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# SUPPORT FOR ENVIRONMENTAL MANAGEMENT OF THE IRAQI MARSHLANDS

*2004 - 2009*

UNITED NATIONS ENVIRONMENT PROGRAMME



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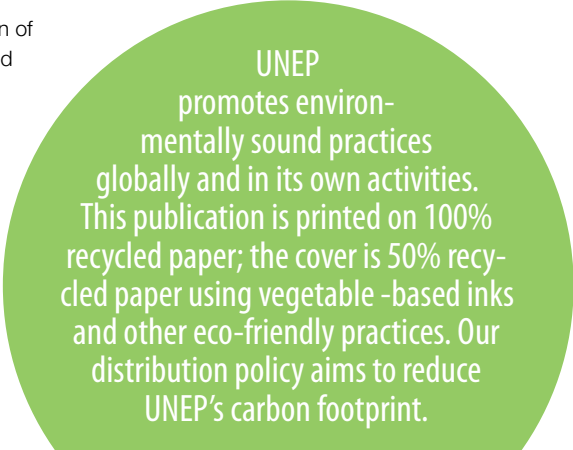
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**SUPPORT FOR  
ENVIRONMENTAL MANAGEMENT OF  
THE IRAQI MARSHLANDS  
2004 – 2009**

UNITED NATIONS ENVIRONMENT PROGRAMME

## Foreword by Achim Steiner, UNEP Executive Director

UNEP's Iraqi Marshlands Project was one of the largest environmental projects conducted within the framework of the United Nations Development Group (UNDG) Iraq Trust Fund. This project has also been one of UNEP's most wide-ranging efforts to support the transfer of Environmentally Sound Technologies (ESTs).



This publication presents the major activities and results achieved by this project, which had the goal to support sustainable development of Iraq by rehabilitating and managing the damaged ecosystem through technology support and capacity building. Among the project achievements was improving access to drinking water and wastewater management using ESTs and it has generated visible and immediate on-the-ground benefits for the rural residents. The analysis presented in this report strengthens our conviction that ESTs can address post-conflict and longer-term priorities for basic services including drinking water and ecosystem management, and therefore should be an integral concept for re-development initiatives.

The project was implemented under very difficult security situations, calling for very close cooperation with Iraqi partners. UNEP would like to thank the cooperation extended from the Iraqi partners, particularly the Ministry of Environment, as well as the Ministry of Water Resources, Ministry of Municipalities and Public Works, local governorates, community groups, academic institutions and non-governmental organisations. UNEP is also grateful for the support provided to the project through the UN Iraq Trust Fund, the Government of Japan and the Government of Italy.

While we are coming to the completion of the original project, our work in this important area, and in Iraq as a whole, is far from complete. The area is now facing yet another crisis from a two-year drought and impacts of desertification, in part due to the effects of climate change and reduction in water resource availability. The environment still needs to be prioritized and mainstreamed in the national development agenda, and there remains a lot of work to do in the Marshlands and beyond. UNEP is committed to continue cooperation with the Government of Iraq to address these challenges. For example, UNEP is cooperating with UNESCO to develop and implement a longer-term sustainable management and preservation plan for the Marshlands based on the World Heritage inscription requirements.

UNEP's work in the Iraqi Marshlands has been unique for a whole variety of reasons, but the lessons we have learned go beyond the Marshlands. They have the potential to be transferred to other areas in Iraq that face environmental and socio-economic challenges. They can also provide a blueprint for the management and rehabilitation of many other ecosystems across the world. We hope that the insights and our collective wisdom featured in this document will be useful to inform future work in the rehabilitation and restoration of economically-important ecosystems.

A handwritten signature in black ink that reads "Achim Steiner". The signature is written in a cursive, flowing style.

Achim Steiner  
UN Under-Secretary General and Executive Director  
United Nations Environment Programme

## Foreword by Her Excellency Mrs. Narmin Othman, Minister of Environment of Iraq

The Iraqi Marshlands are considered to be one of the most important ecosystems in Iraq, as well as the Middle East. They cover a large area in the southern parts of Iraq, with very unique and rich natural and human resources. The indigenous people of the marshes have maintained their inherited cultures and customs that are thousands of years old. The area is thus considered as a place of considerable cultural importance for world heritage, in addition to its environmental and economic value.



Since its establishment in 2003 as part of the new face of Iraq, the Ministry of Environment has placed an emphasis on environmental management, most notably in the Marshlands region, in cooperation with other line ministries. The Ministry of Environment has also recognized the importance of international cooperation. The international community answered Iraq's call for urgent help to save the marsh environment and the residents. I wish to take this opportunity to thank the United Nations Environment Programme (UNEP) for undertaking the implementation of the Environmental Management of the Iraqi Marshlands project. I also extend my gratitude to the people and the Government of Japan as well as Italy for supporting this project.

