Palestinian National Authority
Palestinian Water Authority

السلطة الوطنية الفلسطينية
سلطة المياه الفلسطينية

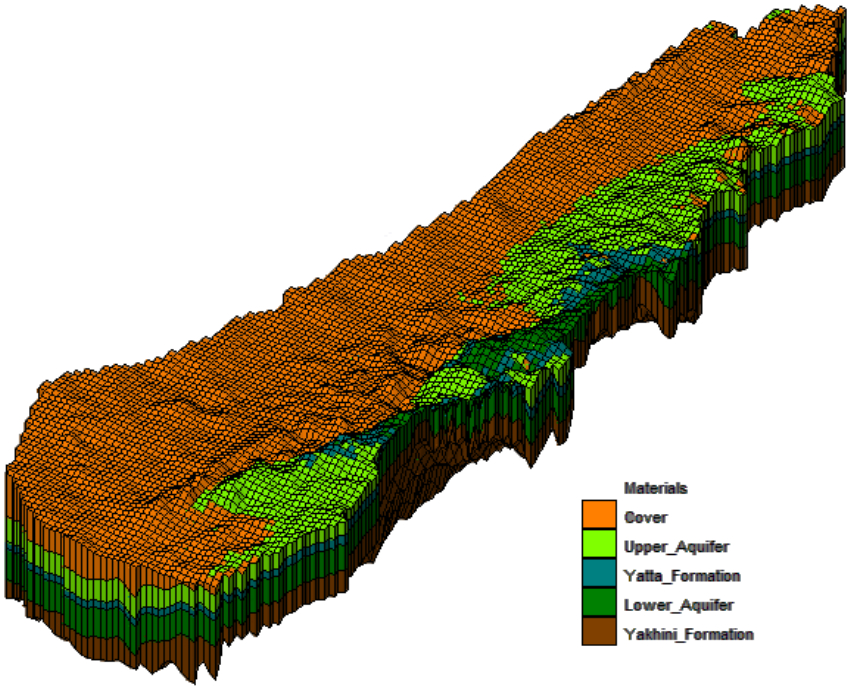
Sustainable Management of the West Bank and Gaza Aquifers

UNIVERSITY OF NEWCASTLE

NERC British Geological Survey

Department for International Development
DFID

Conceptual Flow Model of the Western Aquifer Basin



Final Report
SUSMAQ-MOD # 06 V 0.4

Prepared by:
SUSMAQ TEAM

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Groundwater Systems and Water Quality Program
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This report is an output from the Modelling Study Team, part of the SUSMAQ project.

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The SUSMAQ Project

The aim of the project is to increase understanding of the sustainable yield of the West Bank and Gaza aquifers under a range of future economic, demographic and land use scenarios, and evaluate alternative groundwater management options. The project is interdisciplinary, bringing together hydrogeologists and groundwater modellers with economists and policy experts. In this way, hydrogeological understanding can inform, and be informed by, insights from the social sciences. The results of the study will provide support to decision-making at all levels in relation to the sustainable yield of the West Bank and Gaza aquifers.

The project runs from November 1999 to October 2004, and is a partnership between the Palestinian Water Authority, University of Newcastle and the British Geological Survey. The project is funded by the United Kingdom's Department for International Development (DFID).

The Hydrogeology and Flow Modelling is part of the SUSMAQ project.

The Modelling study focuses on the geology and hydrogeology of the Western Aquifer Basin (WAB), its inflows (recharge) and outflows (spring and well abstractions). The conceptual model is followed by a numerical model, using the GMS software modelling code.

This report aims to set up a conceptual hydrogeological model of the WAB.

Bibliographical Reference

Conceptual Flow Model of the Western Aquifer Basin. Report No.: SUSMAQ-MOD # 06 V 0.4, Sustainable Management for the West Bank and Gaza Aquifers, Palestinian Water Authority (Palestine) and University of Newcastle upon Tyne (UK).

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Feedback

The SUSMAQ and PWA teams will appreciate any feedback on this report. Feedback should be sent to the above contacts.

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1. Introduction

The Western Aquifer Basin covers an area of 9155 km^2 within Israel and Palestine and is therefore the largest of all groundwater basins in historical Palestine. A small portion extends into the northeastern Sinai. The basin extends around 235 km from Mount Carmel in the North to Northern Sinai in the South and between 70 and 30 km from the Mediterranean coast in the West to the West Bank heights in the East (Figure 1.1). Being distributed between Palestine, Israel and Egypt, this aquifer is a shared aquifer. However, this study limits the analysis to the hydrogoelogical boundaries within the political borders of Israel and Palestine since it is believed that there is both little recharge and discharge on the Egyptian side and the database is scarce for this area. It should be noted that the recharge and discharge potential of the Western Aquifer Basin within the political borders of Egypt is a matter for further investigation and it is beyond the scope of the Sustainable Management of the West Bank and Gaza Aquifers, SUSMAQ, Project.

