



INTERNATIONAL HYDROLOGICAL PROGRAMME

UNESCO-Flanders Science Fund-In-Trust Project on Capacity Building and Training on Environmental Planning and Management in Palestine: Phase-II

Final Technical Report

**UNESCO Cairo Office Publication
December 2008**

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Final Project Report (513RAB2041)
Published by UNESCO Regional Office in Cairo, 2008
UNESCO Publications EG/2008/SC/RP/01
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Preface

This report is the final report for the Phase II of the UNESCO – Flanders Funds-in-Trust Project “Capacity Building and Training on Environment Planning and Management in Palestine” (FUST code number 513RAB4021) executed by UNESCO and implemented by the water institutions in the Palestinian Occupied Territories (POT), during the period 2003-2008. The first phase of the project was implemented earlier during the period 1998-2001 by Al-Azhar University in Gaza.

This report presents the results of three main modalities of the implementations of the project; namely, the research activities, training, and the project international conference. Twenty one research activities were implemented under this project, six main training activities in which more than 180 experts were trained in priority areas identified by the Palestinians experts. More than 80 papers were presented in the project international conference which was attended by more than 220 experts in August 2007.

This Project was funded by the Government of Flanders Kingdom of Belgium. All the project team appreciates the technical and financial support of the Flemish Government represented by Dr. Rudy Herman.

The Project was managed by a steering committee representing key institutions in the POT, the donors and UNESCO. A technical advisory committee was formed from water experts who represent all institutions working in water area in the POT including governmental, public, and non-governmental organizations. This wide partnership between the project and all stakeholders contributed effectively to the success of its implementation. The successful implementation of this project was due to joint cooperative efforts between the Flanders, UNESCO and all experts and partners in the water sector in the POT.

Thanks are due to Dr. Tarek Shawki, the Director of UNESCO Cairo Office for his continuous support and help. Special thanks are also due to all the members of the project steering and technical committees, Palestinian National Commissions of UNESCO for their good contribution and efforts. Many thanks and appreciation are due to the Project Director Dr. Radwan Al-Weshah for his efficient management of the project in a transparent way, Mrs. Dalia Khalil at Cairo office and Mr. Mustafa Elbaba from Al-Azhar University. The efforts of all the project implementers and partners are highly acknowledged.

Cairo, December 2008

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Acronyms and Abbreviations

ALECSO	:	Arab League Educational, Cultural and Scientific Organization.
FIT	:	Funds-in-Trust
FRIEND	:	Flow Regimes from International Experimental and Network Data.
FUST	:	Flemish-UNESCO Science Fund in Trust
GPN	:	Groundwater Protection Network.
HELP	:	Hydrology for Environment, Life and Policy.
ICARDA	:	International Center for Agricultural Research in the Dry Areas.
IHP	:	International Hydrological Programme of UNESCO.
NGO	:	Non-Governmental Organization.
PMM	:	Project Management Unit Meeting.
PMU	:	Project Management Unit.
POT	:	Palestinian Occupied Territories.
SC	:	Steering Committee
TCC	:	Technical Coordination Committee.
TNC	:	Technical Network Commission
UCO	:	UNESCO Cairo Office.
UNEP	:	United Nations Environment Programme.
UNESCO	:	United Nations Educational, Scientific and Cultural Organization.
UNICEF	:	United National Children’s Fund.
WRC	:	Water Research Center of the Al-Azhar University in Gaza.
WHN	:	Wadi Hydrology Network.

Project Summary

The UNESCO-FLANDER FIT (Abbreviated as FUST) Project on Capacity Building and Training on Environment Planning and Management in Palestine is funded by the Government of Flanders Kingdom of Belgium and executed by UNESCO Cairo Office.

The first phase of the project started 1998 and was completed in 2001. In 2002 the project was extended for a second phase 2003-2008. The total approved budget of Phase II of the project is US \$850,000.

This project is implemented by all water related universities and institutions working in the water field in Palestine including NGOs.

The second phase of the Capacity Building and Training on Environmental Planning and Management project was launched in January 2003 for the period of 5 years and funded by the Government of Flanders, Belgium. The project activities have been executed and implemented by UNESCO Cairo Office in joint collaboration with all the universities, water institutions and NGOs working the field of water resources management and environment in the Palestinian territories. The second phase of the project aimed at ensuring the long term conservation of the water resources in the Palestinian Territories through building capacities and setting up a water resources network to foster the cooperation between the actors in the field, with respect to training, research and public awareness.

The project priorities and the main components of the project have been identified by top-notch Palestinian and Flemish water experts. During the project period, the steering committee and the technical network commission were formed and convened once every year to review, discuss and approve the overall workplan and implementation of the project activities. Moreover, upon the successful completion of the project, the following results were accomplished:

1. Formation of the Technical Network Commission from about 20 key experts nominated by universities and institutions that have water activities in the West Bank and Gaza.
2. Twenty one research projects were funded through competitive process and successfully implemented .
3. Six training workshops were successfully implemented based on competitive merits. More than 180 Palestinian participants were trained in the identified priority areas.
4. The documentation center at Al-Azhar University in Gaza has been equipped. Six desktop PCs, three LCD Monitors, one laptop computer, laser printer, one LCD Projector with ceiling kit and movable projection screen were purchased. A collection of books were procured for the

- documentation centre. The video conference system has been purchased, installed and now operational at Al-Azhar University. Palestinian participants were supported to attend an international course on Scientific and Technological Information Management in Universities and Libraries in Brussels, Belgium to strengthen the documentation center.
5. A network of scientists and experts working in the field of water resources and environment has been developed and strengthened.
 6. The project website was developed and posted on the internet for the project and the project brochure was prepared, printed and distributed to all water institutions and universities working in Gaza and West Bank and other stakeholders.
 7. The International Conference: Sustainable Development and Management of Water in Palestine, Amman, Jordan, 27-29 August 2007. This conference was organized to present the research outputs of the project to the international scientific community. About 126 participants from more than 12 countries, comprising international and regional key-water experts, policy makers, Palestinian researchers, stakeholders and representatives of the international and regional organizations attended and contributed to the deliberations of the conference. The conference was highly covered by the Media in Palestinian territories and Jordan.
 8. Preparation of two project proposals, the first on the “*Capacity Building of Water Institutions in the Palestinian Territories*” and the second one is on “*Enhancement of Water Resources Research in the Palestinian Territories*”. These two proposals are ready to be submitted to potential donors for funding through the UNECO additional programme framework.
 9. Letters of appreciation and support were received from all relevant governmental and non-governmental agencies highlighting the positive impact of this project on the water sector in the PT and recommended the extension of the project to a third phase. Media coverage of project activities were covered in news papers and TV.
 10. The project was internally evaluated by UNESCO governing bodies and it was externally evaluated by international experts selected by the donors. Both evaluations commends highly the high-caliber implementation of the project and its positive impact on the water sector in Palestine.

Chapter 1

Introduction

Water scarcity in the Middle East is becoming a developmental constraint seriously impeding the economic growth. By many, it is also considered as a potential threat to the peace in the region.

Primarily depending on shared groundwater as the major water supply source, the Palestinian Territories represent a typical example of those areas. In addition to absolute physical limits of water resources, the past political situation under the occupation led to an inequitable distribution of the resources. As, under this situation, the water resources were managed by the military authorities, a Palestinian legal or institutional framework was completely absent, while also the necessary Palestinian expertise in the field of water was missing.

The signing of the "Declaration of principles on interim self-government arrangements" by the Israeli Government and the Palestine Liberation Organization (PLO) in September 1993 is regarded as a historic event opening the way to a new era of peace in the region. In its wake, the international community has taken actions to gather resources and finance to consolidate this peace process, and UNESCO has been a pioneer among them.

Co-operation between UNESCO and Palestine in the field of science has developed over two decades with emphasis on training. In the field of water sciences, immediate objectives have been set regarding the management of coastal waters and the establishment of a fresh water policy. To achieve these objectives, priority items were identified in the Memorandum of Cooperation between UNESCO and the Palestinian Authority, namely :

- Capacity building and manpower development
- Enhancement of research and development
- Assessment and database building of water resources and usage
- Upgrading water resources planning and management

Within this framework, the project "Capacity Building and Training on Environmental Planning and Management" was designed to meet the needs of the Palestinian Autonomous Territories as defined by a UNESCO mission in 1995. The project was launched in 1998, for a duration of 3 years and with a total budget of US\$ 550 000. It was financed by the Government of Flanders (Belgium), executed by UNESCO and implemented by the Water Research Center (WRC) at Al Azhar University of Gaza.

The second phase of the Capacity Building and Training on Environmental Planning and Management project was launched in January 2003 for the period of 4 years and funded by the Government of Flanders, Belgium. The project

activities have been executed and implemented by UNESCO Cairo Office in joint collaboration with all the universities, water institutions and NGOs working the field of water resources management and environment in the Palestinian territories. The second phase of the project aimed at ensuring the long term conservation of the water resources in the Palestinian Territories through building capacities and setting up a water resources network to foster the cooperation between the actors in the field, with respect to training, research and public awareness. An extension of this project is however essential to achieve the long objectives term.

Chapter 2

Project Initiation

The aim of this project is to ensure the long term conservation of the water resources in the Palestinian Territories through the strengthening of the institutions acting in the water resource sector. The project aims at:

- enhancing national appreciation of water as a socioeconomic good
- making the Water Research Center (WRC) in Al-Azhar University in Gaza that will serve as a national focal point for promoting regional and international co-operation and as a coordinator of the water related activities in the Palestinian Territories
- avoiding duplication and risk of inadequate attention to Palestinian capacity building.

A fact finding mission of March 1995 (Raes, 1995) suggested to support the WRC for the following main reasons

- the striking character of the water problems in the Gaza strip
- the existing proposal to create a WRC at Al Azhar University
- the existing links with the Palestinian Water Team, dealing with the Israeli-Palestinian negotiations on water issues, and with the Palestinian Water Authority (at that time not yet fully established)

Since its launching in 1998, the main items that have been implemented are the procurement of a computer center, the extension of a water and soil laboratory and the establishment of a documentation center at WRC. Also, capacity building programs (workshops, seminars, training activities) have been organised, partly at the WRC and partly in the region. These programs were attended by staff of the WRC and other universities, of ministries and/or NGO's or other companies. A small part of the budget was allocated to public awareness projects. For an extensive report on the activities, it is referred to the yearly activity reports of the WRC.

The first phase of the project (1998-2000) was funded by the Flemish Government by about US\$550 000. About US\$250,000 were used for the WRC for the improvement of its laboratory and hardware infrastructure and about 300 000 US\$ for capacity building for the staff of the WRC and for training of professionals of the water sector through WRC (See the final report of Phase I published by UNESCO Cairo in November 2001). The current project which build on the first phase is financed by the Government of Flanders (Belgium) and executed by UNESCO, in the framework of the FUST. The Flemish contribution amounts to US\$850,000 for the period 2003-2008. This project was intended to be implemented by all water institutions in the POT including Gaza Strip and the West Bank.

2.1. Immediate objectives

- To establish a Palestinian Water Resources network, involving the institutions and research centers acting in the water sector in Palestine
- To establish a modern and comprehensive documentation center, accessible by all players of the Palestinian water sector
- To strengthen the staff of the universities in Palestine, in view of its abilities to provide training to the Palestinian water sector on diverse water issues
- To enhance the research capacity of the universities in Palestine
- To link public awareness activities to the previous activities, to raise public concern and understanding for the conservation of the water resources in Palestine

2.2 Development objectives

The project will also establish and strengthen linkages and cooperation in the field of research and training between Palestinian institutions acting in this field.

2.2.1 The Water Resources Network

The Water Resources Network (WRN) on training and research in Palestine, initiated by UNESCO, was established with the aim of

- fostering and facilitating the collaboration between the actors in the water field in Palestine with respect to training and research
- defining the priority areas for training and research
- acting as a selection committee for training and research projects funded by the FIT project
- evaluating the progress of the latter projects

All Palestinian institutions and research centres acting in the water sector are invited to participate to the network.

The network is managed by a Technical Network Commission (TNC) and a secretariat. The TNC consists of representatives of the institutions that participate in the network and of a representative of UNESCO. Its president is elected by the members for a period of 1 year. The

network secretariat is located at the Water Resources Center, Al Azhar University, Gaza.

2.2.2 Training projects

The FIT project funded training projects along three different strands, namely:

- Strand A : capacity building of trainers in view of training of staff of the water sector
- Strand B : capacity building of scientific staff for education and research
- Strand C : special projects for top level staff

Strand A : Capacity building of trainers in view of training of staff of the water sector

The funding under this strand aims at supporting the universities and NGO's (the 'providers' of training), to allow them to provide on the job training of staff of the water sector (the 'user' of the training).

The initiative for a training course is to be taken by a 'user' within the water and sanitation sector. The (principal) user will also be the co-ordinator (CO) of the project. Proposals for funding should be submitted jointly by the user(s) and by the provider(s).

The project does however not directly fund the 'users'. Instead, the project focuses on the capacity building at the level of the providers of the training, in order to allow them to provide the training service and with the aim of making them independent of future external aid. This means that the project offers means for on the job training of trainers and/or for the development of training material.

The training of trainers has to be considered in its broadest possible sense. It may deal with the training in a specific technologic or scientific domain, but also with the management of training activities, generic training techniques,

Strand B : Capacity building of scientific staff for education and research

Funds can be requested by a research institution or a group of institutions for training related to

- the management of research centres and research projects
- a specific research project
- the use of available laboratory equipment

The training related to management of research projects and research centres aims at

- improving the managerial competence at the Palestinian research

- institutions
- improving their chances to participate to (international) research projects

As the managerial practices should account for the local situation, only training within Palestine can be considered.

The training linked to research projects aims in a first instance at providing assistance to research projects submitted in the framework of the FIT project, but could be extended to other on-going research projects. The funds can be used for short term visits (maximum 3 months) of Palestinian researchers to foreign research centres or for researchers from Flemish universities to Palestine, in the framework of a common research project or to gain expertise in specific research domains.

Funds with regard to the use of available laboratory equipment are meant to palliate problems with regard to

- the lack of expertise on the use of existing equipment
- the malfunctioning of the available equipment.

Funding can be requested for training on the use of research infrastructure (on the spot or abroad). Funds for the purchase of new equipment are excluded, but funding can be requested for the rehabilitation of existing equipment (limited to 15% of the cost of the original equipment). With respect to this strand, special attention should be given to the multiplication effects of the training and to the potential to effectively use the equipment for research, training or services to the community.

Strand C: Special projects for top level staff

Proposals can be submitted by top level staff of universities and administrations (e.g., directors of departments, rectors, official negotiator) to attend workshops and seminars abroad on special topics such as management techniques, water policy issues, negotiation techniques, insofar the topic of the workshop or seminar is related to their regular activities and beneficiaries of the funds are actively involved in the development of the Palestinian water policy.

Chapter 3

Project Management and Monitoring

The Steering committee consists of the UNESCO, the Flemish Government, the Palestinian Ministry of Higher Education, PWA, Al-Azhar University, and two representatives from the Technical Network Commission (one from Gaza and one from the West Bank). The Technical Network Commission (TNC) consists of representatives of interested 15 universities and institutions that have water activities in the West Bank and Gaza. A series of Steering Committee and Technical Network Commission meetings were held in during the period 2003-2008. The steering committee members review and approve the project overall policy, future trends and workplan and selected the members of the Technical Network Commission (TNC) members (7 members from Gaza and 8 members from West Bank). The TNC members approve the research and training proposals to be funded and the steering committee approved the TNC recommendation.