Throughout the UNEP Marshlands project, various Iraqi Ministries took responsibility for direct field implementation of many activities. Such involvement played a very positive role in raising the capabilities of the ministry staff, in addition to helping to achieve the project benefits. The project implementation was conducted in a manner that reflected the commitment of all sides. We are also very pleased that the project team was selected for the UN 21 Award Prize in 2007. We take this recognition to our hearts and congratulate all who have contributed to this achievement and well-earned recognition.

Iraq is committed to helping protect the planet's environment by means of the participation in the international community. In this regard, Iraq has acceded to a number of Multilateral Environmental Agreements such as the Convention on Biodiversity, the United Nations Framework Convention on Climate Change and the Kyoto Protocol, the Ramsar Convention on Wetlands, as well as the Vienna Convention and the Montreal Protocol on the Protection of Ozone Layer. Iraq is also facing emerging environmental concerns, including the impacts of the two-year drought and desertification in the marsh area and beyond. Addressing these challenges requires enhanced international cooperation. I look forward to continuing our partnership with UNEP for the sustainable development of Iraq.

A handwritten signature in blue ink, which appears to read "Narmin Othman". The signature is fluid and cursive, with a large loop at the end.

Narmin Othman Hassan  
Minister of Environment  
Republic of Iraq

## Acknowledgement

This project was made possible by cooperation of many individuals and institutions. UNEP would like to thank them, particularly the following Iraqi institutions: Ministry of Environment, Ministry of Water Resources, Ministry of Municipalities and Public Works, Ministry of Planning and Development Cooperation, State Ministry of Marshlands, Centre for Restoration of the Iraqi Marshlands, Basrah Governorate Council, Missan Governorate Council, Thi-Qar Governorate Council, local governments in Basrah, Thi-Qar, and Missan, Al-Chibaysh Marsh Arab Forum, Marsh Arab Forum of Thi-Qar, Missan Marsh Arab Forum, Basrah University, Thi-Qar University and Women and Environment Organization.

Cooperation was also extended by the following institutions: American University of Beirut, Arab Center for the Studies of Arid Zones and Dry Lands, Cairo University, Center for Environment and Development for the Arab Region and Europe, Global Environment Centre Foundation, International Agricultural Centre, International Institute for Geo-Information Science and Earth Observation, International Lake Environment Committee, Japan International Cooperation Agency, Nature Iraq, Osaka Municipal Government, Secretariat of the Ramsar Convention, Shiga Prefecture Government, United Nations Education, Science and Cultural Organisation, United Nations Economic and Social Commission for West Asia, United Nations Information Centre in Japan, United Nations Office for Project Services, Wetlands International, and World Health Organization. Furthermore, financial contributions from the Government of Italy, Government of Japan and the United Nations Development Group Iraq Trust Fund are acknowledged with great appreciation.

The core team members merit special recognition: Dr. Ali Abdul-Zhra Zebon Al-Lami, National Coordinator, Dr. Chizuru Aoki, Senior Programme Officer, Dr. Sivapragasam Kugaprasatham, Project Officer (former), and Ms. Aya Mimura, Team Assistant.

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## Executive Summary

This publication is a completion report for the “Support for Environmental Management of the Iraqi Marshlands” project implemented by the United Nations Environment Programme (UNEP) from August 2004 to December 2009. The initiative was one of the largest post-conflict environmental projects conducted within the framework of the United Nations Development Group (UNDG) Iraq Trust Fund, as well as one of most extensive initiatives by UNEP to implement Environmentally Sound Technologies (ESTs) on the ground.

This report has been prepared in response to numerous requests for comprehensive information regarding the project and for a document that chronicles the project development and results. The specific objectives of this report include the following:

1. To provide detailed descriptions of activities undertaken by UNEP within this project
2. To assess the impacts and benefits of UNEP’s interventions through this project
3. To document the lessons learned by UNEP in implementing activities in a complex post-conflict environment

The report also makes recommendations on future initiatives to improve environmental conditions for this area as well as for the country.

