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Water Supply Alternatives for the Tripoli Area, North-Western Libya

WATER SUPPLY ALTERNATIVES FOR THE TRIPOLI AREA, NORTH-WESTERN LIBYA

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Libya is one of the south Mediterranean countries with an aerial extent of 1,752,000 Km^2 and it has a shoreline of about 1900 Km. The population (approximately 6.0 millions) is growing and lives mainly in the Mediterranean coastal zone, with a large proportion in the main cities of Tripoli, Benghazi and Misurata.

The study area consists of the Tripoli city and four suburbs, located in Northwest of Libya. Groundwater is the main source of domestic and irrigation water in the region. It is found that rapid increase of economic activity in the last thirty years increased the groundwater demand. This has caused groundwater extractions to be in excess of replenishment, resulting in decline of water levels and deterioration in the quality of groundwater.

In this paper a review of the domestic water supply for the Tripoli area for the periods prior and after the year 1996 is outlined. Further, a proposed alternative water supply scheme is proposed that include conveyed water, desalination and treated water reuse showing the supply rates for each alternatives and taking in consideration the future domestic water supply for the study area.

The study area is located on the coast, North West of Libya, consists of the city of Tripoli and four suburbs around the city as shown in Figure (1), with an aerial extent of about 200 km^2 and a population of over one million. The Tripoli area has the Mediterranean climate, with a mean monthly temperature ranges from 13°C to 32°C and an average annual precipitation of 350 mm/year. Ninety percent of this precipitation occurs between October and March.

The hydrogeology of the Tripoli area consists of an unconfined aquifer and a number of confined aquifers underneath. The upper unconfined aquifer is of Quaternary-Miocene-Pliocene origin that extends throughout the whole area with a thickness of about 150 meter and contains water of good quality except near the coastal areas where high abstraction of the groundwater has led to seawater intrusion. The confined aquifers have water with salt concentration higher than the acceptable limits for drinking water, but these limits are acceptable for the irrigation of salt tolerant crops.

Prior to 1975, most of the domestic wells in Tripoli area were producing good quality water with production rate of about 140,000 m^3/day. This was at that time nearly equal to the daily mean demand for Tripoli area. During the period from 1975 to 1985, the salt concentration in the water of most domestic wells increased to over 1500 ppm (TDS), except the wells of the Ayn-Zara well field. This well field produced good quality water with supply of 30,000 m^3/day in 1983 from 87 wells. However, during this period the demand became greater than the available supply, where large deficit of water flow rates occurred. For the period from 1985 to 1996, as the population of this area has increased and the standard of living has risen, the water demand for domestic uses has also increased drastically. In the mean time the water supply has deteriorated in quality due to mainly salt

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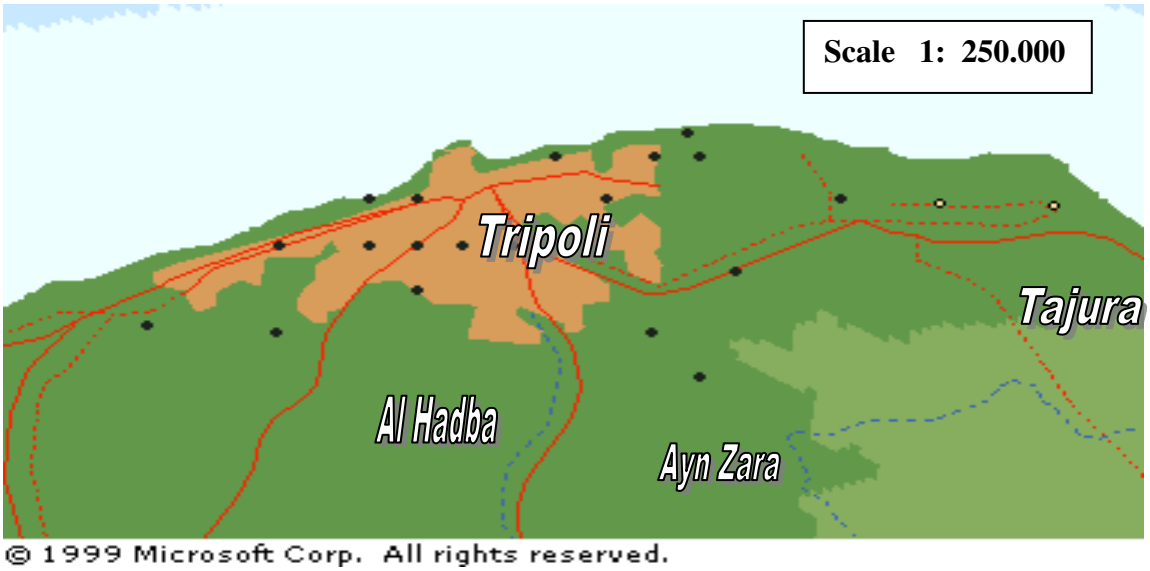

Figure 1 Study Area.

water intrusion in the area, as some wells contained up to or more than 18,000 ppm. Therefore many wells were totally shut off due to the high concentrations of salt in water which caused many problems including corrosion of all components of the network. For this reason the water supply has dropped and the water deficit has increased. Over the period from 1990 to 1996 the water rate deficit was greater than the supply rates. To solve this problem, Tripoli was allocated 400,000 m3/day of water from Phase II of the Man Made River Project as domestic supply the end of 1996.

A water supply scheme for the Tripoli area is proposed that includes a three supply alternatives (Conveyed water, desalination and water reuse). Due to the finite nature and the cost involved of the supply from the Man Made River conveyed water and to further utilize this water in the agricultural sector, the supply rate from this source is reduced to 300000 m^3/day in the proposed scheme. The scheme includes a revival of developing two major seawater desalination plants, which were proposed in the past. The two plants, which will be located to the east and west of the city of Tripoli, will produce 120000 m^3/day each. Of the total desalinated water of 240000 m^3/day about 200000 m^3/day will be allocated for the Tripoli area. For the proposed system, the treated water of the three major sewerage plants at Al-Hadba and Ayn-Zara is included at about 60% of the effluent rate capacity of these plants. About 150000 m^3/day of treated water will be utilized in the domestic uses, which will only supply green areas irrigation, and some local industrial uses. It should be noted that treatment plants require major overhaul and maintenance and a separate distribution infrastructure system must be constructed for the water reuse system.

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