3.1 *Implementing Partners*

Project implementation is opened to all Palestinians stakeholders based on a transparent competitive process. Among the successful implementation partners are:

1. Agricultural Relief Union (NGO)
2. WRC – Al Azhar University in Gaza
3. Islamic University of Gaza
4. Land Reclamation Dept.
5. Environment Quality Authority
6. Palestinian Water Authority- Gaza
7. Purdue Project, PWA
8. Al Quds University
9. An Najah National University
10. ARIJ Institute (NGO)
11. Berzeit University
12. Bethlehem University
13. Ministry of Agriculture
14. Palestinian Hydrology Group (NGO)
15. Arab Scientific Institute for Research and Transfer of Technology-ASIR (NGO)
16. House of Water and Environment (NGO)

3.2 Implementation Strategy

The major elements of the project strategy are

- The strengthen of the documentation center at Al Azhar University, to ascertain the continuation of the previous project;
- The creation of a water resources network on training and research, to widen the scope of the previous project and to ascertain the best possible use of the resources, through a national coordination of the activities;
- Enhancement of human and institutional capacities of water sector in POT. This will be done through a series of research and training activities;
- Public awareness and public participation by disseminating the results of the project through different platforms including international conference, website and technical publications; and
- Prompting the issues of partnership and ownership of the project by creating a management structures that involves all stakeholders including the Flemish, the Palestinians and UNESCO.

3.2 Project Monitoring and Management

The project is managed by a steering committee (SC) that is supported technically by a wider technical network commission (TNC) who provides technical support to the SC. Members of the SC UNESCO, the donors representatives, and various Palestinian authorities. Two additional members from the TNC are elected to be members of the SC with a two-year term. The SC includes the following members:

1. Mr. Rudy L. Herman, representative of the Flemish Government
2. Mr. Radwan Al-Weshah, Project Director, Regional Hydrologist, UNESCO Cairo Office (UCO).
3. Mr. Jawad Wadi, President, Al- Azhar University.
4. Mr. Abedelsalam Shala'b, representative of the Ministry of Higher Education in Palestine.
5. Mr. Rebhy Al-Sheikh, Deputy President, Palestinian Water Authority.
6. Mr. Anan Jayyousi, An Najah University and TNC representative.
7. Mr. Yousef Abu-Mayla, the Director of the Water Research Center in Al-Azhar University in Gaza.

The duties of the SC

- Control and compliance of the training and research projects to the project objectives,
- Evaluation and approval of deliverables of the latter projects, and
- Budget review and evaluation of the documentation center.

The Steering Committee meeting is organized once a year to review, adopt the project expenditure and implemented activities for the last year, as well as to approve the activities for the future year within the overall project workplan. The main objectives of the Steering Committee (SC) meeting are to:

- Review and evaluate project activities in the last year.
- Approve expenditure of year last according to the project workplan.
- Adopt and approve the workplan and list of activities for the coming year per the recommendations of the Technical Network Commission.

The Technical Network Commission (TNC) is an advisory committee to the Steering Committee (SC) and its meeting is organized once a year to discuss and review technical aspects and activities of the project in the past year and to recommend to the SC activities for the coming year within the overall project workplan.

The main objectives of the Technical Network Commission (TNC) meeting are to:

- Review and evaluate the technical activities (training & research) implemented since the last meeting and prepare recommendations for approval of the Steering Committee of the project.
- Prepare a list of activities and revised work plan for extending the current project duration for the approval of the project SC based on the overall objectives of the project.
- Discuss the plan for the organization of the project international conference.
- Explore the possibility of the expansion of the project and linking it to other national activities.

Invitations has been sent to the water related institutions to participate or nominate members in TNC. Selection of the TNC members has to be approved by the SC. The TNC elected each meeting two members from them to serve in the project SC. Members of the TNC include:

1. Mr. Jawad Wadi, President of Al-Azhar University, Gaza
2. Mr. Massoud Keshtah, Agricultural Development Association (NGO), Gaza
3. Mr. Yousef Awayes, PWA, West Bank
4. Mr. Amjad Aliewi, House of Water and Environment (HWE), West Bank
5. Mrs. Karen K. Assaf, Arab Scientific Institute for Research and Transfer of Technology-ASIR (NGO), West Bank
6. Mr. Hazem Kittani, PWA, West Bank
7. Mr. Rashed Al-Saed, Birzeit University, West Bank

8. Mr. Issam Nofal, Ministry of Agriculture, amallah, West Bank
9. Mr. Anan Jayyousi, An Najah University and TNC representative, West Bank
10. Mr. Yousef Abu Mayla, Chairman of TNC, Gaza
11. Mr. Khalid Qahman, Environment Quality Authority, Gaza
12. Mr. Mahmoud Abdel Latif, Purdue Project, PWA, representing
13. Mr. Nahed Ghbn, Gaza, and GTZ/PWA project
14. Eng. Dr. Rebhy El-Sheikh, PWA, Gaza
15. Dr. Amer Sawalha, Al-Quds University, West Bank
16. Dr. Hasan Shaban, Land Reclamation Authority, Gaza
17. Dr. Ayman Rabi, Palestinian Hydrology Group, West Bank
18. Dr. Mohamed Al-Agha, Islamic University, Gaza
19. Dr. Omar Zimmo, Berzeit University, West Bank
20. Dr. Willy Bauwens, Representative of the Flemish Counterparts, Belgium
21. Eng. Mohammed Abu Jabal, WRC-Al Azhar University
22. Dr. Radwan Al-Weshah, Project Director, Regional Hydrologist, UNESCO Cairo Office (UCO)
23. Eng. Moustafa Elbaba, Project Manager, Gaza

Chapter 4

Project Activities and Workplan

The project workplan was proposed by UNESCO and approved by the donors. A project budget code was created in UNESCO system. The initial workplan of the project was discussed and finalized during the project steering committee meeting. It has been revised based on the progress made annually. This revisions were submitted and approved by the UNESCO system. The initial workplan of the project is shown in Annex 2.

The project modalities comprise several major activities including:

4.1 Research

Since there is not a clear research policy in the POT, funding for research were occasional and mostly funded by international donors. However, *applied research* is carried out at most universities in the framework of contracts with Palestinian Ministries, international aid programs, MSc and PhD scholarships. The resources available at the universities to perform research *tend to decrease*, due to the fact that international aid projects are now coordinated by the PWA or MENA, ministries that did not exist 3 years ago. Moreover, the universities face strong *competition from some NGO's*.

Collaboration takes place between the Ministries, the universities and the NGO's, resulting for the universities in short term, applied research contracts. This results in a short term vision with regard to the research strategy the universities should adopt: the (fluctuating) demand determines the research agenda. Another tendency is that most centers tend to focus on research in the same field, again, dictated by the immediate demand and the corresponding income opportunities.

Within this project, the framework of research focused on research topics that are relevant for the problems in Palestine as identified by the project technical commission; The development of vision and strategy with respect to the research carried out at the different centers (universities and governmental bodies); the integration of knowledge, as opposed to the fragmentary approach; and the collaboration between the different centers of expertise, to avoid duplication and make maximal use of the available potential

Research Proposal (I-1)	
Title	The effect of soil type and wastewater composition in the nitrification processes during groundwater recharge.
Researcher(s)	1. Thaer Abushbak 2. Mohammed Abu Jaball
Research Institutions	1. Central Laboratory for Water and Soil; Ministry of Agriculture 2. Water Research Centre; Al Azhar University
Budget	\$7910
Duration / Term	12 months, starting 29/11/2003
Advisory Panel	Dr. Nahed Ghbn Eng. Masoud Keshta
Progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 29/11/2003 and first payment effected on 15/1/2004 • First progress report submitted and approved by advisory panel on 31/10/2004 • Installation of experiment setup and pre soil investigation has been accomplished, chemicals for the nitrification study has been ordered, de-nitrification and combined study are delayed • Second payment has been effected on 8/2/2005 • Final report have been submitted and final payment effected on 30/6/2005. 	

Abstract

This research studied the renovation of secondary effluent using SAT system technique under the conditions of Gaza Strip. It used the same secondary treated wastewater produced by Gaza City wastewater treatment plant. The ideal operation was not a one research straightforward conclusion, since management strategies that may augment one output may actually diminish another. Subsequently, the best way to determine the operation strategies is through experimentations under both laboratory scale experiments and small-scale pilot projects.

The major observation for nitrogen was that SAT systems tend to promote nitrification of NH_4^+ in the applied wastewater and transform the majority of influent nitrogen to NO_3^- , by adsorbing NH_4^+ during wetting time and nitrifying them during wetting time. Laboratory and field attempts to establish denitrifying conditions were sometimes not successful. However, in this experiment, and with a short wetting time of one day the attempts to establish denitrifying conditions by manipulating the C:N ratio in a loam sandy soil were successful.

Complete denitrification of the applied NO_3^- was achieved with reasonable C:N ratio with 1:1 and 3:1 ratio, but it was unsuccessful with C:N ratio of 1:3. During the experiment, IC of concentration 5 mg C L^{-1} and TOC of 5 mg C L^{-1} were found sufficient reactants allowing both complete nitrification and denitrification of total N of around 40 mg L^{-1} in the applied wastewater in a loam sandy soil. The main process of removing PO_4^{+3} from the applied wastewater was found to be sorption to the soil particles as a result of the exchange capacity of the soil during the wetting time. Then this was consumed by the microorganisms causing an effective and noticeable recovery of the active soil sites for the next wetting time. Additionally, short drying time of two days did provide complete nitrification, thus allowing NH_4^+ not to build up in soil. The loam sandy soil was found effective to adsorb both NH_4^+ and PO_4^{+3} and held it there for the drying time to be utilized by the microorganisms, avoiding them from reaching the groundwater. The IC in the wastewater was found not to be a limiting reactant for the nitrification process since it was found all the time in levels higher than the input concentrations.

Finally, and in connection with the water quality improvements, and from an environmental point of view, the study has indicated that short wetting time may eliminate NH_4^+ , which is considered as pollutant, from the percolated wastewater. However, a peak in NO_3^- concentration in the percolated wastewater is expected due to the nitrification process which is mainly occurs during drying time. It is important to highlight here that all these results were monitored by the Central Laboratory for Water and Soil (CLWS)-Ministry of Agriculture (MoA).

Key words: Soil type, wastewater, groundwater recharge, Gaza

Research Proposal (I-2)	
Title	Controlling Bacterial Re-growth by Improving the Design of the Household Storage Tanks
Researcher(s)	1. Dr. Anan Jayyousi 2. Mr. Atef Abu-Jaish
Research Institutions	Water and Environmental Studies Institute (WESI), An-Najah National University, Nablus, Palestine.
Budget	\$8000
Duration / Term	2 years, starting 20/11/2003
Advisory Panel	Dr Alfred Abedrabbo Dr. Amer Swalheh
Progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 29/11/2003 and first payment effected on 15/1/2004. • First progress report submitted and approved by advisory panel on 8/5/2005 • Experiment was carried out on three galvanized tanks, data collected and results obtained during the first phase of the study • Second payment has been effected on 15/5/2005 • Final report submitted on 1/6/2005. <p>The extremely low residual chlorine in water supplied by Nablus Municipality was the main cause for obtaining bacterial regrowth in the tanks. Longer storage periods provide an opportunity for residual chlorine to drop and allow for significant increases in bacterial concentration to occur. The traditional cubic tank needs modification in order to maintain acceptable residual chlorine and water with minimum bacterial counts during water storage.</p> <p>No one of the three tanks showed significant difference from the other two types with respect to bacterial re-growth, residual chlorine, temperature, pH, or turbidity. However, the cylindrical type showed better results than the other two types. More time is needed for the experiment to determine if the cylindrical type is a satisfied improvement to the traditional tank type.</p> <ul style="list-style-type: none"> • Final payment effected on 1/6/2005 	

Abstract

Water distribution systems play a major role in determining the final quality of potable drinking water. Pathogenic and toxigenic microbiological agents in drinking water can cause diseases and death to consumers. The health risks associated with these pathogens range from viral and bacterial gastroenteric diseases to infections such as hepatitis A and giardiasis. Drinking water samples (n=24) with a volume of 1000 ml were collected in sterile bottles from the distribution systems at different regions in Ramallah District in Palestine. Moreover, swabs from the inside of the water distribution system of the same regions were taken. Samples were filtered through a 0.45 μ M membrane, and various tests were conducted on each sample including total coliform, fecal coliform, heterotrophic plate count, *Pseudomonas auroginosa* count, fecal streptococci, sulfite reducing anaerobes, residual chlorine, turbidity, ammonium and nitrate. For protozoa, microscopic examination was done for the swabs transported in saline from the biofilms within the same day of sampling.

Four samples out of 12 (33%) contained too many to count for HPC. The remaining 8 samples contained an average of 26 CFU/100 ml. Five samples out of 12 (42%) were found to contain total coliform. The number ranged between 0 and 80 CFU/100 ml. The average number of total coliform was 14 CFU/100 ml. Summer samples were found to have more total coliforms than winter ones. Neither winter nor summer samples were found to contain fecal coliforms. Residual chlorine ranged between 0.08-0.55 mg/L (average 0.24mg/L) and nitrate concentrations in drinking water samples ranged between 4.79-16.26 mg/L (average 9 mg/L). PCR results of the DNA extracted from a total of 25 samples of different origins (pipe water, tank water and biofilm swabs) revealed that 23 samples did not contain the microbes (bacteria and protozoa) considered in this study.

Our results show that the drinking water quality in the distribution system of Ramallah District is of good quality and intermittent water supply should be avoided when possible, as this was associated with an increase in total coliform and turbidity.

Key words: health risk, microbial growth, biofilms, water distribution systems

Research Proposal (I-3) AB-23	
Title	Impact of global Changes on Surface Water Resources in Wadis Contributing to the Lower Jordan Basin
Researcher(s)	1. Dr. Anan Jayyousi 2. Mohammad Taha Al-Hanbali
Research Institutions	Water and Environmental Studies Institute, An-Najah national University, Nablus, Palestine.
Budget	\$6000
Duration / Term	1 year, starting 20/4/2004
Advisory Panel	Dr. Karen Assaf Dr. Amer Swalheh
<p>Progress Status</p> <ul style="list-style-type: none"> • Contract amendment has been signed on 20/4/2004 and first payment effected on 9/5/2004 • First progress report submitted and accepted by the advisory panel on 8/5/2005 • The report provides an overview of all data available to the project team at present; the report describes both the rainfall data and the data on water resources on the study area. • Second payment has been effected on 15/5/2005 • Final report submitted on 31/5/2005 • Results of the streams water quality analysis show that runoff during winter as well as peak discharge periods out of the springs improve the quality of the water in the stream, due to the mixing factor. In addition, the microbiological analysis shows that contamination of the water is caused by the untreated wastewater that is flowing from Nablus city and Faria Village and Camp. Nevertheless, the overall quality of the water shows that it can be used for irrigation. • Final payment effected on 31/5/2005 	

Abstract

With limited resources and rapidly increasing demands, sustainability is becoming an increasingly important, yet difficult goal to achieve in wadis (Salih and Ghanem, 2003). Sustainability of wadi systems is more complicated due to the conflicts and interactions among the different resource utilizations. It is a fact that sustainability of any natural entity can only be achieved through an integrated approach for its management.