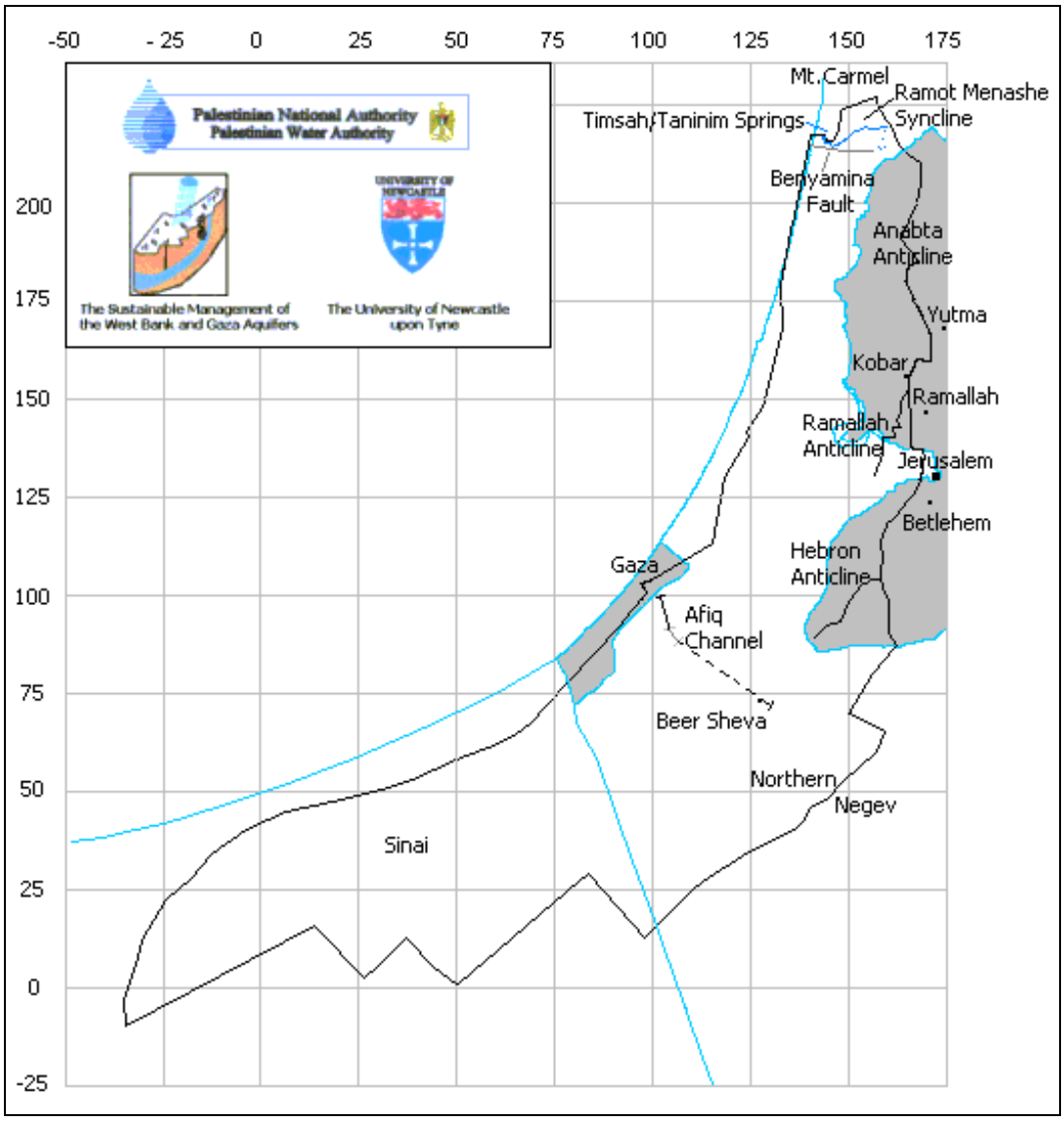

Figure 1.1: Location map of the Western Aquifer Basin

The climatic zones range from sub-humid Mediterranean climate conditions (more than 700 mm annual rainfall) to arid desert conditions in the Sinai. The ground elevation lies between sea level and 1000 m above sea level in the Hebron area. The range of age of the outcropping formations reaches from Jurassic sediments at the exposed cores of the anticlinal axes to Holocene and recent alluvial deposits, especially in the coastal plain. The water use is very heterogeneous, due to both natural and political reasons. While some areas are fully developed and even overexploited (coastal plain in central Israel), other areas rarely yield sufficient water in satisfying quality (Negev and Sinai) or are hindered by imposing unjust Israeli restrictions on developing the good potential of the aquifer basin (West Bank foothill region).

The geology of the Western Aquifer Basin (WAB) consists mainly of a group of karstified limestone and dolomite of Late Albian to Turonian, shown in a geological map (see Figure 1.2). The WAB boundaries extend between the anticlines of the mountainous ridges of the West Bank in the east to the Mediterranean Sea in the west. In the north, the basin is bounded by the edge of the foothills of the Carmel Mountain and the Taninim Stream. In the south it is bounded by a rift located southwards of Beer Al Sabi'.

The WAB is recharged mainly from precipitation falling on the mountains of West Bank while the historical outlets of the basin were through Ras Al Ain (Yarkon) and Al Timsah (Taninim) springs and hence the Israeli named the basin Yarkon - Taninim Basin.