Located in southern Iraq in the areas surrounding the confluence of the Euphrates and Tigris Rivers in the Governorates of Basrah, Missan and Thi-Qar, the Iraqi Marshlands constitute the largest wetland ecosystem in the Middle East, and are of environmental and socio-cultural significance. The Marshlands have been damaged significantly by drainage operations undertaken by the former Iraqi regime and upstream dam construction. In 2001, UNEP alerted the international community to the destruction of the Marshlands when it released satellite images showing that 90 percent of the Marshlands had already been lost. By the time the former Iraqi regime collapsed in 2003, these Marshlands had been almost entirely destroyed. Extensive ecological damage to this area, with the accompanying displacement of much of the indigenous population, was identified as one of Iraq’s major environmental and humanitarian disasters in post-conflict assessments by international organisations.

The UNEP "Support for Environmental Management of the Iraqi Marshlands" project commenced in August 2004, in order to respond to the Iraqi priorities in the Marshland area in an environmentally sound manner in the post-conflict period. The priorities included addressing marshland water quality and management needs to protect human health, livelihood and the ecosystem, and providing safe drinking water and sanitation. Environmentally sound interventions were required to meet the needs of the inhabitants and returning displaced persons in this area of damaged ecosystems. The UNEP project therefore had the aim of supporting the sustainable management and restoration of the Iraqi Marshlands by facilitating strategy formulation, monitoring marsh conditions, raising the capacity of Iraqi decision makers, and providing water, sanitation and wetland management options on a pilot basis utilizing Environmentally Sound Technologies (ESTs).

The project was carried out in three interlinked phases, with two sub-components for the second phase. Each phase focused on complementary areas of marshland management and EST pilot implementation. Phase I (2004 – 2007) was implemented within the framework of the UNDG Iraq Trust Fund, with a US\$11 million contribution from the Government of Japan.

This project phase focused on: support for strategy development and coordination; data collection and baseline analysis; capacity building; pilot EST implementation; and awareness raising and follow-up. Phase II-A (2006 – 2008) was developed as basic data were still missing and were not being shared to make sound management decisions and guide efficient implementation of marshland management initiatives. Phase II-A was supported by the Government of Italy, which made a US\$947,000 contribution. It focused on supporting data collection and analysis of water, environment and socio-economic parameters, and enhancing data sharing based on a uniform platform.

Building on the results of Phase I and in response to requests from Iraqi partners, Phase II-B and Phase III continued to address the overwhelming need for basic services in an environmentally sound manner. Phase II-B (2006 – 2008) was supported by the Government of Japan, which made a US\$1 million contribution. This phase focused on continuing on-the-ground initiatives for drinking water provision and water quality management, as well as community level initiative support. Phase III (2007 – 2009) was also supported by the Government of Japan. This final phase expanded the EST pilot implementation to include alternative energy sources and targeted capacity building that included Multilateral Environmental Agreements (MEAs) and other issues relevant for establishing a longer-term marshland management framework. The budget for this phase was US\$900,000.

The line ministry for the project was the Ministry of Environment (MOE). Given the cross-cutting nature of the project, cooperation was also established with the Ministry of Water Resources (MOWR) and its Centre for Restoration of the Iraqi Marshlands (CRIM) and the Ministry of Municipalities and Public Works (MMPW). Cooperation was also established with the Governorate Councils of Basrah, Missan and Thi-Qar, and with local communities.

The project identified nine expected benefits at the inception of Phase I, many of which were relevant for the subsequent phases. Overall, the following nine benefits were achieved in the areas of technology support, socio-economic improvement, policy coordination, capacity building, data and information management, and longer-term sustainability:

#### Technology support:

- The project implemented environmentally sound technology (EST) options on a pilot basis to evaluate their performance and suitability under local conditions, thereby contributing to the restoration and management of the Iraqi Marshlands through identification and assessment of suitable mitigation options, particularly for water, sanitation and marshland management.
- In total, more than US\$5.4 million worth of ESTs were procured and implemented for the project, including six modular reverse osmosis water treatment facilities, distribution networks, a photovoltaic power supply system to augment conventional power for a water treatment facility, one constructed wetland EST for sanitation, one wetland rehabilitation facility, one pilot facility for natural wetland system and nine solar stills for household water provision. The level of investment in Phase I was approximately US\$4.7 million, exceeding the target of US\$3 million set for this phase.

#### Socioeconomic improvement:

- The project improved access to drinking water and sanitation/wastewater with ESTs for rural residents, and improved ecosystems and biodiversity in communities participating in the pilot projects. Approximately 25,000 persons gained access to safe drinking water and a community of 170 residents gained access to a sanitation system

using constructed wetlands. Wetland rehabilitation and reconstruction initiatives were implemented at the community level as well as at the marsh level. The project articulated the need for water quality management before utilizing the Main Drain, which is used to drain wastewater from Baghdad and upstream areas and has diverted water that previously flowed into the Marshlands, as a water source for their reflooding. Both biodiversity and species richness increased during the project period in the vicinity of water treatment pilot sites monitored for phytoplankton, zooplankton and macrobenthos, while other parameters showed mixed results.