In this paper, an attempt is made to summarize the challenges facing sustainable development of Wadi Fara'a and to propose some solutions towards achieving that goal. The challenges considered in this paper include technical, socio-economic, environmental, institutional, political and legal aspects. Wadi Fara'a located in the North Eastern part of the West Bank is taken as an example due to its characteristics as a natural environmental set-up that must be managed in a comprehensive, sustainable manner.

The proposed solutions are based on the outcome of the Al-Fara'a and Jerash integrated watershed management project. The overall aim of the project is to create sustainable development conditions for the study area through which water resources, natural resources and human resources are protected and conserved. The project is conducted by the Palestinian Environment Quality Authority (EQA) and United Nations University (UNU-INWUH) which received financial support from the European Union (EU); Short and Medium term Environmental Action Program (SMAP) and the Dutch Ministry of Environment (VROM).

Key words: sustainability, wadis, hydrology, Palestine, Wadi Far'ah

Research Proposal (I-4)	
Title	Socio-economic Aspects of Water and Sewerage Infrastructure in Gaza Governorates
Researcher(s)	Mohammed S. Eila; Master Degree in Regional Development Planning Post Graduate Diploma in Regional Development Planning and Management
Research Institutions	Hosting Institute : Palestinian Environmental Quality Authority – Department of Natural Resources
Budget	\$6000
Duration / Term	14 months, starting 23/11/2003
Advisory Panel	Dr. Mohammad Abu Shammaleh Eng. Rebhy Al Sheikh
Progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 29/11/2003 and first payment effected on 15/1/2004 • First progress report submitted 3/11/2004 • Preparation of indicators-based profile and evaluation of the existing situation were implemented • Second payment pending the approval of the advisory panel • Final report submitted on 12/6/2005 <p>Main results are: Socio-economic aspects of water and wastewater infrastructure have been developed based on cause-effect relationship. The sustainability approach gives insight into the management of water resources as a function of the complex interaction of a large number of socio-economic factors. The effectiveness of such an approach depends on finding the nontraditional ways of dealing with identifying the socio-economic aspects for water resources management.</p> <ul style="list-style-type: none"> • Final payment effected on 12/6/2005 	

Abstract

The current understanding of the socio-economic aspects of water and wastewater infrastructure is dominated by simplifications, which in turn, underline many water policies that led to unsustainable use of this scarce resource in Gaza Strip. Therefore, this research aims at establishing an integrated socio-economic framework that identifies the most influential socio-economic factors. It also aims at establishing a prediction model for the relationship between these influential indicators with water/wastewater related indicators.

The methodology presented in this research work, offers opportunities to simulate the future demand of the different water abstraction and water consumption per capita based upon actual conditions within 25 municipalities. The determinant variables of have been identified and prioritized using statistical analysis and Artificial Neural Network (ANN). The results were compared with other statistical techniques. ANN prediction model helped in drawing scenarios for future development. These pathways indicate that water policies and projections for the future must not only capture the population indicators as the only drivers but also account for the specific human resource development indicators and urban environmental conditions.

The research concluded that sustainable development of water and wastewater infrastructure should take into consideration several factors such as population, income per capita, growth, water price, operational costs, water system efficiency, efficiency in revenues/tax collection and ability/willingness to pay for water and wastewater services. This recognition requires moving beyond some of the simplifications that persist in much of the current understanding of the causes of unsustainable water resource management.

Key words: Socio-Economic aspects; Water Resources management; Gaza; Palestine

Research Proposal (I-5)	
Title	Integration of Environmental Concerns into Water Resources Planning and Management in Gaza Strip
Researcher(s)	Said Mustafa Jalala Director General
Research Institutions	Palestinian Authority; Environmental Quality Authority (EQA)
Budget	\$6000
Duration / Term	18 months, starting 10/12/2003
Advisory Panel	Dr. Mohammed AL Agha Dr. Mohammad Abu Shammaleh
Progress Status	<ul style="list-style-type: none"> • Contract has been signed on 29/11/2003 and first payment effected on 15/1/2004 • Final report submitted, the research was completed and accepted by the advisory panel on 3/3/2005 • Second and Final payments were effected on 28/3/2005.
Abstract	<p>Sustainable water resources management in Gaza Strip (GS) as a case study is a complex challenge which requires a new approach if management should be based on sound scientific findings in order to optimize and conserve the precious and scarce water resources. Increased water demand from population and economic growth, environmental needs, land use change, urbanization, over abstraction of aquifer, deterioration of water quality, pollution from local and diffuse sources, water infrastructure hotspots and impacts on public health and ecosystems are all factors that will continue to create severe water shortage problems. During the recent years, water resource shortage and water pollution have severely underpinned social and economic fabric of the Palestinian society which is characterized broadly as under-developed with widespread poverty.</p>

Considering the doubling of population of GS by the year 2020, the predicted water demand will increase to reach $260 \text{ hm}^3 \cdot \text{y}^{-1}$ which definitely exceeds by about three times the ecological limits and sustainable capacity of the GS coastal aquifer. The current water management challenge is to remediate and restore the coastal aquifer as part of nature conservation and to bridge the present and future water supply-demand gap based on provision of water with adequate quantities and qualities according to WHO standards.

In this research, environmental indicators related to water been developed based on cause- effect relationship tackling the life cycle of water resources management. The Driver-Pressure-State-Impact-Response (DPSIR) was selected as a well established framework to develop the possible variables under five categories which are pollution pressures, water quality and impacts. The effective variables have been characterized and prioritized using artificial neural networks (ANN), cluster analysis and health risk assessment. The selected variables have been classified and organized using cluster analysis.

Within the integrated process for water resources management, it is recommended to adopt two significant approaches. The first is the preventive approach which is to move from restorative to protective management, while maintaining support for remediation of existing water hotspots, since the costs of preventing water pollution are rather small compared to remediation. The second is the ecosystem approach which aims to meet the human water requirements whilst maintaining the hydrological and ecological processes. Besides, the existing project-focused Environmental Impact Assessment (EIA), Strategic Environmental Assessment (SEA) procedure is recommended as an effective decision-making tool to strengthen the integrated approach and to mainstream the environmental sustainability considerations into water sector developmental policies, plans and programs. SEA ensures that the cumulative and large scale effects of certain water sector policies, plans and programs are identified and addressed at early stage and before their adoption.

Keywords: ANN; Gaza Strip; groundwater; pollution pressures; public health and ecological impacts; state of water quality.

Research Proposal (I-6)	
Title	The reuse of reclaimed wastewater for irrigation of agricultural crops in the Palestinian highlands
Researcher(s)	Dr. Ziad Mimi Dr. Jamil Harb
Research Institutions	Institute of Water Studies, Birzeit University
Budget	\$ 8000
Duration / Term	24 months, starting 10/12/2003
Advisory Panel	Dr. Alfred Abedrabbo Dr. Omar Zimmo
Progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 27/11/2003 and first payment effected on 15/1/2004 • First progress report submitted and accepted by the advisory panel on 10/11/2004 • Vegetative growth was measured, reproductive growth and yield were registered periodically and soil samples were collected both at planting time and by the end of growing season to assess the heavy metals pollution. • Second payment effected on 8/2/2005 • Final report submitted on 1/6/2005. • Research results: <ol style="list-style-type: none"> 1. Results of 1st year: During the growing season samples were collected and will be analyzed in the coming months. However, data related to the impact of irrigation with reclaimed wastewater on yield are ready. 2. Results of the 2nd year: The following results are only a part of the obtained results. In the coming weeks we will process the remaining results. Moreover, statistical analysis will be conducted for all results, and the interpretation of results will be done later. • Final payment effected on 1/6/2005. 	

Abstract

This research project was initiated as response to the fact that water is the major constraint for agricultural development and sustainability in Palestinian territories (PT's)); this water scarcity will become more critical as urban and industrial sectors place higher and higher demand on water. Consequently, the reuse of reclaimed wastewater represents an attractive alternative for Palestinian farmers. However, several factors and conditions restrict the use of treated wastewater in agriculture. In this respect, the sociocultural factors could be considered as the main factors that restrict the reuse of treated wastewater. Furthermore, crop type and irrigation system are additional factors.

The aim of this research is to investigate the feasibility of using reclaimed wastewater as an alternative water resource in irrigating agricultural crops in the Palestinian highlands (e.g. Ramallah district), a region where water resources for agriculture is very limited. Namely, the research objectives are:

1. to introduce and enhance the reuse of wastewater as a non-conventional source of water for irrigation and consequently to evaluate the suitability of reclaimed wastewater for various agricultural crops grown in semi-arid conditions (Palestinian territories).
2. to evaluate the impact of reclaimed wastewater on plant growth and development and to assess the impact of this water source on calcareous soils.
3. to assess the impact of reclaimed wastewater used to irrigate crops on the post harvest quality of fresh product.

In the framework of this research project, we conducted several experiments, and recently we finished an experiment that focused on the use a mixture of brackish water with treated wastewater, to achieve double purposes: to dilute the brackish water in order to use it as an irrigation source, and to benefit from the high salinity level of brackish water to eliminate pathogens may found in reclaimed wastewater.

Key words: water reuse, reclaimed water, irrigation, Palestine

Research Proposal (I-7)	
Title	“Prevalence and characterization of <i>Shiga toxigenic Escherichia Coli</i> (STEC) in Tulkarm and Jenin domestic wells in the West Bank “
Researcher(s)	Marwan “M.S.” Budair
Research Institutions	Palestinian Water Authority
Budget	\$6000
Duration / Term	2 years, starting 20/3/2004
Advisory Panel	Dr. Jad Issac Dr. Alfred Abedabbo
<p>Progress Status</p> <ul style="list-style-type: none"> • Contract has been signed on 6/4/2004 and first payment effected on 12/5/2004 • First progress report submitted and approved by advisory panel on 3/3/2005 • About 80 samples are collected before and after chlorination for the <i>Total Coliform</i> bacteria, biochemical tests were done, about 35 <i>E. coli</i> were isolated from the 80 samples and preserved in preservative broth in the deep freeze. • Second payment has been effected on 15/3/2005 • Final report submitted on 12/6/2005 • Final payment effected on 12/6/2005 • 	

- Main results:
 1. Total Coliform differentiation:
The total coliform bacterial isolates was identified in 63 (67%) of the 94 water samples analyzed in this study
 2. The efficiency of Chlorination systems: Our results as in table 4 shown that 100% of the chlorinated samples (69%) in both Tulkarm and Jenin cities were zero% contaminated, and all of them were potable and good quality water samples.
 3. Distribution of the contaminated samples that do not have chlorination systems: Results revealed that among northern Palestinian domestic wells, the rate of contaminated samples especially without chlorination system was 83 % (24 / 29) of the non chlorinated samples which account about 31% of the total (94) water samples, this finding indicates that the contaminated water is a serious problem in Palestine, emerge a public health problem. The more serious problem was in Jenin city that have 100% contaminated samples of the non chlorinated samples that were 56% of the total samples in Jenin city.
 4. Distribution the contaminated samples according to the depth of the wells:
We divided the well depth into five depth groups as shown in table 5. Rate of contamination were decreased as increasing the well depth, from 100% in the first depth group to 71%, 63%, 41% and 7% in the final group.
 5. Resistance to antibiotics: Among the β -lactam antibiotics tested, imipenem behave as the most potent antibiotic (25%). The highest activity of imipenem seems to be related to its stability against most β -lactamases and it is a rapid permanent.
 6. The prevalence of STEC by using multiplex PCR assays: The PCR product of stx-encoding genes (STEC isolates) was not identified in any of the 44 (47% of the total water samples) E. coli isolates in both Tulkarm and Jenin districts Wells
 7. Epidemiological study by clonal analysis of E. coli isolates by the ERIC-PCR: ERIC-PCR pattern E1 isolates were widespread throughout northern Palestine represented by 12 (71%). The remaining ERIC-PCR patterns (E2 to E5) were considered as sporadic since they were found only in a small number of isolates, were found in five isolates

Research Proposal (I-8)	
Title	Ground water quality and pollution due to pesticide and trace metal in Palestinian territories
Researcher(s)	Subhi Samhan
Research Institutions	Palestinian Water Authority, Central laboratory
Budget	\$4970
Duration / Term	2 years, starting 20/3/2004
Advisory Panel	Dr. Anan Jayyousi Dr. Ayman Rabi
progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 24/3/2004 and first payment effected on 5/4/2004 • First progress report submitted and accepted by the advisory panel 13/3/2005 • Available data was reviewed and summarized, samples from 50 wells were collected, and samples were tested and investigated at both labs of PWA and Abi Dies Univ. Efforts have been exerted to update available data and finally a conceptual framework has been developed for result analysis • Second payment effected on 25/4/2005 • Final report submitted on 8/6/2005. • The main results were: <ol style="list-style-type: none"> 1. Result revealed that the incremental of Nitrate and Potassium in the shallow wells indicate with high risk for the presence of pesticides and traces metal. 2. Result revealed that the Paraquat was not found in the tested wells in the tow area of study this because the Paraquat which recently used or it is biodegradable. 3. Tulkarem Area is significantly more in term of No polluted from the trace mainly Pb 90%, Cd 20% and Cr 35% of the tested sample. On the other hand, Jenin polluted mainly by Pb 85% from the tested sample. 4. Traces and heavy metal related to the presence of cationic parameters, which can be easily exchange in the complex compound as aligned. • Final payment effected on 8/6/2005. 	

Abstract

There are 123 types of pesticides used in the West Bank and 14 of these pesticides were internationally suspended, cancelled or banned by WHO. Furthermore, some of those pesticides are still used. It is important to monitor groundwater for pesticides and trace elements because of the heavy industrial activities in the West Bank.

This study aims determine quantitatively and quantitatively the effect of pesticides on groundwater due to the agricultural activity in the Jenin and Tulkarem areas. Moreover, trace elements and heavy metals such as cadmium (Cd), lead (Pb), iron (Fe), zinc (Zn), chromium (Cr), copper (Cu) were determined quantitatively for the same period of study starting in April 2004 to May 2005.

Most of the tested wells for lead (Pb) and chromium (Cr) in the Tulkarem area were above the WHO standard for potable water. Trace elements and heavy metals relate to the presence of cationic parameters which can be easily exchanged in the complex compound as aligned were investigated in the two areas. In the Tulkarem area it is significant that the polluted samples were (Pb) 90%, Cd 20% and Cr 35% from the tested samples. On the other hand in Jenin the tested wells polluted with Pb were 85%. On the contrary, pesticides concentration is greater in Jenin wells compared with Tulkarem tested wells. Moreover, the polluted wells in the studied area by nitrate (NO₃) and potassium (K) were above the WHO guidelines, where as they were free from fecal coliform as pathogenic indicators which leads one to conclude that groundwater well pollution is due to fertilizer from agricultural activity and not to sewage (wastewater) disposal in most of cases.

Results revealed that the groundwater usage for drinking was at high risk from pollution by trace metals and rising amounts of nitrate and potassium in Jenin wells due to the industrial and agricultural activity that is not controlled or monitored. Moreover, results revealed that the Paraquat was not found in the tested wells in the studied area because it was either recently used or biodegradable.

It is recommended to initiate a pilot scale study for chlorinated water using Trihalomethane which is highly carcinogenic as a health indicator that affects human beings. Public awareness campaigns are needed for all related institutions dealing with water, as well as consumer dealing with the issues of water pollution and water treatment for the future. Moreover, work is needed to correlate transport models of trace metals with hydrological issues.

