchments and aquifer studies accompanied by human resource development and institutional capacity-building. Water is, and will remain, one of the nation’s most valuable resources. Optimization and strategic management of the water sector was seen as a key dimension of the Omani Economic Diversification Strategy at the vision “2020” Conference in 1995. With the demand for water domestic, industrial, commercial and municipal purposes expected to increase by more than 50% over the next twenty years, effective water management is demanded. To assist in meeting the Vision 2020 strategy and maintaining the country’s water security, a National Water Resources Master Plan has been prepared.
2. Strategic Development of Water Resources in Oman

It has long been recognized that the successful and sustainable future development of water resources in Oman depends on a thorough understanding of the available resources to meet potential demands. Significant investment has been made to establish an appropriate technical foundation for resource development, planning and management to meet challenges facing water resources through:

- **Effective Monitoring network**: Currently there are over 4600 monitoring stations for climate, rainfall, wadi flow, aflaj, groundwater levels and groundwater quality. The national monitoring network broadly complies with WMO Standards although data collection is rather sparse in the desert regions.

- **National Well Inventory project**: Two large scale projects were carried out to establish a complete database for all existing wells and aflaj. *The National Well Inventory Project*, embarked on 1992, was initiated with a registration process (167,000 wells) and followed by field inspection that provided a comprehensive data set on water levels, water quality, pump types, water use and irrigated areas. The total number of active wells inventoried was 127,000.

- **National Aflaj Inventory Project**: The National Aflaj Inventory Project, commenced in 1997, recorded a total of 4,112 aflaj of which 3,108 were found operational. Service areas of individual aflaj vary significantly but most are less than 2 ha; the largest single system extends over 1,227 ha. The total area serviced by aflaj in Oman was found to be 26,500 ha of which 56% was under crop at the time of the field survey.

- **Surface Water Assessment and Development**: Surface water assessments have been undertaken in all major catchments mainly through hydrological studies and data analysis, feasibility studies for recharge dams and local flood studies. Such studies and investigations have created a number of resource development opportunities for both storage and recharge dams.

- **Groundwater Assessment and Development**: Groundwater exploration projects have been undertaken in Oman and typically
comprise exploration and test production well drilling, aquifer tests, geophysical and topographic surveys.

There are about storage dams mainly in Jabal Akhdar, to alleviate local domestic water supply problems. A major storage dam is has been completed in Wadi Dayqah to intercept fresh water flows to the sea and supply water to Qurayyat and Muscat. The storage capacity of the dam is 100 Mm$^3$.

Recharge dams have generally been designed to store wadi floods for a few days, to allow silt to settle, before allowing controlled release of water downstream to recharge the alluvium. Water balance estimates indicate that, at national scale, wadi flood flows lost to the sea or the desert average about 119 M.m$^3$/yr. Today there are more than 30 recharge dams in Oman.

3. Non-Conventional Water Resources

Desalination:

Desalination plants make an important contribution to water supplies where natural water resources are unavailable or inadequate. At the moment desalination provides more than about 90% of the potable water supplied nationally. Desalination started in Oman in the early 1970s, primarily to provide potable water to communities but also to other water requirements. They are located both on the coast and in the Interior, primarily of sea water for Muscat and some other coastal towns and of brackish water in the Interior. Desalination supplies have reached areas very far from the sea to supply drinking water for most towns and rural areas. By the year 2015, Oman will cover the rest 10% of population with a supplied network to replace the groundwater supplies in this rural areas.

Wastewater and Sanitation

At the midpoint in MDG timeline, great progress has already been made in Oman. The global economic crisis has not affect Oman’s plans to develop a highly sophisticated wastewater and sanitation network. Oman considered that investing in development is more vital than ever to ensure social stability, security and prosperity to meet its commitment to reaching the MDGs.
The greater part of the water supplied for domestic, industrial and commercial usage returns to the hydrogeological environment as wastewater. Wastewater treatment has been considered as an initial strategic issue to meet the principal reuse of treated wastewater at present is for municipal landscaping in most of the regions in Oman. Muscat Municipality plans a scheme to extend its sewage collection and treatment system. The first stage (2006) should generate 70,000 m$^3$/day of effluent, eventually increasing to an estimated 270,000 m$^3$/day (100 M.m$^3$/year). This scheme will generate a considerable volume of treated wastewater that may be considered a potential water resource to be used in the most beneficial manner. In Salalah, a wastewater treatment plant has been built that will, in the first stage, treat 20,000 m$^3$/day (7.3 M.m$^3$/year) with two further stages to more than double the initial capacity. It is planned to treat the effluent to a tertiary level, to chlorinate it and then to recharge it into tube wells in a line parallel to the coast to stabilize the sea water interface and part will be recovered from wells further inland. At the moment, there are 53 projects for wastewater treatments plants with a comprehensive collection system and networks while more than 43 projects are planned in the next 5 years starting from the year 2011. In completion of these projects Oman will completely meets its commitments toward the Millennium Development Goals.

4. Regulations and Policies

To set a strategy and establish rules and policies that can aid in protection and conservation of the water resources as well as development of the existing water supply, strategic regulations are activated since early eighties represented by:

- Royal Decree 82/88, refer to “the water of the Sultanate of Oman is a national resource to be used according to the restrictions made by the Government for organizing its optimum utilization in the interest of the state of comprehensive development plans”.

