



Palestinian National Authority  
Palestinian Water Authority



السلطة الوطنية الفلسطينية  
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## Field Measurement Campaign for Wadi Natuf Recharge Estimation:

### Background, Design and Workplan

Sustainable Management of the West Bank and Gaza

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NEWCASTLE

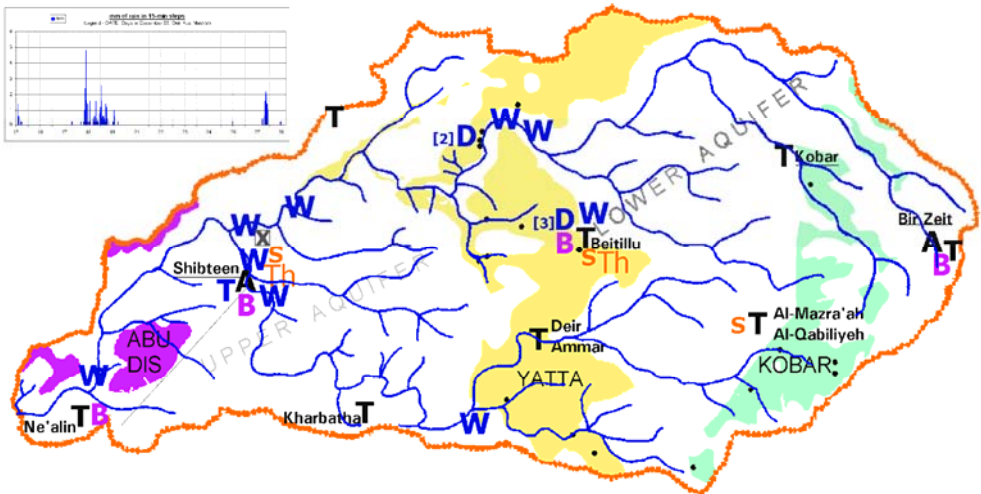
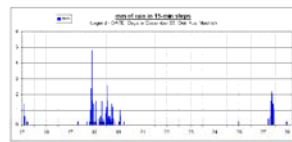


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| <p><b>Disclaimer</b></p> <p>This report is an output from the Natuf Recharge Estimation Component, part of the SUSMAQ project.</p> <p>The findings, interpretations and conclusions expressed are those of the authors (the team) and should not be attributed to other collaborators on the SUSMAQ project.</p> <p>The project does not guarantee the accuracy of the data included in this publication. Information shown in maps, figures, tables and the text does not imply any judgment on legal status of territory or the endorsement of boundaries. The typescript of this paper has not been prepared in accordance with procedures appropriate to formal printed texts, and the partners and funding agency accept no responsibility for errors.</p>   | <p><b>Contact Details</b></p> <p>Professor Enda O’Connell<br/> Project Director<br/> University of Newcastle upon Tyne<br/> Tel: 0191 222 6405<br/> Fax: 0191 222 6669<br/> Email: P.E.O’Connell@ncl.ac.uk</p> <p>Engineer Fadle Kawash<br/> Deputy Chairman<br/> Palestinian Water Authority<br/> Ramallah, Palestine<br/> Tel:02 295 9022 Fax 02 2981341<br/> Email: fkawash@pwa-pna.org</p> <p>Dr. Amjad Aliewi<br/> Operations and Technical Manager<br/> Team Leader, Hydrogeology and Flow Modelling<br/> Sunrise Building<br/> Al-Irsal Road<br/> Al-Bireh/Ramallah, Palestine<br/> Tel. 02 298 89 40 Fax. 02 298 89 41<br/> e-mail: a.s.aliewi@susmaq.org</p>  |
| <p><b>The SUSMAQ Project</b></p> <p>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 modelers 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.</p> <p>The project runs from November 1999 to October 2004, and is a partnership between the Palestinian Water Authority, University of Newcastle and British Geological Survey. The project is funded by the United Kingdom’s Department for International Development (DFID).</p> | <p><b>Recharge Estimation in Wadi Natuf</b></p> <p>The Recharge Estimation in Wadi Natuf catchment area is part of the SUSMAQ project. The Recharge Assessment focuses on a catchment stretching East of Birzeit down to the Green Line. It aims at a better understanding of the mechanisms that control recharge as well as its quantities. A Field Measurement Campaign produces primary data, covering meteorological data such as rainfall and evaporation, surface water data such as run-off, groundwater data such as spring discharge, water levels and water quality of surface, groundwater and other hydrogeological data such as karst features, aquifer characteristics and vulnerability. The report documents the background, objectives, design and work plan for the measurement campaign in winter 2003/2004. .</p> |
| <p><b>Bibliographical Reference</b></p> <p>Field Measurement Campaign for Wadi Natuf Recharge Estimation: Background, Design and Workplan<br/> Report No.: <b>SUSMAQ-NAT #48 V0.3</b>. Sustainable Management for the West Bank and Gaza Aquifers, Palestinian Water Authority (Palestine) and University of Newcastle upon Tyne (UK).</p> <p><b>Study Team and Authors:</b><br/> <b>PWA/SUSMAQ:</b><br/> Clemens Messerschmid, Research and Coordination Advisor, Abbas Kalbouneh – Hydrogeology Researcher, Eng. Omar Zayed, Eng. Emad Sayfi, Eng. Deeb Abdelghafour.<br/> <b>Newcastle University and BGS/SUSMAQ:</b><br/> Dr. Geoff Parkin - Modelling Advisor, Dr. Amjad Aliewi – Team Leader, Dr. Bruce Dudgeon – Hydrogeology and Field Instrumentation Advisor.</p>   | <p><b>Feedback</b></p> <p>The SUSMAQ and PWA teams will appreciate any feedback on this report. Feedback should be sent to the above contacts.</p>   |