Key words: pesticides, trace and heavy metals, groundwater pollution.

Research Proposal (I-9)	
Title	Domestic roofwater harvesting in Gaza strip using spatial rainfall modeled data
Researcher(s)	Dr Yousef Salah Abu Maylah Eng. Mohammed Shaban Abu Jabal MSc Eman Qazaer MSc Zainab Zomlot
Research Institutions	Water Research Center, Al Azhar University Gaza
Budget	\$2620
Duration / Term	9 months, starting 30/5/2004
Advisory Panel	Dr. Karen Assaf Eng Masoud Keshta
<p>Progress Status</p> <ul style="list-style-type: none"> • Contract has been signed on 26/6/2004 and first payment effected on 19/9/2004 • First progress report should have been submitted on 30/9/2004 • Draft Final report submitted on 20/5/2005 • • Around twenty rains cell has been estimated and calibrated to the historical rain cell of the one rain gauge near the middle of Gaza strip. From this application the parameter of this rain cell could be obtained, these parameters could help in the hydrological forecasting, also it also described that the application of model is good in the case of missing data, since the parameter could be given then the data could be optimized. • Second and final payment were effected on 31/5/2005. 	

Abstract

Gaza has very limited water resources: rainfall, and ground water. Rainfall is the renewable source of fresh water in the Gaza Strip. The average annual rainfall in the Gaza Strip increases from 230 mm / Year in the South to a bout 430 mm / Year in the north of the Gaza Strip. Most rain falls in the period mid October till end March; the period May to September is dry with no rainfall. Ground water is considered the main water resource. The present self yield of the coastal aquifer in Gaza is estimated to be only 60 MCM/y due to serious past over pumping mainly during the period of the occupation, which resulted in the encroachment of deep saline water strata and sea water in many wells. Gaza already faces sever and immediate water crisis with much of its drinking water hardly fit for human consumption. Seawater intrusion is already occurring and tests are showing increased salinity levels in some cases, greater than 1,500ppm of chloride and high concentration of nitrate levels (150ppm in some places), making water unsuitable for drinking falling below health standards set by the World Health Organization.

Rainfall data show a considerable spatial and temporal variation over any region. This variation is due to differences in the type and scale of rainfall producing processes, which are strongly influenced by local or regional factors such as topography, wind speed and wind direction. These factors are parameterized in the spatial rain cell model of Willems (1999, 2001), which describes the spatial rainfall structure by considering the following scales of rainfall intensities and rain storm sub-entities: rain cells, rain cell clusters, and small or large mesoscale areas. The model has been used for the application of short-term rainfall series generation in Gaza strip areas it has been calibrated to forty historical rainstorms, which presented in daily time scale. It also has also been implemented for about twenty rainstorms with hourly time scale for only one rain gauge in the middle of the strip.

From this application a good estimate of average areal rainfall have been obtained which could be used in the hydrological applications in the future study. The areal rainfall has been also calculated with the method of Thiessen. Comparison between the different methods for areal rainfall estimation has been done the accuracy of the methods has been calculated in terms of the standard deviation and a visual comparison was made of the different rainfall estimations. From the comparison it could be concluded that the Spatial rainfall is the more accurate than Thiessen method.

Around twenty rains cell has been estimated and calibrated to the historical rain cell of the one rain gauge near the middle of Gaza strip. From this application the parameter of this rain cell could be obtained, these parameters could help in the hydrological forecasting, also it also described that the application of model is good in the case of missing data, since the parameter could be given then the data could be optimized.

Key words: GIS application, spatial rainfall, water harvesting, hydrological forecasting, Gaza Strip, areal rainfall estimation

Research Proposal (I-10)	
Title	Capacity Building for a Program in Water Resources Management in Gaza and the West Bank
Researcher(s)	U.S. – Palestinian Linkages (UPLINK) Program Dr. Mohammad Ramadan Al-Agha (Program Director) & Yasser Nassar (MSc Water Resources)
Research Institutions	Partner institutions : The Islamic University of Gaza (IU-Gaza), An-Najah University, Bethlehem University, Purdue University, Palestinian Water Authority (PWA)
Budget	Funded by USAID through the association Liaison Office for University Cooperation in Development
Duration / Term	7 months, starting 30/5/2004
Advisory Panel	Dr. Hassan Shabban Dr. Yousef Abu Mayla
Progress Status	
<ul style="list-style-type: none"> • Contract has been signed on 5/6/2004 and first payment effected 13/6/2004. • First progress report submitted on Nov 2004 • An educational program (Master's Degree) in water resource management, supported by the Palestinian Water Authority and Purdue University, 18 candidates were admitted, • The MSc program is supervised by a committee that consists of eleven members. Part of the committee's responsibilities includes continuous project evaluation and sourcing of funds to continue the program beyond current funding horizons. • Final payment effected on 31/5/2005. 	

Abstract:

The Islamic University of Gaza, Bethlehem University, An-Najah University/Nablus, Al Azhar University - Gaza, Purdue University/USA, and the Palestinian Water Authority are partnered to establish an MSc degree program that is based on identified competencies needed in Water Resource Management. Distance learning technologies are employed to make this program available to students across the region. The project is a result of an effort to enhance and upgrade the educational standard and build human capacity in the Palestinian territories for the water sector.

The Masters degree is focusing mainly on the development of the water sector in the Palestinian territories and the region. The innovative concept in this program is the competency based approach, in which specific skills and abilities needed by graduates have been identified and arranged into relevant courses. Rather than developing a traditional Master's program by selecting from existing courses that may or may not directly address student needs, this program first identified the knowledge and skills, or competencies, the Masters graduates will need. The program also integrates experiential and classroom learning, and is based on the local priorities and needs of the water sector, as determined in collaboration and coordination with the Palestinian Water Authority.

The funds were provided to the IUG-Purdue project in order to support the partnership between UNESCO FUST project through support of the student activities. The funds were used in the fields shown in the tables above. These fields include supporting the research made by students and the part to be done in the next few months. Chemicals, kits, transportation for sampling and visits, communication including faxes and phone calls, stationary etc.. These supported the students where 3-5 of whom finished their research by the September 2005. The rest of the students (10) finished their research by Feb, 2006. It was found that the best way to make all the students benefit from this amount of money to spend it in this way. Where many of these fields can support almost all the students. It was not easy to specify the money to certain type of students.

The grant although of its small amount, it was possible to make it beneficial to as many as possible of the students. Of course the grant make it possible for the students to fasten their work and finish it before the due time. By the end of the project about 15 MSc theses will be the outcome, where most of them would have directly benefited from this amount of money.

Electronic copies of these theses will be available on the internet for the public access as soon as the project is finished.

Key words: capacity building, water education, master degree, Islamic university in Gaza

Research Proposal (II-1) ABS-14	
Title	Regional assessment of groundwater vulnerability to contamination in Gaza strip
Coordinator	Dr. Mohammad N. Almasri
Research Institutions	1- An Najah Univ, WESI. 2- An-Najah Univ., Dept. of Civil Engineering 3- Environmental Quality Authority, Palestine
Budget	\$10,000
Duration / Term	12 months, starting 10/12/2004
Advisory Panel	1- Mohamed Al-Agha 2- Khalid Qahman
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 9/12/2004 • First payment was effected on 16/1/2005 • First progress report submitted on 30/6/2005 • Final report is due on 30/11/2005. 	

Abstract

The Gaza Coastal Aquifer (GCA) is the major source of fresh water for the 1.4 million residents of Gaza Strip, Palestine. The aquifer is under deteriorating quality conditions mainly due to the excessive application of fertilizers. The vulnerability of the GCA to contamination was assessed using the well-known DRASTIC method. The DRASTIC method was developed by the US EPA to be a standardized system for evaluating groundwater vulnerability to pollution. The primary purpose of DRASTIC is to provide assistance in resource allocation and prioritization of many types of groundwater-related activities and to provide a practical educational tool. Detailed analysis of the vulnerability map of GCA was carried out and did consider different relationships between the vulnerability indices and the on-ground nitrogen loadings and land use classes. In addition, correlation between vulnerability values and the nitrate concentrations in GCA was studied. Based on the vulnerability analysis, it was found that 10% and 13% of the Gaza Strip area is under low and high vulnerability to groundwater contamination, respectively; while more than 77% of the area of the Gaza Strip can be designated as an area of moderate vulnerability to groundwater contamination. It was found that the density of groundwater monitoring wells for nitrate concentration is high for the moderate and high vulnerability zones. The highest first quartile, median, mean, and third quartile of nitrate concentrations are reported in the high vulnerability zones. Results of sensitivity analysis show a high sensitivity of the high vulnerability index to the depth to water table.

Key words: groundwater, vulnerability, agriculture, fertilizers, management, coastal aquifers, contamination

Research Proposal (II-2)	
Title	Hydro-geological Evaluation for the Impacts of the Proposed Philadelphia Moat on The Groundwater Resources in Rafah Area, Gaza Strip, Palestine
Coordinator	Dr. Ahmed Yakoubi
Research Institutions	1- Palestinian Water Authority 2- Palestinian Hydrology Group
Budget	\$7950
Duration / Term	12 months, starting 10/12/2004
Advisory Panel	1- Khalid Qahman 2- Massoud Keshtah
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 13/12/2004 • First payment was effected on 16/1/2005 • First progress report is due on 30/6/2005 • Final report is due on 30/11/2005 	

Abstract

Two scenarios have been adapted and evaluated, namely, the impact of proposed seawater moat or seawater canal in the Philadelphia corridor at the southern western borders of Gaza Strip on the local groundwater quality. Both of the two scenarios have been simulated using numerical groundwater flow and transport model.

In case the seawater moat is constructed and operated along the Philadelphia corridor at the southern western borders of the Gaza Strip, the simulation for this new hydraulic boundary condition will lead to the following conclusions

1. groundwater resources in the vicinity of Philadelphia corridor will be harmed very severely from quality point of view
2. contaminant plume progress rate is 200 m/yr based on the calibrated flow and transport parameters used in the model
3. In terms of quality the most fresh groundwater area beneath the seawater moat on both sides of the borders will be invaded and attached by the contaminant (seawater) plume
4. In terms of production wells, tens to hundreds of production wells (municipal or agricultural) on both sides of the borders will be attached and affected and become useless.
5. Socioeconomic life of the Palestinian and Egyptians (for both farmers and normal citizens) on both sides of the borders will be affected severely due to deterioration of the local groundwater quality that used for agriculture and drinking.

In case the seawater canal is constructed and operated along the Philadelphia corridor at the southern western borders of the Gaza Strip, the simulation for this new hydraulic boundary condition will lead to the following conclusions.

1. groundwater resources on both sides of the borders of Rafah will be affected severely
2. the contaminant plume will invade the local groundwater at a rate of 100 m/yr
3. tens to hundreds of these wells will be affected severely with regard to salinity in the short term (after 1-5 years)
4. Socioeconomic life of the Palestinian and Egyptians (for both farmers and normal citizens) on both sides of the borders will be affected severely due to deterioration of the local groundwater quality

Overall, if such a project is executed it will bring a disaster to both the Palestinians and the Egyptians on both sides of the borders. The impact will not be confined in the vicinity of the Philadelphia corridor but rather it will affect further areas.

Key words: Philadelphia Moat, Rafah Canal, groundwater, Gaza strip, sea water plume

Research Proposal (II-3)	
Title	Application of a UASB-digester system for domestic sewage treatment in Palestine
Coordinator	Dr. Nidal Mahmoud
Research Institutions	1. Water and Environmental Studies Institute, An-Najah national University, Nablus, Palestine. 1- Birzeit Univ., Inst. for Water Studies 2- Birzeit Univ., Dept. of Chemistry 3- Palestinian Wastewater Engineers Group (PWEG)
Budget	10,000
Duration / Term	18 months, starting 10/12/2004
Advisory Panel	1- Omar Zimmo 2- Ayman Rabi
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 9/12/2004 • First payment was effected on 16/1/2005 • First progress report was received on 30/11/2005 • Final report was received and final payment was effected on 30/08/2006 	

Abstract

The treatment of high strength sewage was investigated in a one-stage upflow anaerobic sludge blanket (UASB) reactor and a UASB-Digester system. The latter consists of a UASB reactor complemented with a digester for mutual sewage treatment and sludge stabilisation. The one-stage UASB reactor was operated at a hydraulic retention time (HRT) of 10 hours and at ambient air temperature for a period of more than a year in order to assess the system response to seasonal temperature fluctuation. The one stage UASB-reactor was modified to a UASB-digester system after a year of operation by incorporating a digester operated at 35 °C. The UASB-Digester system provided significantly higher COD removal efficiencies than the one-stage UASB reactor. The achieved removal efficiencies in the one-stage UASB reactor for total, suspended, colloidal, dissolved and VFA COD were 54, 71, 34 and 23 %, and -7 %, respectively during the first warm six months of the year, and achieved only 32% removal efficiency for COD total over the other cold six months of the year. The modification of the one stage UASB reactor to a UASB-digester system had remarkably improved the UASB reactor performance as the UASB-digester achieved removal efficiencies for total, suspended, colloidal, dissolved and VFA COD of 72, 74, 74, 62 and 70%. Therefore, the anaerobic treatment of high strength sewage with fluctuating temperature over the year like the case in Palestine in a UASB-Digester system is very promising.

Key words: anaerobic treatment; low temperature; one-stage UASB; sewage; suspended solids; UASB-Digester

Research Proposal (II-4)	
Title	Management Practices of Spring Discharges in Catchments Contributing to the Lower Jordan Basin
Coordinator	Dr. Ammar Jarrar
Research Institutions	1- An Najah Univ., WESI 2- An Najah Univ., Dept. Civil Engineering 3- Ministry of Agriculture
Budget	\$10,000
Duration / Term	24 months, starting 10/12/2004
Advisory Panel	1- Karen Assaf 2- Abu Mayla 3- Hasan Shaban
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 28/12/2004 • First payment was effected on 3/3/2005 • First progress report was received on 30/10/2005 • Final report was received and final payment was effected on 30/09/2006 	

Abstract

Faria watershed, located in the northeastern part of the West Bank, Palestine, is one of these semi-arid watersheds where recently, the prolonged drought periods in the watershed and the high population growth rate have negatively affected the existing obtainable surface water and groundwater resources. Springs are a major water resource in the watershed where more than 50% of the water needs of the Palestinians in the study area is furnished by these springs. Most of the springs of Faria watershed are located in the upper and middle parts of the watershed. There are 11 fresh water springs in the watershed which can be divided into three groups: Faria, Bathan, and Miska in addition to other two springs that are entirely utilized by the City of Nablus. Discharge data for the springs show high spring discharge variability.

Chemical water quality for the springs has been monitored and records show that the chemical water quality for springs in the Wadi is fair. However, spring water is mixed with untreated waste water from Nablus and Al-Fara'a camp resulting in serious deterioration for the water quality along the main stream of Al-Fara'a. Water quality is not monitored along the main stream of Al-Fara'a therefore there are no data regarding water quality along the stream. Palestinian wells in the upper areas of Al-Fara'a have good chemical and biological quality. Water salinity for wells in the central and lower areas is the major concern for utilizing water from these wells.

Domestic water supplies to the villages and towns in Wadi Al-Fara'a are obtained from existing springs and wells in the area. Ras Al-Fara'a and Wadi Al-Fara'a villages don't have domestic pipe networks. Thus residents of these two villages have to get their water either from irrigation wells, or from the spring there.