- At least 52,000 person-days of employment opportunities were generated for assessments, pilot applications, awareness raising, monitoring, training organization, and security provision. Close linkages between capacity building and project implementation were crucial in building capacity of Iraqi personnel and institutions for tasks associated with project activities. By training and utilizing personnel from institutions at the national, governorate and local levels with mandates on specific aspects of marshland management, the project succeeded in enhancing the longer-term sustainability of institutional capacity and gainful employment of their staff.

#### Policy coordination:

- Greater coordination for marshland management, water and sanitation issues was achieved by directly engaging a number of ministries, governorate councils and local organisations to discuss, plan and carry out specific activities within their mandate areas, as well as within the donor coordination and project management mechanisms.

#### Capacity building:

- The project improved the capacity and knowledge of Iraqi decision makers, technical experts and communities on various aspects of marshland management, including policy and institutional management, technical subjects and analytical methods. 477 international and domestic training placements were provided through the project as well as 22 for study tours. In addition, more than 1,100 women in marshland communities benefited from community initiatives to raise practical knowledge about environmental conservation and personal hygiene. Approximately 1,000 more persons took part in other community level initiatives.

#### Data and information management:

- Extensive data was generated in areas including water quality and biodiversity, satellite image analysis, socioeconomic conditions and waste management practices. Identification and analysis of suitable water, sanitation and marshland management options (which options worked where and how), and policy and institutional needs assessments were integrated into EST pilot projects in addition to data collection, and served as inputs for long-term management plan formulation to benefit the people and ecosystems of Southern Iraq.
- Improved dialogue and access to information and management tools was achieved through the establishment and operation of the Marshlands Information Network (MIN), Iraqi Marshlands Observation System (IMOS), the Roundtable of Iraqi Marshlands Management, Kick-off and Evaluation Meetings and the International Workshop on Iraqi Marshlands Management.

#### Longer-term sustainability:

- Contributions to regional and national rebuilding efforts were realized by three means. Firstly, the project's provision of drinking water has contributed to the return of

formerly displaced residents. As community stability was re-established, the possibility of finding employment and rebuilding life within the marsh area tended to increase. Secondly, Iraqi stakeholders and beneficiaries requested extension of the project with additional activities after recognizing the project's contributions to local and national level redevelopment. Thirdly, this project served as a foundation for UNEP to launch a new initiative with UNESCO to establish and implement a longer-term management plan based on the World Heritage convention. This initiative is important for the region and the country because it is the first to recognize the importance of natural heritage in Iraq.

In addition to the above benefits, the project provided yet another benefit by validating UNEP's track record on field project implementation. The project team was awarded the 2007 UN21 Award commendation from the UN Secretary General. The project was also regarded as a model of international environmental cooperation by the Minister of Environment of Iraq and was lauded by community groups for making a real effort at engaging local communities.

The project was implemented during the height of terrorism and violence in Iraq, which endangered the lives of Iraqi partners, restricted the entry of UNEP personnel into Iraq and presented numerous security challenges for all activities. Working under such difficult conditions, the project and its achievements are a testament to the dedication of the Iraqi partners and the project team personnel.

Despite the project's success and transition towards longer-term initiatives, emerging environmental threats could undermine improvements in environmental management in the area as well as the entire nation. The Marshlands are experiencing negative impacts from a two-year drought, which has significantly reduced the water and vegetative cover of the wetlands as well as the availability of water in Iraq. The drought and desertification, which have been attributed to climate change and a reduction in water availability, are having negative impacts on the economic development and quality of life of Iraqi citizens. The Common Country Assessment for the United Nations Development Assistance Framework (CCA UNDAF) conducted in 2009 stated that Iraq's environmental problems are defined by "declining natural resources, exacerbated by their unsustainable use" (United Nations, 2009). The CCA identified additional environmental challenges, including elevated soil salinity, increasing carbon emissions, loss of biodiversity, deteriorating rural water supply for agriculture and human consumption, as well as limited waste management. It also highlighted the need to diversify Iraq's economy and to use the wealth arising from resources towards sustainable development.

