

HYDRO-INFRASTRUCTURE DEVELOPMENT AND HYDRO-GEOMORPHOLOGICAL RESPONSES: IMPLICATIONS FOR STRUCTURAL STABILITY IN OUTZAGH VILLAGE, NORTHERN MOROCCO



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Abstract

The construction of the Al Wahda dam in northern Morocco has had catastrophic impacts on the built environment around the dam. This study aims at analyzing the aspects of degradation that occurred in the area of the Outzagh village in the province of Taounate near the large hydraulic reservoir of the Al Wahda dam, the first in Morocco and the second in Africa. The problem of stability of terrain is frequently encountered in constructions, roads and canals in the northern region of Morocco. Furthermore, some natural slopes can become unstable; a slope rupture can be catastrophic and causes loss of life as well as considerable material damage such as the situation of Al Wahda dam. The risks of building subsidence and the general deterioration of the built assets result in a radical change in the stability of the Outzagh village compared to the situation prior to the commissioning of the hydraulic Al Wahda dam reservoir in 1995.

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Introduction

Al Wahda Dam has generated significant environmental and geomorphological impacts on surrounding territories and infrastructures. In the locality of Outzagh, several public infrastructures have shown increasing signs of instability, particularly the local high school, which experienced structural collapse. This situation appears to be closely linked to the fragile lithological characteristics of the area, combined with water infiltration and subsurface circulation influenced by the reservoir. The interaction between geological formations, groundwater dynamics, and human constructions raises important questions regarding territorial planning and risk management.

Objectives

The construction of Al Wahda Dam has generated important environmental and geomorphological changes in northern Morocco, particularly affecting nearby infrastructures. In Outzagh, the collapse of the local high school highlights a critical and alarming situation linked to fragile lithology and underground water infiltration influenced by the dam reservoir. This study is essential and highly relevant for understanding the relationship between geological instability, water dynamics, and infrastructure vulnerability, while contributing to sustainable territorial planning and natural risk prevention.

Methodology

The methodology of this study is based on a multidisciplinary approach combining geological, geomorphological, and geotechnical analyses. It includes the analysis of lithology, soil characteristics, and the stability of geological formations surrounding Al Wahda Dam and Outzagh. Field investigations, soil sampling, and the observation of water infiltration and groundwater circulation identify the main factors responsible for infrastructure instability. In addition, spatial analysis and the interpretation of topographic and geological data help assess the relationship between the dam reservoir and the collapse of the high school infrastructure.

Study area

Tanga Park and its natural area extend over an area of approximately 8500 hectares, 70 km northeast of the city of Azilal, and about 100 km in the south of the city of Beni Mellal. It is an exceptional site, especially geomorphologically and ecologically, containing important plant formations and exceptional biodiversity.

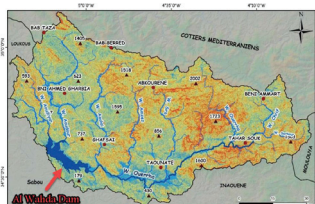
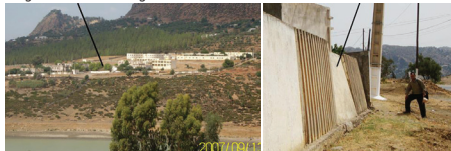


Fig. 1 - Localization of Al Wahda Dam in Ouerrha Watershed.



Photo 1 - Water level of Al Wahda Dam in Outzagh village, Northern Morocco.

Hight School in Outzagh



Photos 2 to 4 - Degradation Aspects of the Hight School in Outzagh.

Results

The results reveal significant impacts of Al Wahda Dam on infrastructures in Outzagh, including the collapse and degradation of several constructions such as the high school, roads, electricity networks, and water supply systems. The study also shows that numerous buildings were abandoned due to severe ground instability caused by the swelling and deformation of marly formations after the establishment of the dam reservoir. Water infiltration and the increase in soil moisture accelerated the weakening of geological formations and intensified structural damage. These findings highlight the strong relationship between lithological fragility, reservoir influence, and infrastructure vulnerability in the region.

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