Agricultural water supply systems are supplied from irrigation wells and springs. For springs, the only pipe network system is Al-Fara'a Irrigation project which extends from Ein Shibli to Al-Jiftlik. Agriculture is the most common economic activity in the area. In addition to agriculture, there are few small industrial and commercial activities in the area. The upper area has few touristic activities and touristic facilities. However, these activities were highly impacted by the closure of roads and the restrictions on travel.

The analyses and data for this study showed that the Palestinian National Authority has recently developed national policies in the areas of water, environment and agriculture. There are no farmers unions which represent the interests of farmers. There are no water user associations which represent the interests of water users and operate and manage water systems.

Key words: springs, irrigation, domestic water, lower Jordan, water quality

Research Proposal (II-5) ABS-51	
Title	Development and valuation of local fixed film materials to reclaim the effluent of septic tank-natural treatment systems for irrigated agriculture
Coordinator	Dr. Rashed Al Sa'ed
Research Institutions	1- Birzeit Univ., Inst. for Water Studies 2- Birzeit Univ. Dept. of Civil Engineering 3- Palestinian Hydrology Group
Budget	\$10,000
Duration / Term	18 months, starting 10/12/2004
Advisory Panel	1. Anan Jayyousi 2. Omar Zimmo
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 9/12/2004 • First payment was effected on 16/1/2005 • Final report was received on 30/4/2005 • Final report was effected on 30/6/2006 	

Abstract

This study evaluates the feasibility of using local fixed film media in waste stabilization ponds to enhance their treatment efficacy. A pilot-scale algae-biofilter system (ABS) was investigated, in parallel with an algae-based control (ABP) over a 6-months period to evaluate the treatment efficacy of both systems. Each system entailed 4 equal ponds in series and was continuously fed with domestic wastewater from Birzeit University. The removal rates of organic matter, nutrients and fecal coliforms were monitored within each treatment system. The results obtained revealed that ABS was more efficient in the removal of organic matter (TSS and COD; 86% and 84% respectively) and fecal coliforms (4 log₁₀) than ABP (81%, 81%, 3 log₁₀ respectively). Nitrogen was reduced in the ABS to an average of 24 mg N/L; in contrast the effluent from the control ABP which contained 32 mg N/L. Passive aerated ABS system is thus an efficient, a low-cost and feasible land-saving option to algae-based ponds.

Key words: waste stabilization ponds, rural areas, domestic wastewater, algae-biofilter, rock filter, nitrification, removal efficacy, effluent reclamation and reuse

Research Proposal (II-6)	
Title	Critical Improvements of the Drinking Water Disinfection System within the Nablus Municipality
Coordinator	Dr. Hassan Arafat
Research Institutions	1- An-Najah Univ, Chemical Eng. Dpt. 2- An-Najah Univ., WESI 3- Nablus Municipality, Dpt. of Drinking Water & San.
Budget	\$9,700
Duration / Term	18 months, starting 10/12/2004
Advisory Panel	1. Rebhi Al-Sheikh 2. Hasan Shaban
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 9/12/2004 • First payment was effected on 16/1/2005 • First progress report is due on 30/9/2005 • Final report was received on 30/5/2006 • Final payment was effected on 30/6/2006 	

Abstract

This study aims at investigating the disinfection problems that exist in the water network of Nablus. In order to delineate the segments of the network where problems do exist, historic quality data for the last nine years (1996-2005) was collected, spatially referenced, dated, and digitized. A composite database was thus created to facilitate the spatial and temporal assessment. Thereafter, disinfection methods used by the Water Department at the Nablus Municipality were investigated.

Based on the findings of this study, several key practical recommendations were drawn, which are expected to help the Nablus municipality improve its disinfection system to become more safe and efficient. The key recommendations are as follows:

- 1- The quality control procedures currently used in Nablus municipality need to be improved. The analysis of water samples for residual chlorine, fecal and total coliform are only the first step in the quality assurance of water. The accumulated analysis samples should be reviewed and analyzed monthly for the prediction of future problems.
- 2- Annual or half annual analysis for heavy metals, salinity, Amoeba, fluoride, and nitrate concentrations are recommended. It is also advised to occasionally measure the total organic content of the water.
- 3- The existing chlorination method of using sodium hypochlorite as a disinfectant is a universal method. Nonetheless, the dose of sodium hypochlorite and the location of chlorinators need to be optimized.
- 4- The direct injection or pumping of the disinfectant into the water pipe entry is not the most effective method of mixing. Special types of mixers, such as jet mixers, are recommended to guarantee a homogenous distribution of the disinfectant in the water.
- 5- In certain areas, especially in the Deir-Sharf area, the main drinking water pipe passes right through the sewage channel. This hazardous layout should be changed immediately and the drinking water network should be located as far away as possible from the sewage network.
- 6- The sewage channels passing adjacent to the springs should be relocated far from the springs.
- 7- It is recommended to consider future modifications on the network layout for improving the system hydraulics which can support in a way or another improving chlorine flow at the different nodes, since improvements on the monitoring system can not practically be easy without having a system that can allow for a redesigned flow rates of chlorine in the different parts of the system. This can be achieved, for example, by splitting the network into distinct zones with a minimal degree of overlapping between them.

Key words: water networks, chlorine, water quality, disinfection, Nablus

Research Proposal (II-7) ABS-50	
Title	Health Risks from Microbial Growth and Biofilms in Drinking Water Distribution Systems in Palestine
Coordinator	Dr. Khalid Swaileh
Research Institutions	1- Birzeit Univ., Biology & Biochemistry Dpt. 2- Birzeit Univ., Inst. for Water Studies 3- Al Quds Univ., Medical Research Centre
Budget	\$ 8000
Duration / Term	18 months, starting 10/12/2004
Advisory Panel	1- Rebhy El-Sheikh 2- Amer Sawalha
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 3/1/2005 • First payment was effected on 16/1/2005 • First progress report is due on 30/9/2005 • Final report was received on 30/6/2006 • Final payment was effected on 16/7/2006 	

Abstract

This paper evaluates the feasibility of using local fixed film media in waste stabilization ponds to enhance their treatment efficacy. A pilot-scale algae-biofilter system (ABS) was investigated, in parallel with an algae-based control (ABP) over a 6-months period to evaluate the treatment efficacy of both systems. Each system entailed 4 equal ponds in series and was continuously fed with domestic wastewater from Birzeit University.

The removal rates of organic matter, nutrients and fecal coliforms were monitored within each treatment system. The results obtained revealed that ABS was more efficient in the removal of organic matter (TSS and COD; 86% and 84% respectively) and fecal coliforms (4 log₁₀) than ABP (81%, 81%, 3 log₁₀ respectively). Nitrogen was reduced in the ABS to an average of 24 mg N/L; in contrast the effluent from the control ABP which contained 32 mg N/L. Passive aerated ABS system is thus an efficient, a low-cost and feasible land-saving option to algae-based ponds.

Key words: waste stabilization ponds, rural areas, domestic wastewater, algae-biofilter, rock filter, nitrification, removal efficacy, effluent reclamation and reuse

Research Proposal (II-8) ABS46	
Title	Investigation on domestic Reverse Osmosis Membrane contamination in Gaza
Coordinator	Rebhy El-Sheikh
Research Institutions	1- Palestinian Water Authority 2- Al Azhar Univ., Water Research Centre 3- Al Azhar Univ., Dept. of Microbiology
Budget	\$10,000
Duration / Term	12 months, starting 10/1/2005
Advisory Panel	1- Mohammad Alagha 2- Mahmoud Abdedl Latif
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/1/2005, the contract has been signed with full amount on 3/1/2005 • First payment was effected on 1/3/2005 • First progress report was received on 30/6/2005 • Final report was received on 30/12/2005 • Final payment was effected on 16/7/2006 	

Abstract

The Gaza Strip is located in a semi-arid region characterized by a continuously deteriorating water quality. People have tended in the last few years to desalinate water using Domestic Reverse Osmosis desalination units at their homes. Their selection of the units is not based on any study to the performance of these units and its relation with feed water and product water quality. The low salinity tasted is the only indicating factor for the good water quality from the consumers' viewpoint.

The commercial size reverse osmosis units are characterized by the automatic back washing of membranes which limits possibilities of fouling, the advantage that is not available with the small scale domestic units and hence leads to possibilities of contamination.

Previous studies on the performance of these units have been concentrated on the assessment of chemical characteristics of water while microbiological contamination has rarely been investigated. This study had examined the total coliform and standard plate count for the inlet water, the filtered water and the membrane itself using the Gramstain technique test to identify the bacteria group. Samples have been taken from 120 locations originally serviced with different municipal water qualities all over Gaza Governorates.

A lot of factors affect the number of colonies including age of the membrane, routine maintenance and cleaning and the feed water quality. Generally there is similarity between the types of bacteria groups in the samples taken from different places. The G+ Bacillus bacteria group is the type most found in the membranes.

The level of contamination found in the outlet sample exceeds that of the inlet sample in Gaza, Khanyounis, and Rafah Governorates. In the Middle and the North governorates the rate of contamination is almost equal. The level of contamination in RO membranes was 100 % in Rafah, Khanyounis and North Governorates, 95% in Gaza governorate and 95.8% in the Middle governorate. In addition, the study shows that people in the Gaza Strip have a very low knowledge about water quality.

Key words: contamination, membrane, reverses osmosis, water quality

Research Proposal (II-9) ABS 19	
Title	Optimal Management of Groundwater Resources in Rafah Governorate, Gaza Strip, Palestine
Coordinator	Mazen Albanna
Research Institutions	1- Palestinian Water Authority 2- Islamic University, Environmental & Rural Res. Center
Budget	\$8,000
Duration / Term	12 months, starting 30/1/2005
Advisory Panel	1- Amjad Aliewi 2- Massoud Keshtah 3- Khalid Qahman
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 30/1/2005, the contract has been signed with full amount on 14/12/2005 • First payment was effected on 16/1/2005 • First progress report was received on 30/6/2005 • Final report is was received 30/1/2006 • Final payment was effected on 16/3/2006 	

Abstract

Fresh groundwater resources (Cl < 600 mg/l, NO₃ < 90 mg/l, and Palestinian standards for drinking water) that are available to the Palestinians in the southern area of Gaza Strip are very limited. Therefore, the continuous increase in the water demand has resulted in over pumping the aquifer. This in consequence resulted in the depletion and deterioration of these groundwater resources. In this study, a transient linear optimization management model has been developed to recover the groundwater resources by determining new operational pumping policies for the aquifer in the mentioned area over a planning period of 15 years. The management model is based on the response matrix approach. The management model has been developed after linking a groundwater flow simulation model for the study area to a linear programming management algorithm. The groundwater flow model has been developed using the USGS simulation code MODFLOW. The objective function of the management model was to maximize pumping from the study area while meeting some hydraulic and water demand constraints. Two management scenarios have been tested. In the first management scenario only limits on drawdown at some control nodes in the study area have been set. In the second management scenario, both drawdown limits and upper limits for water demands have been imposed. The idea beyond the drawdown limits at the control nodes in the model domain was to recover the groundwater levels above the mean sea level and then utilize a fraction of the groundwater saturated horizon. The developed management model has been solved using the optimizer LINGO

In the first management scenario, the optimizer tends to locate pumping at the eastern parts of the aquifer where naturally more drawdown is available. Moreover and since no water demand limits were imposed in the first scenario of the management model, the optimizer tended to locate the pumping rates in the last year of the planning period. However when limits on water demand were imposed in the second scenario, the optimizer tended to distribute the pumping rates over the planning period. It is interesting to note that the total optimal abstraction quantities from the study area are less than or equal to the aquifer recharge.

Key words: optimization management model, groundwater flow simulation model, linking code, planning period

Research Proposal (II-10) ABS 53	
Title	The Effect of Wastewater Treatment Plant on Groundwater (Chemical Quality) in Gaza City
Coordinator	Sami Hussein Lubbad
Research Institutions	1- Public Health Lab., Min. of Health, Gaza 2- Al Azhar Univ., Water Research Center
Budget	\$7,950
Duration / Term	12 months, starting 10/12/2004
Advisory Panel	1- Nahed Ghbn 2- Amjad Aliewi
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 10/12/2004, the contract has been signed with full amount on 9/12/2004 • First payment was effected on 16/1/2005 • First progress report was submitted on 21/6/2005 • Final report is was received 20/2/2006 • Final payment was effected on 26/3/2006 	

Abstract

This research work was financially supported by the UNESCO/Flander FIT Project: "Capacity Building & Training on Environmental Training & Management Program for Palestinian People.

Six wells around the wastewater infiltration basins that recharge the groundwater near the Gaza City wastewater treatment plant was monitored monthly, from February to October 2005. Parameters monitored were: Nitrite; Nitrate; Detergents; TOM; TDS; and Chlorides. The study compared the results with the WHO standard for drinking purposes, comparison of results with other results of previous years, and comparison with well distance.

We found that the wells are seriously starting to be affected by the partially treated wastewater recharged wastewater. So, a quick remedial action must be taken to stop the groundwater contamination and the effluent wastewater quality must be improved. This improvement to be by improving the operation of the wastewater treatment plant, and integrating the plant to good operation, where it is overloaded. In the meantime, all the wells in the area of the wastewater infiltration basins must be stopped for drinking water purposes, and the people must be provided with good drinking water from another source.

Key words: wastewater, treatment plant, water quality, operation

Research Proposal (II-11) ABS 12	
Title	Assessment of the Supply/Demand Gap and Evaluation of the Suitable Conservation Measures towards Sustainable Water Resources in Palestine
Coordinator	Amjad Aliawi
Research Institutions	1- House of Water and Environment 2- An-Najah University 3- Bir Zeit University 4- Palestinian Water Authority
Budget	\$10,000
Duration / Term	12 months, starting 15/2/2005
Advisory Panel	
<p>Progress Status</p> <ul style="list-style-type: none"> • The research has started on 15/2/2005, the contract has been signed with full amount on 13/2/2005 • First payment was effected on 2/3/2005 • First progress report submitted on 03/07/2005 • Final report is was received 30/1/2006 • Final payment was effected on 26/3/2006 	

Abstract

As the supply/demand gap continues to expand, the careful management and planning of Palestinian water resources becomes more essential. In order to achieve sustainability of the sources and to fill the deficit, effective management techniques must be introduced.

This research discusses an Integrated Water Resources Management (IWRM) planning tool used to evaluate the overall socio-economic and environmental situation of a specific region that could be at a national, regional or local scale and for specific period of time called the management period. In general this tool is an interactive computer-based system intended to help decision makers utilize data and models to identify and solve problems and make decisions. The general objectives of the tool are to build a rational environment and socio-economic database for a specific area, to evaluate the baseline situation in terms of social, economical and environmental aspects as well as the future situations, and to facilitate the opportunity to build future plans in the social, industrial and agricultural sectors.

Key words: integrated water resources management; planning tools, social, environmental, and economic, indicators

4.2 Training and capacity building

Training and capacity building for the water sector in Palestine is highly needed at all levels. As the number of professionals in the sector is relatively limited though, the establishment of a dedicated training facility can hardly be justified. The best strategy would therefore be to concentrate on maximising the development and use of existing training resources. While several training and capacity building activities for the water sector took place in the past, funded by several aid agencies, these have been largely uncoordinated. Fragmentation and duplication of activities is perceived at the level of the beneficiaries of the activities as well as at the level of the providers. Being aware of this, the Palestinian Ministries (PWA, MENA,...) are actually developing strategic plans for the training of their staff. It is however clear that the ministries depend on external aid for the implementation of the strategy. This project focused in an overall training strategy for the sector.