Reflecting the needs to provide continued interventions and to address emerging environmental priorities, UNEP will continue to be engaged in Iraq. For example, within the Disaster and Conflicts Sub-Programme, UNEP will support in mainstreaming the environment into the course of national development by engaging in the CCA UNDAF process. Within the Ecosystem Management Sub-Programme, UNEP will conduct initiatives on tools for assessing and maintaining freshwater ecosystems and the implementation of ESTs to enhance water regulation and purification services in the Iraqi Marshlands area and beyond. UNEP will also continue to implement the joint World Heritage project with UNESCO, and is committed to continuing cooperation with the Government of Iraq to move towards the sustainable development of this important area as well as the country as a whole.

## Abbreviations and Acronyms

<b>AUB</b>	American University of Beirut
<b>ACSAD</b>	Arab Center for the Studies of Arid Zones and Dry Lands
<b>CCA</b>	Common Country Assessment of the United Nations
<b>CEDARE</b>	Center of Environment and Development in the Arab Region and Europe
<b>CRIM</b>	Centre for Restoration of the Iraqi Marshlands
<b>DEPI</b>	Division of Environmental Policy Implementation of UNEP
<b>DTIE</b>	Division of Technology, Industry and Economics of UNEP
<b>EST</b>	Environmentally Sound Technology
<b>ESTIS</b>	Environmentally Sound Technology Information System
<b>ETM+</b>	Enhanced Thematic Mapper Plus (Landsat)
<b>FAO</b>	Food and Agricultural Organisation
<b>GEC</b>	Global Environment Centre Foundation
<b>GIS</b>	Geographic Information System
<b>GRID</b>	Global Resource Information Database
<b>IETC</b>	International Environmental Technology Centre
<b>ILEC</b>	International Lake Environment Committee
<b>IMOS</b>	Iraqi Marshlands Observation System
<b>IRS</b>	Indian Remote Sensing Satellite
<b>ITC</b>	International Institute for Geo-Information Science and Earth Observation
<b>LISS</b>	Linear Imaging Self-Scanning
<b>MIN</b>	Marshland Information Network
<b>MODIS</b>	Moderate Resolution Imaging Spectroradiometer
<b>MOE</b>	Ministry of Environment
<b>MOU</b>	Memorandum of Understanding
<b>MOWR</b>	Ministry of Water Resources
<b>MMPW</b>	Ministry of Municipalities and Public Works
<b>MOPDC</b>	Ministry of Planning and Development Cooperation
<b>PCDMB</b>	Post-Conflict and Disaster Management Branch of UNEP
<b>RJGC</b>	Royal Jordanian Geographic Centre
<b>PV</b>	Photovoltaic
<b>RO</b>	Reverse Osmosis
<b>ROWA</b>	Regional Office for West Asia of UNEP
<b>TDS</b>	Total Dissolved Solids
<b>UN</b>	United Nations
<b>UNDAF</b>	United Nations Development Assistance Framework
<b>UNDG</b>	United Nations Development Group
<b>UNEP</b>	United Nations Environment Programme
<b>UNESCO</b>	United Nations Educational, Scientific and Cultural Organization
<b>UNICEF</b>	United Nations Children's Fund
<b>UNOPS</b>	United Nations Office for Project Services
<b>USAID</b>	United States Agency for International Development
<b>WEO</b>	Women and Environment Organization
<b>WHO</b>	World Health Organization



# 1. Introduction

This report presents detailed descriptions of activities and results achieved by UNEP’s “Support for Environmental Management of the Iraqi Marshlands Project” carried out from 2004 to 2009. This project has been the largest intervention in Iraq by UNEP to date, and has also been one of the most significant UN-supported environmental initiatives in Iraq.

