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Model investigation on the impact of Raha Beach development on Umm Al Nar Power and Desalination Plant

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Abstract

Umm Al Nar Power and Desalination Plant is one of the largest plants in Abu Dhabi Emirate, United Arab Emirates. The plant was built in the mid eighties and its capacity was increased in 2001. The present plant capacity after the extension is 1000 Mega Watt power and 165 Million Gallon water per day. Recently, it was decided to develop and reclaim the Raha Beach coastal area near the plant for housing and recreation purposes. This requires reclamation of a large area in the Airport Channel, which is a large channel connected to the plant vicinity. A comprehensive study was carried out by Water & Power Research Center of Abu Dhabi Water & Electricity Authority to investigate the impact of the reclamation activities in the Airport Channel on the flow pattern in the plant vicinity and the recirculation of effluents from the outfalls of the plant to its intakes. The paper describes the two-dimensional numerical hydrodynamic flow model used in the study. The model results showing the effects of the reclamation activities on the flow pattern and the brine disposal of the plant is presented and discussed.

Keywords: Tides; Hydrodynamic models; Effluent discharge; Recirculation; Water temperature and salinity

1. Introduction

Umm Al Nar Power and Desalination Plant was built in the mid eighties on Umm Al Nar Island inside a lagoon east of Abu Dhabi Island. The plant is located within the extensive system of interconnected lagoons along the Arabian Gulf of Abu Dhabi, see Fig. 1. The inner waters around Abu Dhabi Island are fed from the Arabian Gulf through two main deep channels, which are Umm Al Nar channel in the North Lagoon and South Peripheral Channel in the South Lagoon. The main hydrodynamic forcing is the tide. The tide in this part of the Arabian Gulf is of mixed, predominately semi-diurnal but with a significant diurnal component [1]. The tidal wave approaches the coast obliquely, with a direction of propagation along the coast from south to north. The tidal wave deforms when propagates inside the lagoons. The meeting point of the tow tidal waves, approaching through Umm Al Nar Channel

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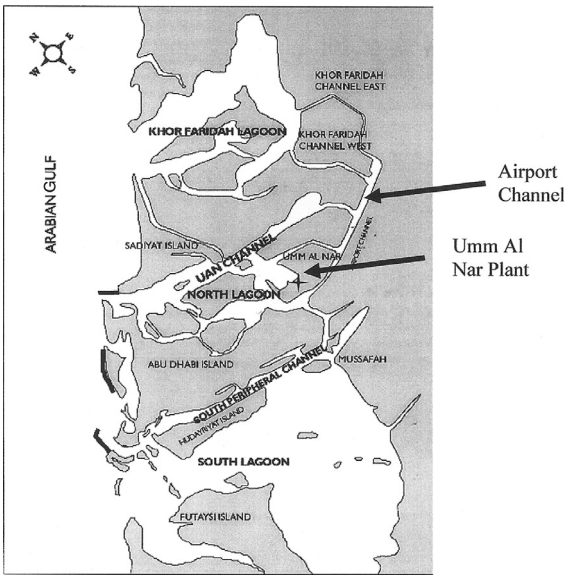

Fig. 1. Layout of the plant within the lagoon system.

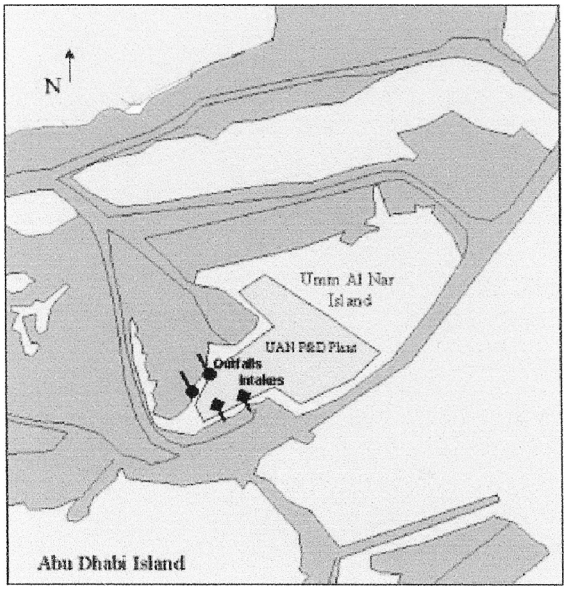

Fig. 2. Location of the intakes and outfalls of Umm Al Nar Plant.

and South Peripheral Channel is located nearby Maqta Channel and Umm Al Nar Plant. The location of this meeting point, the deformation of the tidal wave in the lagoons are the main factors governing the generation of residual flow and hence long-term water circulation and dissipation patterns within the lagoons and to/from the sea [2]. The residual flow can affect the transport and dispersion of the brine effluents discharged from the plant outfall.

Fig. 2 shows a general layout of the intakes and outfall locations of Umm Al Nar Plant.

Fig. 2 shows that a long path is created by building the plant's intakes and outfalls on opposite sites of Umm Al Nar Island to minimize the direct recirculation of heat and salt.

The rapid development in the country requires reclamation and development of the coastal areas for housing, tourism and recreation purposes. In 2006 it was decided to reclaim a large area of the Airport Channel to create a number of artificial islands inside the channel for recreation purpose. The project is known as Raha Beach Development. The Airport Channel as can be seen in Fig. 1 is very close to the Umm Al Nar Plant and the main concern of Abu Dhabi Water & Electricity Authority is the possible impact of the proposed reclamation on the plant efficiency and on the environmental issues in the plant vicinity.

A comprehensive study was carried out to determine the negative impacts of the proposed reclamation which may occur on the plant and/or its vicinity. The paper focuses on studying the possible impacts of the proposed reclamation on the recirculation of the brine from the outfall to the intake of the plant, which might affect its efficiency if it exceeds the admissible limits.

2. Description of the proposed reclamation

Raha Beach Development Project is taken place mainly in the Airport Channel. The project aims at creating a number of artificial islands in the Airport Channel which is directly connected to Umm Al nar Plant vicinity. Fig. 3 shows the Airport channel in the present situation.