4.2.1 Training Course on Groundwater wells in the Northern Governorates in the West Bank:

This Training Course, “Groundwater wells in the Northern Governorates in the West Bank: siting, design, construction, testing & operation and maintenance & rehabilitation” (FIT-TA2002-) provided 17 trainees (water engineers and developers from 3 ministries and 7 municipalities in the Northern West Bank) with essential knowledge and experience on subjects related to groundwater wells so that the Palestinian technical community of the water sector in the north can deal with the following:

- How to assess sustainable yields of aquifers;
- How to determine productive zones in aquifer basins;
- How to site a likely successful well;
- How to construct, test and put into operation a well;
- How to rehabilitate existing low performance wells;
- How to prepare well tendering documents;
- How to deal with operational problems including well pumps;

According to the trainees comments, this training course has developed and strengthened the understanding of the concept of groundwater resources development and this was supported with a program of field visits. In order to benefit their positions in the major municipalities in the northern West Bank this course provided them with the essential procedures and practices for developing and maintaining existing wells in their governorates, as they said that the training course was of great practical experience.

In this course, 4 specialist teams in this field from different Palestinian organizations and universities carried out the training course to fulfil the objectives of the course.

We believed in capacity building and this training course was essential for preparing engineers and specialists in the Northern governorates, who have the basic knowledge about the groundwater resources so that when they returned to their work they will practice the difference.

A complete description of the training course including the training materials, agenda, list of participants, course evaluation and final training report are attached as annex to this report.

4.2.2 Training Course on “Spectroscopic and Chromatographic Instruments for Water Analysis

Different laboratories working in the field of water such as that of the ministry of health, ministry of agriculture, and the environmental quality authority and others are in bad need of training on modern analytical instrumentations to provide good and dependable results. Good and continuous water analysis will lead to develop policies to protect and manage water resources.

The aim of this training course is to provide a practical training on spectroscopic analysis methods of water samples for people working in different governmental laboratories in Gaza strip and also for new graduates, who are lacking practical usage of spectroscopic and chromatographic equipments. This will increase their chance to find a suitable job in the future and help to build up a data bank which could be used to develop policies in order to protect and manage water resources.

The course has been developed by the staff members in the chemistry department of Al Azhar University Gaza, Institute for Drug Analysis and in cooperation with the Water Research Center at Al Azhar University Gaza. The training course was supported by: The Flemish Government & The UNESCO office in Cairo

About 21 participants attended this training activity from eight regional organizations (namely Governor of Gaza, Ministry of Agriculture, Ministry of Health, Authority of Environmental Quality, Soil and Waste Water Laboratory, Graduation Association of AUG, Faculty of Agriculture – AUG, and Faculty of Science - AUG). Annex I shows the List of Participants

The target group has been chosen among water, wastewater and agricultural engineers and laboratory active persons from various specialties in the water

sector from Governor of Gaza, Ministry of Agriculture, Ministry of Environmental Quality, Ministry of Health, University, and from NGOs and private sector. Twenty one participants have taken part in this training course.

The training course provided trainers with the necessary basic tools, chemicals and instruments needed for training the participants on the use of six spectroscopic and chromatographic instruments in the water analysis. A training manual including the practical and theoretical partitions was distributed among the trainers and the trainees to guide them during the training course. The training manual included training methods for water pollution analysis using the following instruments:

Task 1. Thin layer chromatography

Task 2. Ultra Violet / Vis

Task 3. FT - Infrared Spectrometer

Task 4. Flame Photometer

Task 5. Atomic Absorption (AA)

Task 6. High Performance Liquid Chromatography

Each training task contained the following learning and training items:

- Theoretical back ground on the trained instrumental method
- Calibration of the used instrument
- Preparation of standard solutions
- Separation of different organic pollutants on the used instrument
- Developing a separation methodology
- Evaluation of the obtained chromatogram
- Determination of unknown pollutants concentration
- Troubleshooting

The training was a combination of lectures, practical exercises, group work and discussion of participants' experiences, problematic and troubleshooting. A complete description of the training course including the training materials, agenda, list of participants, course evaluation and final training report are attached as annex to this report.

4.2.3 Training Course on Environmental Impact Assessment in Water Projects

This training program is "Environmental Impact Assessment Training Course For Water Projects Activities "Methods and Practices", held in Gaza at the Water Research Centre of al Azhar University in co-operation with Professional

Training Group-GTZ between the period from 04/12/2005 up to 29/12/2005, twelve days (3 days/week).

About 19 participants attended the program. The participants from various organizations in Gaza, Governmental, non-governmental and private sector,

The training programme reached its goal and purpose, that is to develop the knowledge and skills that are needed by participants and to promote good Environmental Impact Assessment practice in water projects. This programme focused on two issues: the development of environmental impact assessment processes that integrate environmental, economic and social objectives in project and program decision-making, and the needs of well-defined target Palestinian groups working in water sectors and take, when necessary, sufficient account of their varied background. The program a practical in nature, be learner active and emphasize environmental problems and conflict-solving situations, as well as technical skills available in Palestine, mainly the Gaza Strip.

The course used a comprehensive text and practical case studies of real water projects in the Gaza Strip, along with participatory, facilitated exercises and role-playing, to explore environmental policies, procedures, and general methods to prepare and use environmental assessments. Participants understood and have an opportunity to use internationally recognized components of the environmental impact assessment process including to following: Scoping the range of environmental concerns - collecting and processing information during EIA – developing alternatives to a project proposal – understanding the role and approaches to achieve effective public participation – identifying ways to mitigate environmental impacts – documenting impacts – analysing how to achieve desired staffing and resource needs for a multi-disciplinary approach – developing and using the environmental impact assessment in planning and decision-making.

The participants practised and have impact to apply all the steps used for Environmental Impact Assessment to real existed projects in Gaza Strip as case studies. These projects are Gaza Central Sea Water Desalination project, Central Gaza Wastewater Treatment Plant, and Gaza Strip Water Carrier. In the beginning to the programme, an introduction to environment and environmental problems related the Middle East region and Palestine were discussed. Palestinian policy of applying the environmental impact assessment also discussed. The participants practised and have impact to apply all the steps used for environmental impact assessment to all projects, especially water projects. So, they are able to acquire basic environmental impact assessment steps. They are able and have capacity to conduct an environmental impact assessment study report and review an EIA statement. Where they are able to understand, predict, evaluate and monitor environmental, social, and economical positive and negative impact of water

projects. Also, they are able to find, and predict all the mitigation measures and monitoring programme for any EIA statement.

Looking to list of participants in annex (I), we can notice that the participation covered all the sectors and departments related to both environmental, and water issues. Some from private sector were attended. So, this variation distribution the knowledge to wide range area and institutions working in planning, legislation, economics, environmental, and water issues in the Gaza Strip. This issue is made a very good contribution between the participants to share experience during the discussions and case study excursions.

The project reached its objectives, by getting the following achievements:

1. The participants can impact to apply all the steps used for environmental impact assessment to all projects, especially water projects.
2. They are able to acquire basic environmental impact assessment steps.
3. They are able and have capacity to conduct an environmental impact assessment study report and review an EIA statement.
4. They are capable to understand, predict, evaluate and monitor environmental, social, and economical positive and negative impact of water projects.
5. They are able to find, and predict all the mitigation measures and monitoring programme for any EIA statement.
6. They shared knowledge and experience during the discussions and case study excursions.
7. They are able to improve existing EIA processes, programs, and assessments for use in decision-making among ministries and other public and private sector groups;
8. Promote the concepts and use of environmental impact assessment among Palestinian stakeholders (e.g. ministries, municipalities, NGOs, public groups);
9. Present the methods to improve the practice of environmental assessment preparation and review;
10. Institutionalize the training with trained in-country facilitators.

A complete description of the training course including the training materials, agenda, list of participants, course evaluation and final training report are attached as annex to this report.

Dr Omar Zimmo, Assistant Professor in the Civil Engineering Department

4.2.4 The training course on Irrigation Water Management (IWM)

The target groups were chosen among water, wastewater, agricultural and agronomist engineers. Palestinian Water Authority, Ministry of Agriculture, Ministry of Environmental Quality and from NGOs and private are the users for this training course. The number of participants was **22**.

It assembled knowledge and developed an approach to empowering a range of stakeholders at national level, technical personnel in ministries of water, agriculture and environment, NGOs and community-based organizations and local authorities, etc. Skills and techniques were provided in irrigation water management in order to ensure successful implementation of irrigation projects.

The training course will provide trainers with basic tools, resource material and case studies and train participants on Irrigation water requirement, Soil water balance of the root zone, Irrigation scheduling, Reuse of reclaimed wastewater for irrigation (impact on plant growth and development and Rain water Harvestings: technical and socio-economic aspects).

- Summary of the impact of the results of the training project, i.e. how and in which areas they may potentially be applied, for example: Impact on the science in the fields of the project and other scientific fields, impact on society, economic impact, impact on technology, commercial exploitation, etc.

The development and dissemination of this training program (UNESCO/Flanders FIT project) through training material, toolkits or documents, which address specific concerns of a range of stakeholders, at sub-national, national and regional levels, present effective tools for accumulation, sharing and using relevant knowledge in the field. The project helped Palestinian participants to share knowledge through fruitful process of dialogue and debate among various water stakeholders. The IWM material distributed in the carried training course has enriched the participants in terms of issues raised and case studies used to illustrate the various concepts of IWM. The themes of the training course revolve around economic, environmental, political and social dimensions of IWM.

As the Agriculture is the backbone of the Palestinian economy, contributing 33% and 24% of the Gross National Products in the West Bank and Gaza Strip, respectively, the prevailing arid and semi arid conditions in Palestine make irrigation imperative for the development of intensive agriculture and food production. Available renewable potential is already fully utilized, while the widening gap between supply and demand is made up with marginal resources, especially, reclaimed municipal wastewater which is becoming an increasingly

important source of water for agricultural, and also rainwater harvesting. The impact of proper management of water resources under water scarcity is expected to develop and adopt certain scientific techniques and therefore enhance scientific fields. Also, proper irrigation water management will contribute to poverty alleviation through the saving in water resources that will be used for further production of crops and increasing the number of employment. The drought environment in Palestine calls on efficient means of irrigation water management. For instance, means for measuring irrigation water and monitoring soil water in the crop root zone - to be adopted by farmers in irrigation scheduling. Techniques for determining the date of irrigation taking into consideration all constraints regarding water delivery, rainfall, type of irrigation and crops grown. Guidelines on irrigation scheduling that are practical, simple and easy to understand- reflecting climate, soil, etc are expected to have obvious impact on technology and commercial exploitation.

A complete description of the training course including the training materials, agenda, list of participants, course evaluation and final training report are attached as annex to this report.

4.2.5 Integrated Water Projects Management

This course is also provides the principles of the field of project management. in addition to the following topics:

- the basic tools and language of project management
- defining project scope and goals
- project planning ,scheduling and estimating
- procurement management
- project quality management
- project monitoring and control

Practical applications of these fundamental concepts will be presented via case studies, real-world examples in water sector field supported by computer applications,

This course is designed for managers and development professionals working in water sector who interested in learning about formal project management techniques and principles, Project procurement management, Project Planning and Scheduling, Project Execution and Project Quality Management and control, the proposed no. Of participants are expected to be 20 participants.

This course will cover the basic understanding and knowledge of project management planning and execution. This course will add to your “tool-set” the skills and competencies needed to plan, manage, and control tasks and outcomes culminating in a successful project.

This training course comprises a four module series and will focus on water sector projects activities in the following topics:

- Introduction to Project Management.
- Project procurement management
- Project Planning and Scheduling using Microsoft Project to Plan and execute your Projects.
- Project Quality Management and control.

This course is designed for managers and development professionals working in water sector who interested in learning about formal project management techniques and principles, Project procurement management, Project Planning and Scheduling, Project Execution and Project Quality Management and control, the proposed no. Of participants are expected to be 20 participants.

4.2.6 Training course: Application of Integrated Water Resources Management Tools

This training course on IWRM took place at Water Studies Institute (WSI), Birzeit University with two parts: Part one: 21 November 2005 – 1December 2005, Part two: 17 December – 27 December 2005. The target groups have been chosen among water, wastewater and agricultural engineers, managers and engineers from various specialties in the water sector from municipalities, Palestinian Water Authority, Ministry of Agriculture, Ministry of Environmental Quality, Ministry of Planning and from NGOs and private sector in various aspects. 33 participated in the training course.

It assembled knowledge and developed an approach to empowering a range of stakeholders at national level, technical personnel in ministries of water, agriculture and environment, NGOs and community-based organizations and local authorities, etc. in water resources management. Capacity building at national was provided with skills and techniques in community management of water resources in order to ensure successful implementation of IWRM at the local level.

The training course provided trainers with basic tools, resource material and case studies and trained the participants on the application of the IWRM using the training manual which have been published by ESCWA, which involves 16 modules addressing technical, socio-economic, institutional and legal dimensions of IWRM challenges in the region.

In the past five years, important steps have been taken towards articulating an Integrated Water Resources Management (IWRM) vision for the Arab region, and national strategies for reforming the water sector and related ministries in line with this vision. However these attempts remain fragmented and scattered. While some progress has been achieved in assessing water resources, projecting

needs, defining priorities or initiating some institutional reform, limited progress is noted at the level of translating IWRM concepts and policies into clear strategies and implementing them. Coordination among various concerned sectors and mobilization of resources at the national and local levels remain the most significant challenges in this regard, often due to lack of technical and institutional capacity, limited financial resources and weak political will to carry out necessary actions. Hence, building and sustaining local capacity within water and water-related institutions at technical, institutional, legislative and managerial levels, emerges as a cornerstone for promoting effective implementation of IWRM concepts, tools and policies.

The development and dissemination of capacity building programs (like the UNESCO/Flanders FIT project described here) through training material, toolkits or documents, which address specific concerns of a range of stakeholders, at sub-national, national and regional levels, present effective tools for accumulation, sharing and using relevant knowledge in the field. The project helped Palestinian participants to share knowledge through fruitful process of dialogue and debate among various water stakeholders. The IWRM material distributed in the carried training course has enriched the participants in terms of issues raised and case studies used to illustrate the various concepts of IWRM. The themes of the training course revolve around economic, environmental, political and social dimensions of IWRM. The training discussed how the expert can apply IWRM taking into account the previous dimensions.

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The training course provided trainers with basic tools, resource material and case studies and trained the participants on the application of the IWRM using the

training manual which have been published by ESCWA, which involves 16 modules addressing technical, socio-economic, institutional and legal dimensions of IWRM challenges in the region.

The main tasks of the training course were:

- Task 1. IWRM CONCEPTS AND APPROACHES
- Task 2. WATER GOVERNANCE
- Task 3. WATER USES
- Task 4. WATER MANAGEMENT TOOLS

The manual has been prepared based on the IWRM principles, GWP ToolBox, different ESCWA publications and documents and the Training of Trainers Manual on IWRM prepared recently by the Swiss Center of Hydrology (2003). The theoretical material has been prepared for a global audience and it was used in many different regions of the world, but it come with information custom-designed for the ESCWA region. An effort was made, however, to customize exercises and quote relevant case studies from ESCWA region throughout the different modules.