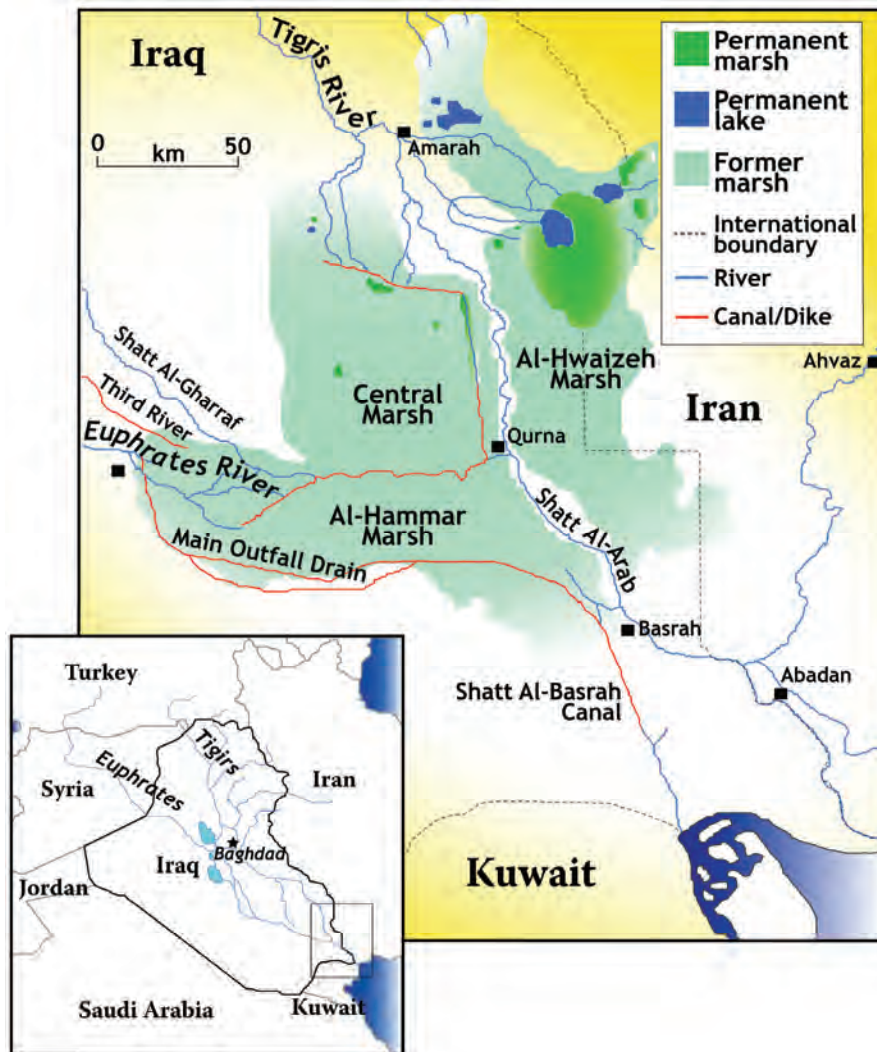


Figure 1 Iraqi Marshlands location map

## 1.1 Background

The Iraqi Marshlands constitute the largest wetland ecosystem in the Middle East and are of environmental and socio-cultural significance. Located in the areas surrounding the confluence of the Euphrates and Tigris Rivers in the Governorates of Basrah, Missan and Thi-Qar in southern Iraq, the Iraqi Marshlands consist of interconnected wetland systems of the Central Marsh, Al-Hammar Marsh and Al-Hwaizeh Marsh (29°55' to 32°45' N and 45°25' to 48°30'E). The area is connected to the Gulf by the Shatt Al-Arab River shown in Figure 1.



The Iraqi Marshlands have been extensively damaged, in large part by deliberate acts by the former regime. Numerous engineering structures including more than 30 dams have been built along the Tigris and Euphrates Rivers over the past 100 years to control the water flow for irrigation, public water supply and hydroelectric power generation (Iraqi Ministries of Environment, Water Resources, Municipalities and Public Works, 2006). While these dams have contributed to the reduction of available water for the Marshlands, the destruction of the marshes is primarily attributable to the extensive drainage structures built during the 1990s for the purpose of drying out the area. Initiatives were also carried out to divert water for irrigation, to build railways and other transport infrastructure by filling wetland areas, and to build canals and dykes to control flows, thus limiting the number of water release points to the wetland system and reducing the overall flow. This intentional drainage may also have been motivated by political retaliation against factions opposed to the former regime. Other aims may have been to tighten security and control by destroying natural landscapes that provided hiding places, and to force emigration. These actions led to the systematic shrinkage of the Marshlands and damage to the ecosystems as well as to the livelihood of the residents.

By the time the former Iraqi regime collapsed in 2003, the Marshlands had been almost entirely destroyed. In 2001, UNEP alerted the international community to the destruction of the Marshlands when it released satellite images showing that 90 percent of the Marshlands had already been lost. Experts feared that the marshland ecosystem would be completely lost within three to five years unless urgent action was taken.

The extensive ecological damage to this area and the accompanying displacement of much of the indigenous population were identified as major environmental and humanitarian disasters by UNEP and the United Nations–World Bank Needs Assessment Initiative for the Reconstruction of Iraq in 2003 (United Nations and World Bank, 2003).