- Royal Decree 29/2000, refer to a new water low “Water Protection Low” emphasis on regulations for wells and aflaj, and regulations for desalination units on wells.

- Royal Decree 114/2001, organize the disposal of solid and dangerous wastes, environmental pollutants and untreated sewage wastes without a permit.
- Royal Decree 115/2001, refer to organizing disposal of liquid and solid waste products.
- In 2001 a series of Ministerial decisions, refer to the implementation of water supply well fields protection zones at several regions of the Sultanate. The key regulatory measures includes; aflaj protection, Well permits, contractor registration regulations, violations and enforcement.

Well fields were also defined and legislation were set to regulate activities to be protected both as a water resources and from pollution. There is also comprehensive environmental legislation towards protection of the water resources from solid waste and waste water disposals. A number of initiatives by the Government organization have been aimed at encouraging water conservation. This includes irrigation improvement and leakage control beside the other commercial activities.

5. National Water Resources Master Plan

The National Water resources Master Plan aims to provide a sound basis for development and management of the country’s water resources. It recognizes that water will remain one of the nation’s most valuable resources and that it will be of vital importance in the future. The Plan has been formulated to achieve planning horizon of 2020. The Plan also takes account of the need to provide for sustainable development and security of supplies beyond this date. The Plan, summarily described below, was formulated on a number of principles including:

- The development of the country’s water resources should be sustainable in the long term, not just technically but also economically, environmentally and socially.

- Where resources are already being degraded due to over-consumption or pollution, the water balance of the aquifer should be restored to sustainability by 2020

- The non-renewable resources should form a strategic reserve and those of potable quality be allocated only for priority domestic and industrial use. Their development should be planned in distinct stages with adequate intervals for evaluation of the aquifer response to pumping. The long-term strategy should be flexible and a well managed approach to the use of these resources adopted.
• The provision of domestic and industrial water supplies has priority over its use for agriculture except where resources are used in aflaj areas where the current supply of water will be maintained.

• A reform of irrigated agriculture should be encouraged to increase production from the water made available, to increase financial returns and to minimise "virtual water imports".

The Master Plan has suggested some primary actions that are necessary for best development and management of the country's water resources. This actions includes:

**Potable water supply for towns and priority purposes**: The Plan provides for the necessary water resources investigations and assessments, including identification and investigation of wellfields and the monitoring and protection of water sources.

**Increase in recovery and development of Indigenous water resources**: The Plan includes projects to increase the availability of indigenous water that can lead to reduced dependency of the country on much higher-cost supply alternatives and imports of "virtual water", where technically and economically feasible. This can be through reducing surface and sub-surface losses to the sea or to the desert, increasing water availability by treating and re-using wastewater and making limited and strategic use of non-renewable potable and brackish water reserves.

**Establishment of sector water allocations**: With the increasing demands on indigenous water resources, the Plan recommends that sector water allocations are set, as early as possible, which formally establish the prioritisation of water use. Allocations, on a catchment basis and subject to periodic review, would be made for each of the following sectors:

• Domestic
• Industrial/Commercial/Municipal
• Environmental
• Aflaj
• Agriculture (irrigated from wells)
Management of water demand: Many projects have been conducted to evaluate the proper integrated water management plans in agricultural, commercial, industrial and municipal sectors were taken. Adapting cropping patterns, introduction of modern irrigation systems, water demand in agricultural sector can be reduced. Quotas, derived from sector allocations and linked to well permits, have been introduced for those farmers using water from wells for irrigation.

6. CONCLUSIONS

As we are at the Water is essential for life. No living being on planet Earth can survive without it. It is a prerequisite for human health and well-being as well as for the preservation of the environment. Water scarcity, implies large challenges in Oman in addition to what is expected from climate change effect related to natural disasters such as floods and droughts. Meeting basic human needs, water supply and sanitation services, as well as water as a resource critical to sustainable development, Oman have taken important plans to meet this goals.

Water challenges will increase significantly in the coming years. Continuing population growth and rising incomes that will lead to greater water consumption, as well as more waste. The availability of the renewable water resource in Oman is “scarce” and water security demands priority attention with large investment in desalination, wastewater treatment and in integrated water resources management. Wastewater from municipal areas represents an important resource that should be incorporated within resource planning. As the coverage of collection and treatment systems expands, effluent of better quality may be used beneficially either for direct use in agriculture or to recharge the aquifer through recharge lagoons.

While the long term water security of the population has to be ensured, a sound balance has to be struck between the use of indigenous water and imported “virtual water”, within the confines of the economy. Opportunities to augment resources by conventional and non-conventional means have been identified and are at varying stages of development.

The introduction of appropriate demand management measures in areas irrigated from wells will have to be introduced to overcome locally serious deficits, if Oman is to ensure the future sustainable use of water resources and yet meet the demands for domestic and industrial supplies. Public awareness information campaigns should be augmented as a preliminary
action to active conservation control, of domestic, industrial and agricultural water use. The state of sanitation in Oman is given high priorities with access to sanitation across the country to more than 90% of the population. Progress on sanitation and drinking water were given special

The Millennium Development Goal's (MDGs) targeted by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation. At the current rate of progress, Oman allow access to sanitation and safe drinking water to all people by the year 2015 exceeding the millennium goals target.