Each module has Session Topic Synthesis in the introductory pages of the module. The synthesis was designed for the decision makers to help them in understanding the principles and dimensions of IWRM.

Participants were trained on the use of the IWRM manual and received the related course and resource material. The training manual on the Application of IWRM which was published recently by ESCWA was used in the training course for Palestinian water experts. The implemented training course on IWRM continues the cumulative process of capacity building initiatives on IWRM in the Arab region. It provides trainers from the Palestine, with basic tools, resource material and case studies to train a range of stakeholders at national level, technical personnel in ministries of water, agriculture and environment, NGOs and community-based organizations and university professors, etc.

Contributions made by participants of case studies they are familiar with, which illustrate the concepts, policies, tools and issues presented in the modules.

A complete description of the training course including the training materials, agenda, list of participants, course evaluation and final training report are attached as annex to this report.

List of implemented training activities								
No	Title	Coordinator	Duration	Hosting Institute	Target Group	No. of trainees	Instructors	Budget
1	Groundwater wells design and constructions in the Northern Governorates in the West Bank	Dr. Amjad.aliewi Eng Ayman Jarar	January 21 – Feb 3, 2006	House of water and Environment	PWA, engineers, water managers, regulators and developers from water departments in Municipalities and Local Councils, Water Utilities and Water Supply Bodies	17 with 1 female	Amjad Aliewi Marwan Ghanem Muath Abu Sadah Deeb Abdul Ghafour Ayman Jarrar Amjad Tayseer Assi	\$ 20,000
2	Spectroscopic & Chromatographic instruments for water Analysis	Dr. Mazen Hamada	December 10, 2005 – January 18, 2006	WRC, Al Azhar University	Staff of the following: Universities Ministry of Environment, PWA, NGO's Ministry of Health, Ministry of Agriculture,	21 out of them 8 females	Mazen Hamada Eyad El Kashef Nasir Koudeir Ali El Louh Aiman Daa'ma Hassan Tamous Zyad Abu Zayed	\$ 14,520
3	EIA for water Projects	Dr. Nahed Ghbn Eng. Mohamad Abu Jabal	December 20, 2005 - January 14, 2006	WRC, Al Azhar University	University lecturers, engineers staff of the municipalities and PNA, university graduates and employees working in water and environmental sectors with UN Organization, NGOs, and private sector.	17 out of them 2 females	Nahed Ghbn Mohammed Abu-Jabal Zaher Salem Rajeh Abbas	\$ 9775

4	Irrigation Water management	Dr. Omar Zimmo Eng. Masoud keshta	Jan 7 – 21, 2006 (WB) Jan 7 – 15, 2006 (GAZA)	WSI Birzeit University & PARC* (Palestina n Agricultura l Relief Committee s)	water, wastewater and agricultural engineers from Municipalities, Palestinian Water Authority, Ministry of Agriculture and from NGOs and private sector working in irrigation and agricultural sector.	22 out of them 5 females	<u>WB Team:</u> Dirk RAES , (PhD) Omar Zimmo, (PhD) Maher Abu-Madi, (PhD) Jamil Harb, (PhD) <u>Gaza Team:</u> Hussam EL Najar Abdel Majeed Nassar Jamal ELDadah Masoud Keshta Mohammad Al-Muqaied,	\$ 19,965
5	Integrated Water Projects Management	Eng. Rebhi El Sheikh Dr. Yousef Abu Mayla	November 19, 2005 – January 2, 2006	WRC, Al Azhar University	managers and development professionals working in water sector	20 of them 5 females	Adnan Enshassi Nabil swahi Mamdouh El ghazali Hani Skik Walid Hussein Mohsen Elghazali	\$ 20,000
6	Applications of IWRM	Dr. Ziad Mimi	January 7 – 27, 2006	WSI Birzeit University	water, wastewater and agricultural engineers, managers and municipalities Engineers, PWA, Ministry of Agriculture, Environmental Quality Authority, Ministry of Planning and from NGOs and private sector	33 out of them 17 females	Ziad Mimi Omar Zimmo Nidal Mahmood Iyad Yaqoob Hazem Kittaneh Ayman Rabi Maher Abu Madi Kamal Issa Jameel Harb Rashed Al-Saed Khaled Nassereddine	\$ 19,700

Chapter 5

Project International Conference

The conference “Sustainable Development and Management of Water in Palestine” is an activity of the “Capacity Building and Training on Environmental Planning and Management” Project 1998-2007, funded by the UNESCO-FLANDERS FUST, Flemish Government-Kingdom of Belgium that provided both financial and technical support, and is implemented by the Water Research Center at Al-Azhar University in coordination with all Palestinian institutes working in the field of water and environment. The Conference was supported by the Palestinian Water Authority, UNESCO, Al Azhar University, Palestinian House of Water and Environment, Flemish government of Belgium, GTZ, Green Cross, GWP-Med and MED EUWI, DSi and The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD). Researchers from the Arab region and the International Community participated in this conference by presenting papers about the results and current status of their research.

This report provides an account of the above conference that took place in Amman from 27-29 August 2007. The conference was organized by the House of Water and Environment.

5.1 Objectives of the conference

1. To focus on the challenges the Palestinian water sector faces and to demonstrate how solutions can be found through applied, innovative research, programmes on sustainable development and management, and capacity-building.
2. The conference aims to contribute to the long-term discussion on the development and management of water resources in Palestine through holistic approaches.
3. To present and disseminate information on the 21 research projects that are funded by the FLANDERS Project.

5.2 Conference Organization

The Steering Committee of UNESCO- FLANDERS FUST PROJECT met on 3-4 December 2006 in Amman and assigned the responsibility of Organizing the Conference to the House of Water and Environment through UNESCO. The following committees were formed:

5.3 The Conference Steering Committee

Fadle Kawash	Palestinian Water Authority	Palestine
Jawad Wadi	Al Azhar University	Palestine
Rebhi Al Sheikh	Palestinian Water Authority	Palestine
Rudy Herman		Belgium
Radwan Al Weshah	UNESCO	Cairo Office
Abed Assalam Shala'ab	Ministry of Higher Education	Palestine
Amjad Aliawi	House of Water and Environment	Palestine
Anan Jayyousi	Al Najah University	Palestine
Abdin Saleh	UNESCO	Cairo Office
Yousef Abu Mayla	Al Azhar University	Palestine

5.4 The Conference Organising Committee

Amjad Aliawi (Co-Chairman)	House of Water and Environment	Palestine
Radwan Al Weshah (Co-Chairman)	UNSECO	Cairo Office
Mohammad Abu Jabal	Al Azhar University	Palestine
Issam Nofel	Ministry of Agriculture	Palestine
Jumana Abu Sada	House of Water and Environment	Palestine
Hazem Kittaneh	Palestinian Water Authority	Palestine
Deeb Abdul Ghafour	Palestinian Water Authority	Palestine
Mahmoud Abul Latif	Palestinian Water Authority	Palestine
Karen Assaf	House of Water and Environment	Palestine
Moustafa El Baba	Al Azhar University	Palestine
Masoud Qeshta	Agriculture Development Association	Palestine
Dalia Khalil	UNESCO	Cairo Office

5.5 The Conference Scientific Committee

Abed Assalam Shala'ab	Ministry of Higher Education	Palestine
Willy Bauwnes	Flemish Government	Belgium
Amjad Aliewi	House of Water and Environment	Belgium
Dirk Raes	K. U. Leuven University	Palestine
Radwan Al Weshah	UNESCO	Cairo Office
Jad Isaac	Applied Research Institute of Jerusalem	Palestine
Alfred Abed Rabo	Bethlehem University	Palestine
Nahed Ghabn	Palestinian Water Authority	Palestine
Maher Abu Madi	Birzeit University	Palestine
Rashed Al Saed	Birzeit University	Palestine
Omar Zimmo	Birzeit University	Palestine
Nidal Mahmoud	Birzeit University	Palestine
Yousef Abu Mayla	Al Azhar University	Palestine
Marwan Haddad	Al Najah University	Palestine
Karen Assaf	House of Water and Environment	Palestine
Ziad Mimi	Birzeit University	Palestine
Anan Jayyousi	Al Najah University	Palestine
Amer Merei	Al Quds University	Palestine
Hafez Shaheen	Al Najah University	Palestine
Shaddad Attili	Negotiation Support Unit	Palestine
Abdul Rahman Tamimi	Palestinian Hydrogeology Group	Palestine
Marwan Ghanem	Birzeit University	Palestine
Yousef Abu Safeyya	Environment Authority	Palestine
Rebhi Sheikh	Palestinian Water Authority	Palestine
Ahmed khater	Consultant-Expert International	Egypt
Mohamed Abd El Motaleb	Water Research Institute	Egypt
Magdy Hefny	Regional Center for Research & Studies of Water Ethics	Egypt
Mohamad Shatanawi	University of Jordan	Jordan
Manar Fayyad	University of Jordan	Jordan
Abdin Saleh	UNESCO	Cairo Office
Walid Abdul Rahman	King Fahid University of Petroleum and Minerals	Saudi Arabia
Walid Zubari	Arabian Gulf University	Bahrain

About 120 water experts and scientists from 12 different countries of the world submitted abstracts to the Conference Committees. The Organizing Committee and the Scientific Committee classified them according to the following themes:

1. Integrated water resources management.
2. Water supply/demand management.
3. Institutional and human resources capacity building.
4. Conflict resolution on trans-boundary water resources management.
5. Water quality and environmental issues.
6. Cultural, ethical and socio-economic aspects of water resources.

The Scientific Committee evaluated the 104 abstracts. They accepted 90 abstracts and asked their authors to submit full papers. 84 full papers were received and evaluated by the Scientific Committee. Another Evaluation Committee, consisting of Hazem Kittaneh, Amjad Aliawi, Alfred Abed Rabo, Maher Abu Madi, Rashed Al Saed and Shaddad Attilli, has been formed to review the results of the Scientific Committee's evaluation of the 84 full papers. 57 papers have been accepted to be published in the proceedings of the conference, and 22 papers were accepted as posters.

The Organizing Committee developed a special Website for the conference, on which all updates have been uploaded. The programme of the conference was developed according to the results of the evaluation of the papers. Then the Jordan Intercontinental Hotel in Amman was chosen as a venue of the conference. A booklet of the abstracts and the programme of the conference were printed (500 copies each) and distributed in the conference. A bag with full stationary plus a gift were also given to the participants. The conference took place successfully on 27-29 August 2007 at the Intercontinental Hotel. A committee of Editors (Dr Amjad Aliawi, Dr Anan Jayyousi and Dr Karen Assaf) are currently preparing the proceedings to be published towards the end of 2007.

5.6 Conference Recommendations

The conference recommendations were grouped to address various aspects of water resources in the POT as follows:

5.6.1 Research and Training:

- There was strong support among all participants that there should be continued support for research and training in the water/wastewater sector in Palestine. Other points raised were:

- There should be proper dissemination of R&D results and reports among different research institutions and with other stakeholders.
- There should be more emphasis in research projects on topics such as socio-economic issues, ethics, etc.
- Proposals should encourage scientific and research visits and academic exchange programs that target young Palestinian researchers.
- Encourage better use of the funding opportunities/ exchange programmes that are offered through the EU
- Organize targeted and demand-driven workshops and training courses that respond to the on-the-ground needs of the Palestinian water sector. The workshops/ courses will try to bring together practical and theoretical approaches to water resources management within an IWRM framework.
- Palestinian students should be included in research support programs.

5.6.2 . Capacity Building:

- It was the opinion of participants that there is a need for a third phase of the Capacity Building Project of the Flemish Flanders FUST through UNESCO-Cairo, stressing the importance of what was accomplished in Phases One and Two.
- Capacity building should be focused and applied to technical, administrative and management problems existing or foreseen in the institutional set up of the water and wastewater sector in Palestine with the aim of developing the leadership in the water sector.
- Develop capacity building programs that will benefit from available programs in the Arab and Euro-Mediterranean countries in order to develop a competent Palestinian staff.
- Enhancement of the capacity building and networking through participation in such programs as AWARENET – a networking project of ESCWA/ Beirut.
- Address holistically capacity building as a need driven to meet objectives and accountability towards governance requirements

5.6.3 Negotiations:

- There is a unanimous belief that there is a great need to be fully and completely prepared for the eventual start of the Final Status Negotiations and thus the decisions and agreements to be made regarding the water sector.

- There is a need to unify Palestinian outward speech on issues related to Palestinian Water Rights in the Final Status Negotiations through building a water profile including historical background, facts and figures.
- Groundwater and economic models developed for the Palestinian water sector should be updated and utilized for technical and management support as well as for studying and illustrating negotiation scenarios.
- Consider the organization of simulation exercises, with the assistance of regional and international experts that would explore and work on the different negotiation scenarios.
- Institutional reference and capacity building are becoming top priority means for enhancing capabilities outside and inside the PWA in order to manage and steer the forthcoming period of negotiations with Israel and neighboring countries sharing water resources.

5.6.4 Information and Knowledge Sharing:

- The need for access to data and information was stressed, as can be seen by the following two points:
- There is a need to create a national open-source knowledge map to be placed at an easily-identified and easily-accessed reference point for common use.
- Enhanced cooperation is needed between Palestinian, Arab and Euro-Mediterranean institutions in order to establish and develop a data base system linked to geographic information systems (GIS) in the field of water and environment.

5.6.5 Public Awareness:

- Users of publicly shared water resources (wells and springs) should be made aware of the benefits of the establishment of Water's Users Associations and be encouraged to establish such bodies.
- Cultural and water ethics could contribute towards raising consciousness and awareness among Palestinians regarding their rights for sufficient and clean water that meets their needs.
- Advocacy programs should be carried out at different levels (more explanation is needed).

5.6.6 Planning and Development:

- There is a need to develop a platform for future programs of action with new updated priorities. *For example*, water tariffs need to be calculated based not only on economic factors, but also on social factors.
- It was also stressed that planning should not just be on paper and on file. As seen below, the participants want to see project implementation!
- Initiate and support the implementation of water projects on the ground.
- Initiate an open-consultation process of Planning for the Water Sector in Palestine with the assistance of all involved stakeholders. The process could provide a clear view of the objectives, the envisaged trajectory and the steps in order to reach the identified objectives, responding to the Millennium Development Goals and the Johannesburg Targets. The Mediterranean Component of the EU Water Initiative (MED EUWI) could contribute to that.

5.6.7 Cooperation:

General recommendations often referred to the issue of conflict resolution and cooperation in the water sector, stressing that these issues should be concentrated on and given increased attention. Note below that cooperation is also recommended between the Arab States and in the Euro-Mediterranean context, as well.

- More efforts should be made towards cooperation within the Arab region and in the Euro-Mediterranean context in the water and wastewater sector.
- There should be an increase in the activities, similar to this conference, which enhances the cooperation between professionals and stakeholders in Palestine, the Arab region and the Euro-Mediterranean countries.
- Improve the interaction and cooperation between Palestinian R&D organizations and the different Arab and Euro-Mediterranean networks and partnerships.
- Encourage co-operation and explore potential synergies with already existing Initiatives and Processes in the Mediterranean Region, like the MED EUWI, GEF Strategic Partnership for the Mediterranean, Joint WFD/ MED EUWI Process, Horizon 2020, etc
- There should be a shared vision and rating of the challenges facing the Palestinian water sector and it is important to streamline all activities and programs and projects towards attaining the objectives emanating from such a vision.

