AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

WATER QUALITY IMPROVEMENT WITHIN WAVE PROTECTED COASTAL ZONES

BY

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STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of PHD in Civil Engineering.

The work included in this thesis was carried out by the author and no part of the thesis has been submitted for a degree or qualification at any other University or Institution.

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others

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ABSTRACT

Ahmed Mahdy Hashish, "WATER QUALITY IMPROVEMENT WITHIN WAVE PROTECTED COASTAL ZONES".

Coastal changes; erosion and accretion are natural and ongoing processes. The natural balance between erosion and accretion can greatly be affected by manmade coastal structures. This may adversely impact the surrounding coastal environment causing deteriorated water quality and unbalanced ecosystems.

Shoreline changes due to manmade structures are usually designed without taking the effect on water quality into account. This study proposes a methodology for studying water quality in coastal zones that significantly can alter the design.

Miami, Mandrah, and Montazah Beaches in Alexandria, Egypt provide an example of this problem and are used in this research as a case study.

In this research, a multi-component numerical modeling technique was developed for simulating the 2D depth averaged hydrodynamics and water quality in coastal areas. G*eographic information system* (GIS) is being used as the main pre-processing tool for the analysis of the study area.

The multi-component technique comprises four mathematical models (NMLONG, RMA2, STWAVE, and RMA4) to study waves, currents and water quality on the study area. Five scenarios are studied by this technique to get the environmental impact in terms of water quality. Different breakwater configurations are studied using the developed methodology to assess the hydrodynamics and water quality parameters. Biological oxygen demand (BOD) is the water quality parameter investigated in the study area. A statistical methodology was implemented to compare between the impacts of different breakwater configurations on the water quality within the study area. The optimum solution is the one having the least difference with the natural case.

The results showed that the optimum solution that significantly reduces the water quality deterioration is the submerged breakwaters. A wave analysis has been conducted to the submerged breakwater for computing the wave run-up to ensure the protection of the shore line.

An evaluation for the submerged breakwater scenario was performed in order to identify the optimum free board over the submerged breakwater.

Key words: Coastal zones **- w**ater quality – hydrodynamic – finite element.

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