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## **1. Scope and Objectives**

The Sustainable Management of the West Bank and Gaza Aquifers (SUSMAQ) Project includes a major component called, "Recharge Estimation". The objective of this component is to provide estimates of groundwater recharge to the West Bank aquifers and vertical flows between aquifer units. Recharge is a key element in the modelling of the groundwater system of the Western Aquifer Basin and without it the model will lack accuracy. Recharge estimation plays a vital role for the understanding and quantification of groundwater resources. In the karstified series of the outcropping formations of the Western Aquifer Basin (WAB), a highly complex pattern of recharge is to be expected. Lack of reliable data from the literature makes it necessary to further investigate this component in modelling the groundwater system of the WAB. Intensive fieldwork in a chosen study area will provide primary data on the factors that govern recharge.

Up to this time, there is no comprehensive assessment of recharge in Palestine that is based on fieldwork and primary data. The available literature on recharge provides broad assumptions that recharge as just a percentage of rainfall. Recharge fieldwork is still missing. Therefore, this document is about generating primary data (e.g., field data) about recharge in the West Bank aquifers.

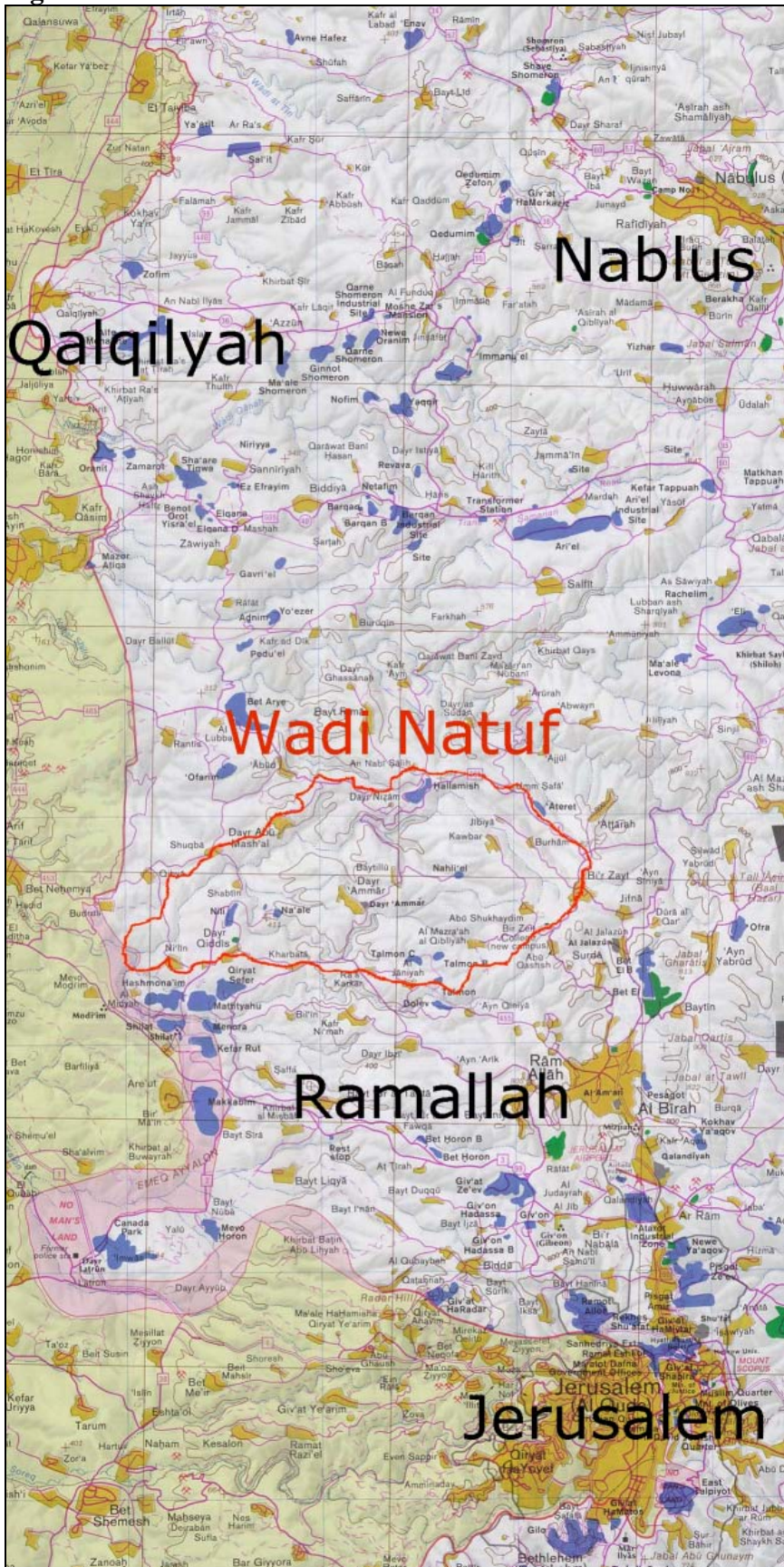
In the light of the above, the importance of carrying out fieldwork for recharge estimation can be summarised as follows:

- The flow and pollution models of SUSMAQ will not produce accurate results if the recharge estimation is not based on primary data generated in the field;
- The primary data generated from this research will help validate the Recharge Model that will be developed by the BGS.