5.6.8 Donor Funding and Coordination:

All participants recognized and accepted the need for continued donor participation and support to the Palestinian water and wastewater sector. Some specific points made are below:

- Donor Policy should be wisely directed in order not to increase the gap between the governmental and private sectors.
- Utilization and best exploitation of existing donors' assistance, including the opportunities provided by the European Neighborhood Policy Instrument, the Horizon 2020 Initiative, the World Bank funding programmes, etc.
- Funding and support for individual or institutional research or studies of water supply, quality and use and all its related and relevant aspects should be continued.
- Consider, after consultation with the relevant stakeholders, the establishment of a donor co-ordination body to promote a unified approach towards donor funding. The aim of the body would be to: co-ordinate funding so as to avoid overlapping/ repetition; make better use of existing funds; and look for additional funding sources. MED EUWI could contribute towards this objective.
- An innovative recommendation was, as follows:
- Responsible Palestinian government parties and entities should seek donor support and funds for setting-up a trust fund for the future infrastructure development needed to utilize the water sources and quantities returned through the recognition of Palestinian water rights during or after the final status negotiations.

5.6.9 Follow up Actions of the Conference:

General comments, suggestions and hopes for the future are as follows:

- ✓ Papers and presentations made in this conference could constitute a platform for constructing a Palestinian program that could meet the objective of strengthening the Palestinian water sector. An action to this end is needed.
- ✓ It is recommended to concentrate in future conferences on one subject /theme of water management in order to give adequate time for speakers to present their papers and hold more in-depth discussions.

- ✓ It is envisaged that all participants will work towards having the next international meeting of this type in Palestine.

In conclusion, it should be noted that the House of Water and Environment and the Palestinian Water Authority attended in Istanbul in March 2007 the kick-off meeting of the 5th World Water Forum that will take place in Istanbul in 2009. Also, another conference about river basins was attended by HWE and the PWA in Antalya.

Based on the above participation – it is extremely important that this conference be considered as a continuation to the efforts being made towards the global picture to improve water resources issues - with emphasis on Palestine. The House of Water and Environment will continue to work with the DSI of Turkey for the preparation of the 5th World Water Forum in order to include a special session on Palestinian Water Issues.

5.7 Evaluation of the Conference:

A form has been distributed to the participants during the conference in order that they could give their opinion about the conference. Below is a table that shows the results of the survey:

Number of forms: 55

Item	Result (%)		
	Excellent	Good	Fair
1. Travel and Arrangements	41	26	33
2. Airport Reception and Local Transportation	56	22	22
3. Programme	53	38	9
4. Quality of Material and Presentation	42	49	9
5. Experiences and Contribution of the Lecturers	55	41	4
6. Discussion and Interactions	42	49	9
7. Level of Capacity Building Enhancement	31	55	14
8. Accommodation	87	10	3
9. Meeting Facilities	70	22	8
10. Coffee Breaks and other Facilities	75	25	0

On average of 89% of the participants were happy with the conference with all its activities and organization.

Chapter 6

Analysis of Project Results

Despite the difficult times in POT especially the closure on Gaza and the West Bank, the project has fully achieved its goals and expected results. . It was well covered in the scientific community and in the media as UNESCO Flanders Project.

1. The water network of experts expanded the project's impact from one beneficiary university to include additional universities and key actors in the water sector in Gaza and the West Bank; Balance between participants from Gaza and West bank has been maintained in all project activities;
2. Documentation center of Al-Azhar University has been equipped with a video conference facility that was very useful during the project team meetings because the borders between Gaza and the West Bank are fully closed most of the times;
3. Research projects has been conducted with great efficiency and high professional calibers. Careful and in-depth competitive and transparent process in selecting the funded proposals contributed significantly to the good quality of the research results. This process has to go through internal selection by the project TNC and it has to be approved by the SC. It worth mentioning that, with some thousands dollars, the researchers achieved a high-quality research which sometime comparable to hundreds of thousands project. Careful spending, effective budgeting and in kind contribution from the research bodies helped in achieving these good results. Each research progress was monitored and peer-reviewed by independent members of the TNC. We received many fruitful comments from the reviewers that help in enhancing the final outcome and research results.
4. Furthermore, more than 16 papers from the research projects were submitted and accepted by the scientific committee of the international project document. These papers among others were subjected to another cycle of peer-reviewing by independent experts.
5. The project training activities trained more that 140 experts from POT in various training priority areas identified and recommended by the project TNC and approved by the SC. This covers experts from West Bank and Gaza, and gender mainstreaming was improved as almost 30% of the trainees were females.. Again, careful and in-depth competitive and transparent process in selecting the funded training proposals contributed significantly to the good quality of training. The quality of the training material, well designed delivery process, use of high-tech instruction and demonstration tools, and high qualifications of the trainers contribute to the great results of training in this regard. . The external reviewers commends highly the quality of the training material.

6. The project conference was a wrap up event that crowned all the project activities. The high political and scientific interests in the conference contribute to its great success. More than 120 participants from the region, Europe and North America participated in this conference. High level decision-makers from the UN community as well as from POT and Jordan participated in this conference. More than 79 technical papers were presented and fruitful and sometime heated discussions enriched the conference.
7. The conference was well covered in the media including newspapers, radio and TV. The recommendations of the conference received high supports from the international and donors community. The conference was posted on the internet and the conference papers were distributed in hard copies (as conference abstracts) and soft copies as full papers and presentations.
8. The management mechanism of the project was unique and fully transparent. These project TNC and SC meetings were organized annually on a regular basis event if outside Palestine (due to security issues and other reasons). Representatives of UNESCO and the Flemish donors played a central role in keeping the project on track and achieving the project objectives. The Project TNC reviewed the project workplan from technical and quality-impact point of view and this has to be approved by the project SC who requested the UNESCO Cairo office to take the needed action. This applies to the activity before it was implemented and later in the following meeting the results will be evaluated too. Samples of the minutes of the project TNC and SC meetings are attached in the Annexes.
9. The Flemish contributions were not only in terms of financial support only, but also it was extended to be technical support as many Flemish experts are members of the TNC and the reviewing bodies of the project which greatly enhanced the project results quality and impact;
10. The commitments from the Palestinian institutions, governmental bodies, professionals, and UNESCO National Commission contributed greatly to the success of the project success despite the many constraints faced because of local or regional special conditions of the POT.
11. The project was also subjected to UNESCO internal evaluation and external evaluation commissioned by the Flemish donors. All the evaluator commends highly the results achieved given the difficult working environment of the project due to political and security constraints. Thanks to modern communication tools such as e-mails, video conferencing which enable the project to communicate with all partners despite all constraints.
12. The UNESCO- FUST steering committee, at UNESCO HQ, reviewed the project progress annually and create an enabling environment to implementing the project successfully.

Chapter 7

Project External Evaluation

The project was evaluated and audited by the internal oversight office of UNESCO. The evaluation and audit outcome were very positive and they commend the quality and modality of implementation despite the hard political constraints on the ground.

Towards the end of the project, the donors commissioned an external evaluation and review committee to review the whole Flemish FUST projects executed by UNESCO. Among these projects was this project. This evaluation took place in mid-year 2007, they issued their final report as received by UNESCO in late 2007. Furthermore, an independent expert from Egypt has been asked to provide a project evaluation based on the project implemented activities and documentations available. Due to the overlap of these evaluation processes, their results are briefly aggregated in this chapter.

By the end of the project, twenty one research projects were completed and their final reports submitted, this involved a team of more than 85 researchers and reviewers. The selection process of these research and training activities has been very transparent, based on independent peer-reviewed evaluation and full approval of the project TNC and adoption by the project SC. Training materials were developed for 6 expanded courses covering integrated water management, EIA for water analysis, irrigation water management, spectroscopic and chromatographic instruments for water analysis, and on ground water well siting, design, construction, maintenance, and rehabilitation. More than 140 trainees and 20 trainers representing a wide swath of water sector actors from municipalities, environmental management, agriculture, university research, regulators, and public health specialists attended these training activities. Six regular annual meetings of the TNC and SC kept the project under in-depth review and evaluation. Copies of the project final reports on research activities and training are presented in the electronic version of this report's annexes. Furthermore, samples of the annual meetings of the TNC and SC reports are presented in the report annexes too. The project conference attracts more than 104 abstracts out of which about 70 papers were accepted and presented based on independent peer-review process. A complete proceedings of the conference papers' abstracts and organizational matters are attached to the electronic version of this report.

It can be clearly seen that the project achieved its goals despite the many odds in the region. The impact of the project was well recognized by the water sector at large in the POT. The careful and efficient execution of the project from UNESCO Cairo is commended. The technical and financial contribution of the Flemish donor is highly appreciated. Finally the effective feeling of ownership and high-quality deliverables of the project by the Palestinian experts and partners were key factors to the project success.

Chapter 8

Findings and Conclusions

8.1 Findings and Lessons Learned

- Against a background of extreme political and economic difficulties, this ambitious capacity building project has, in the opinion of all reviewers, succeeded beyond all reasonable expectations. An active network of water experts including governmental and public agencies, NGOs, and private experts has been developed. The network, assisted and nurtured by the project steering committee, and especially by the dedication of Flemish scientists and advisors, has managed to identify priorities, facilitate research, and foster the development of training activities that address local needs and represent a national consensus of water actors. Part of the success is owed to the flexibility and understanding demonstrated by the steering committees of the FUST project as well as the FUST TNC and the careful management from UNESCO side.
- Clearly, the project faced some difficulties and constraints, particularly with respect to the activation of the documentation center and the late start of some training activities due to the political conditions in the POT. However, resources were well mobilized to carry out, even under difficult situation, a suite of competent research projects and outstanding professionally designed and delivered training workshops and courses. Furthermore, the project management structure provided a mechanism to address some of the key challenges that faced the project.
- At the technical level, the majority of the final 21 research reports demonstrated promising scientific competence and creativity. These projects covered policy research, hydrologic modeling for both surface and ground water, GIS enabled modeling and analyses, water quality research, experimental design, and advanced mathematical modeling. Most projects focused on applied research, and in many instances, can be classified as base-line assessment studies of existing environmental conditions as opposed to cutting edge research. A positive influence on research activities has been the thorough technical review of the proposals submitted in lieu of the first call, which was conducted by external Flemish expert. The appointment of an advisory panel for each research/training proposal is also a positive development to enable a sort of independent follow up and review of the results and final reports. An agreed-on evaluation criteria, procedures, schedules, guidelines, and mechanisms been thoroughly followed.
- Project documentation is an important aspect of project management. This project is thoroughly documented. The minutes of the SC and TNC meetings provide a good history of important discussions. The documents also included

summary of research project progress relative to its milestones. The project management at UNESCO Cairo has done an outstanding job in this regard.

- Detailed reviews of the training material of all 6 training activities delivered reveal the high professional standards and competence levels of the providers. Without exception, the reviewers are very impressed with content and quality of all technical training materials, exercises, and presentations. One can imagine the possible multiplication of impacts given that a training team of more than 20 experts are involved and more than 140 trainees participated actively in these trainings.
- The continuing deterioration of the political situation in POT is rather unfortunate. This reviewer believes that in cases such as Palestinian water resources, capacity retention is as important as capacity building. It gains multiplicative effect with every scientist, engineer, and expert who provides continuity by deciding to remain and contribute. The final research reports and the quality of the technical material of the last 6 training courses demonstrated that FUST-Phase II, has succeeded in providing Palestinian experts in the water area with excellent opportunities to enhance the institutional and human capacities of the water sector. It has also enhanced the capacity of universities to conduct applied research within their national priorities. The impact of this project may go beyond POT Palestinian experts may be in high demand in neighboring countries. More importantly, the Flemish support has allowed them to contribute to improving the potential for water resources sustainability. It has been successful, despite of all extreme difficulties and constraints.
- Currently, it is unlikely that similar activities can be carried out in the Palestinian Territories without Flemish support. The first two phases of FUST project provided infrastructure and research capacity building. Several Palestinian agencies expressed strong support to the development of phase III of the project. Plans are underway to write a proposal for the third phase. This reviewer is strongly supportive of the establishment of a phase III project with increased West Bank participation. The FUST steering committee is encouraged to inquire about the possibility of providing some salary contribution to researchers, or perhaps require the involvement of graduate assistants, involvement from universities with graduate programs.
- The earlier FUST 2002 review encouraged the expansion of the active participation from Flemish counterparts in phase II of the project. Obviously this recommendation was thoroughly followed. Flemish counterparts were partners in all stages and demonstrated dedication and enthusiasm. Yet, there is a danger of the project becoming over-reliant not merely on their input, but on them performing some of the tasks that can and should be performed by the project management, partners, and local experts.
- The procurement of video conferencing facility in the documentation center in Al-Azhar university in Gaza has been a feasible solution to promote and

enhance communication between the project partners in Gaza strip and the West Bank especially after the closer of the connections between the two regions. It has been used many times to address joint issues related to the project or other Palestinian priorities. The use of modern information communication technologies and internet has been fully utilized in this project.

- The organizing of some of the project steering committee and TNC meetings as well as the project international conference in Egypt and Jordan have raised the visibility of the project in the region and have extended the project network to interact with other regional and technical water networks in the region especially in Jordan and Egypt.
- The project sustainability has been promoted by preparing two newly project proposals to address Palestinian priorities and needs in research and capacity building. These proposals can be easily formatted to be a full project document for potential donors and funding opportunities that may arise soon. Complete copies of these proposals are available on the electronic version of this report.
- The positive and encouraging feed back from various Palestinian stake holders on the project impact goes beyond the amount of financial funding of the project. Despite the fact that the project budget is about 850 thousand dollars, its visibility and impact can be fairly compared to multi-million projects in the POT. Audio-video clips and letters of feedback on the project are attached in the electronic version of the report.

8.2 Concluding Remark

In conclusion, despite of the political turmoil, and the deteriorating economic conditions, particularly in Gaza strip, this ambitious project has been successful in meeting many of its goals. More than 180 trainees of which about one-third were women, 21 research projects were completed, and several improvements in the documentation centers and other infrastructure have been achieved. The Flemish financial support along with the active technical participation from Flemish scientists in all aspects of the project played a major role in the eventual success of this project. This support contributed to measurable improvement in the Palestinian capacities, both in human and institutional aspects, to address future challenges in integrated water resources management, an issue of critical national priority in Palestine. The impact of the project was well recognized by all Palestinian stakeholders.

As noted the project was able to achieve excellent results and to perform against significant constraints and special circumstances in the region. It is of high importance supporting the Palestinian efforts to improve their ability to deal with a looming water crisis. All stakeholders and reviewers strongly recommend continuing support for such project. Two future research proposals have been prepared and made ready for any future funding possibilities to build on the achievement of this project.

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Annexes

(Each Annex is included in separate folder)

1. The Project Brochure and Website
2. Initial Project Workplan
3. Sample of the Project SC Meeting
4. Sample of the Project TNC Meeting
5. Call for Research Proposals
6. Future Research Project Document
7. Future Capacity Building Project Document
8. Selected Photos
9. Letters from Stake Holders
10. Final Report of the 21 Research Activities
(Soft copy only)
11. Final Report of the 6 Training Activities
(Soft copy only)
12. Conference Abstract Book (Soft copy only)
13. Audio-Video Feedback (Soft copy only)

Remark:

All annexes are included as is without concise editing. Their content is the responsibility of their original authors.