Critical problems and associated priority needs for the Iraqi Marshlands were identified during the immediate post-conflict period by the Iraqi authorities and the UN assessments. Some of the key needs identified include the following:

1. **Marshland degradation:** While the reflooding of dried areas started in 2003, it showed varying degrees of ecosystem recovery. Marsh water was suspected to be contaminated with pesticides and salt from the dried surface, and from untreated industrial discharge and sewage from upstream. Haphazard breaching of embankments had also resulted in stagnant contaminated water in some areas which impacted vegetative and fish recovery. Water quality and marshland management were identified as urgent priorities to protect human health and livelihood, and to preserve biodiversity as well as the ecosystems themselves.
2. **Lack of drinking water:** The 2003 UN interagency assessment and a public health survey by the United States Agency for International Development (USAID) found that the provision of safe drinking water was the critical priority for the residents of the Iraqi Marshlands (United Nations, 2003). While some residents were able to purchase tanker water, many, particularly those living within the marshes, obtained drinking water directly from the marshes without treatment (USAID, 2004).
3. **Lack of sanitation:** Assessments found that most settlements lacked basic sanitation systems and that wastewater was often drained through open channels to the nearest stream or to the street. The presence of human waste in the streets was noted in 50

percent of villages in the region. Outbreaks of water-borne diseases were also prevalent. The provision of wastewater treatment services was therefore critical for public health. In addition, the return of displaced persons to the Marshlands continued to place an increasing burden on the provision of drinking water and sanitation.

The Iraqi authorities recognized the above needs and identified the management of the Marshlands, provision of water and sanitation and capacity building as priorities in Iraq's reconstruction. The need for immediate environmental relief in the Iraqi Marshlands was also raised as a priority by the high-level Iraqi delegation to Japan. In December 2003, the Prime Minister of Japan was requested, in person, to prioritize marshland management and restoration by the Government of Iraq. In March 2004, the Iraqi Minister of Environment met with the Japanese Foreign Minister and Environment Minister, and again requested that Japan prioritize support for marshland management and restoration. Specifically, the Iraqi Minister of Environment requested assistance in the improvement of water quality as well as in the provision of technologies, equipment and training.

Responding to these requests for prioritization, the Government of Japan made financial contributions to the United Nations Development Group (UNDG) Iraq Trust Fund and earmarked funds for the management and restoration of the Iraqi Marshlands. In addition, the need for coordination of activities and strategy formulation for longer-term marshland management had been identified within the UNDG Iraq Trust Fund framework. Additional assistance was provided to UNEP on a bilateral basis by the Governments of Italy and Japan.

## **1.2 Project Goals and Objectives**

The development goal of this project is to support the sustainable management and restoration of the Iraqi Marshlands, with the following immediate objectives:

1. To monitor and assess baseline characteristics of the marshland conditions, to provide objective and up-to-date information and to disseminate tools needed for assessment and management
2. To build capacity of Iraqi decision-makers and community representatives on aspects of marshland management including: policy and institutional aspects; technical subjects; and analytical tools
3. To identify environmentally sound technology (EST) options suitable for the immediate provision of drinking water and sanitation as well as wetland management, and to implement them on a pilot basis
4. To identify needs for additional strategy formulation and coordination for the development of a longer-term marshland management plan based on pilot results and cross-sectoral dialogue (UNEP, 2004).

## **1.3 Project Funding**

Funding for Phase I of the project was US\$11 million provided in July 2004 from the UNDG Iraq Trust Fund with contributions from the Government of Japan. In 2006, the Government of Italy and the Government of Japan made additional bilateral allocations of US\$947,234 and US\$1 million respectively to continue the project into its second phase. In 2007, the Government of Japan made an additional allocation of US\$900,000 for the third phase.

## 1.4 Project Phases

This project has been organized into three phases, with two sub-components for the second phase. Each phase was supported by donor contributions and focused on complementary areas for marshland management and EST pilot implementation, as shown in Figure 2.

### Phase I

Phase I of the project was implemented within the framework of the UNDG Iraq Trust Fund. The Government of Japan provided contributions to the Trust Fund, of which US\$11 million was earmarked for Iraqi Marshlands' management. Phase I had the immediate objectives articulated above and focused on the following activity components:

1. Support for strategy development and coordination
2. Data collection and baseline analysis
3. Capacity building
4. Pilot EST implementation
5. Awareness raising and follow-up