There are a number of modelling studies about the Western Aquifer Basin carried out by the Israelis (Bachmat, 1995; Guttman and Zukerman, 1995; Zukerman, 1999), but no comprehensive model has been undertaken on the Palestinian side as yet. However, the Israeli studies lack the following:

- Some of them are based on a coarse grid of 25 km^2 cell size and therefore do not reflect realistic averages of the aquifer hydraulic and physical properties.
- Recharge estimates were made on generic relationship between rainfall and runoff.
- There is a great distrust in the geometry and hydraulic connection between aquifers developed in most of these studies.
- The assumption of considering the WAB to have only one aquifer unit is not very convincing
- Even with the above inaccuracies about most of the Israeli studies, the SUSMAQ team was not able to have free access to all the details of the Israeli studies on the WAB.

The aim of this study is to develop a conceptual model for the Western Aquifer Basin with emphasis on the boundary conditions, geometry, recharge, and other important conceptual details about WAB.

This conceptual model will then be used to develop the numerical model for the WAB.

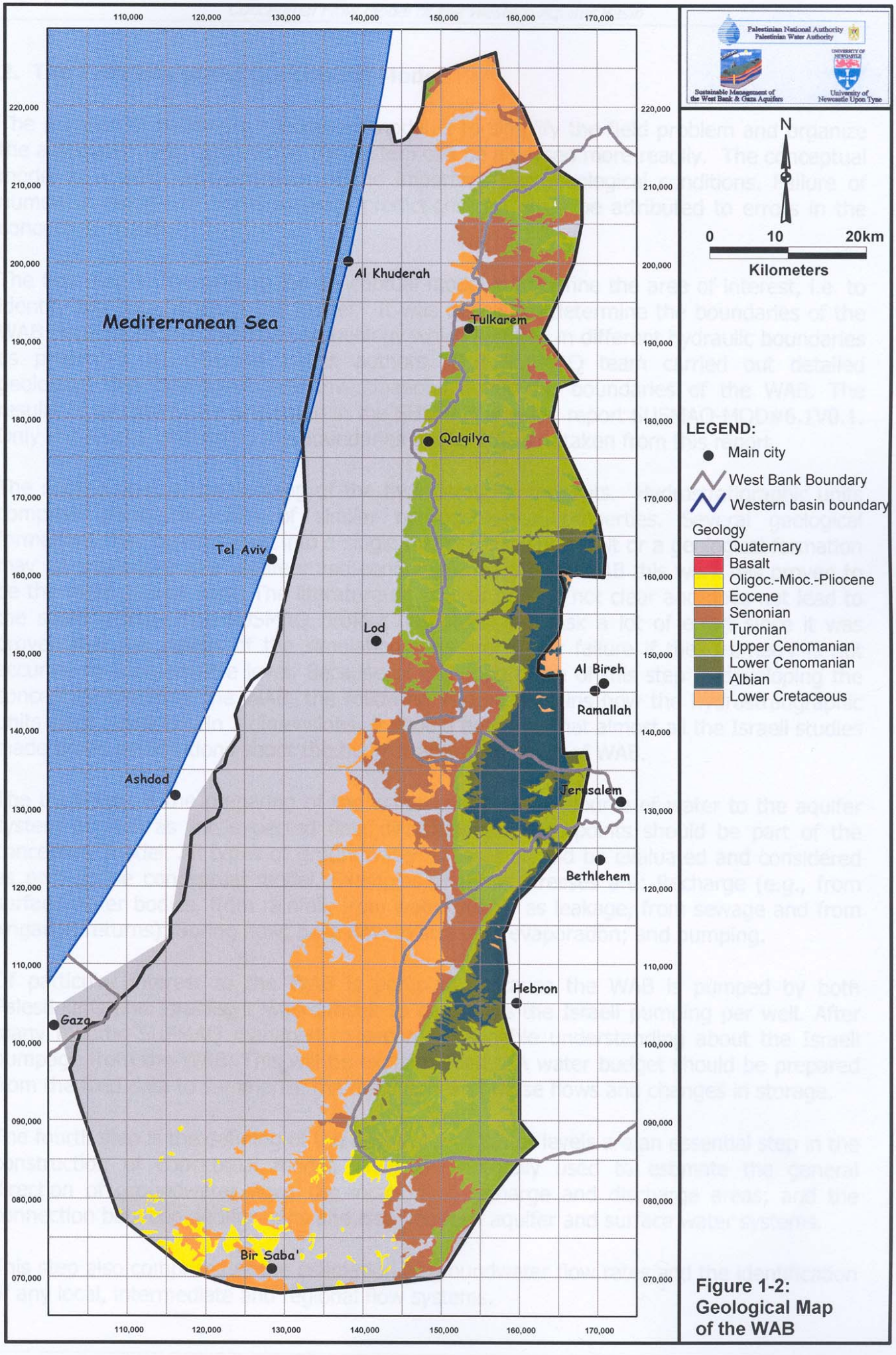

Figure 1-2: Geological Map of the WAB

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