This research is about undertaking fieldwork for recharge estimation in an experimental catchment in the Western Aquifer Basin (called the Natuf catchment). The idea is to instrument a Wadi within the Natuf catchment near Ramallah (see Figure 1) as a means of collecting good primary data for use in recharge estimation. The political unrest in the West Bank has made it difficult to travel freely in the West Bank and Israel in order to carry out work in the Western Aquifer Basin as a whole. Therefore, the relatively easy access to the Natuf catchment in addition to diverse hydrogeological features was behind choosing this catchment. The salient points about this catchment include:



Figure 1: Location of Wadi Natuf catchment area



- Relatively small in area (~90 km<sup>2</sup>),
- Presence of outcrops of the upper and lower aquifers and the dividing “aquitard” (Yatta formation), and of some outcrops of the under- and overlying aquicludes (Kobar and Abu Dis groups),
- One production well and two monitoring wells (with monthly level and pumpage data),
- Several hundreds of small springs and groundwater outlets,
- Relatively easy and quick access from Ramallah,
- Populated by 19 Palestinian villages and 7 illegal Israeli settlements.

It is realised that the recharge estimation for the Natuf Catchment of the Western Aquifer Basin will provide a good understanding about recharge in this basin. This understanding will be used within a GIS framework to extrapolate the results across the WAB. However, the findings of this work should encourage more recharge fieldwork in other catchments of WAB so that the results can be integrated to provide a comprehensive recharge map for the whole basin.

The objectives of the Natuf catchment study are:

- To instrument Wadi Natuf catchment near Ramallah as a means of collecting good primary data for use in recharge estimation;
- To use the results from the field programme in order to provide insight into the recharge processes
- To provide data for the Recharge Model under development by the BGS;
- To train the involved PWA staff in both the fieldwork and in how to analyse the primary data in order to estimate recharge.



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