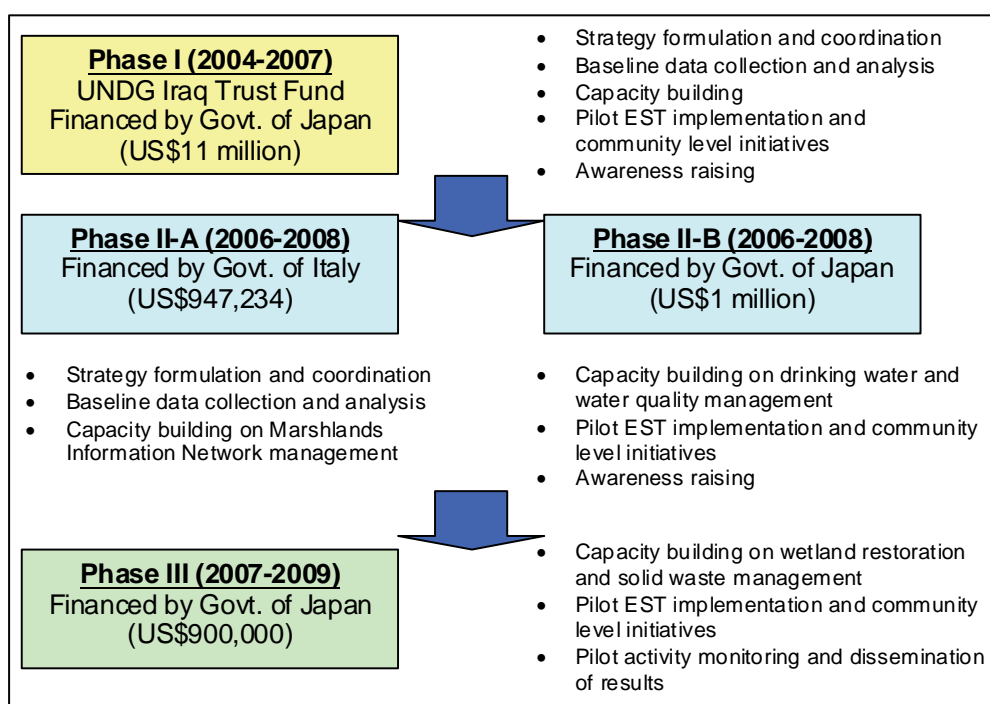


Figure 2 Iraqi Marshlands project phases and supported activities

### Phase II

Phase II had two parts supported by bilateral contributions to UNEP; each focusing on different aspects of marshland management. Phase II-A was supported by the Government of Italy and had the following immediate objectives:

- To support data collection and analysis in water resource, environmental and socio-economic and land planning categories, and to share this information in order to help fill the recognized gap in the availability of marshland management data
- To increase the number of Iraqi institutions with access to the platform for data and analytical tool sharing, thus promoting the network required for the development and implementation of the Marshlands management plan

- To provide necessary hardware to major national and governorate level institutions and to strengthen capacity in data collection, management and analysis.

Phase II-A was developed to support the collection and analysis of data on water, environmental and socio-economic parameters, and to enhance data sharing on a uniform platform. Phase II-A addressed the recognized need to continue with basic data analysis, information sharing and capacity building; all of which were necessary to develop and implement a coordinated Iraqi Marshlands management master plan and to implement ESTs. Key activities included the following:

1. Organisation of kick-off and coordination meeting
2. Support for data collection and assessments to be shared on the Marshlands Information Network (MIN) platform
3. Overall data analysis and management to ensure compatibility and comparability
4. MIN expansion to establish nodes at key Iraqi institutions
5. Workshops to train Iraqi partners on information management
6. Support for in-country secondary MIN training
7. Organisation of evaluation meeting

Phase II-B was implemented in parallel to Phase II-A, focusing on continuing on-the-ground initiatives for water quality management and drinking water provision. This phase received support from the Government of Japan and had the following immediate objectives:

- To provide safe drinking water utilizing ESTs on a pilot basis in an Iraqi community
- To build capacity of decision makers and community representatives on water quality management and safe drinking water provision
- To raise the capacity and awareness of local community members, particularly women, on the marshland environments and associated health impacts through support for local initiatives

Specific activities supported within Phase II-B included the following:

1. Pilot project for drinking water provision
2. Training course on drinking water and sanitation provision through ESTs and marshland management
3. International workshop on Iraqi Marshlands management
4. In-country secondary training support
5. Local community initiatives on marshland environments and health impacts, with a focus on participation by women
6. Updating materials for raising awareness

### **Phase III**

Phase III was the final project phase in the immediate post-conflict period, and was financed with contributions from the Government of Japan. Phase III objectives included the following:

- To investigate the potential for alternative energy sources in the pilot provision of safe drinking water utilizing environmentally sound technologies (ESTs) in an Iraqi community
- To improve water quality and wetland conditions by utilizing ESTs on a pilot basis

- To raise the capacity and awareness of decision makers and local communities about marshland management by supporting targeted training and local-level initiatives

Phase III focused on expanding the EST pilot implementation to include alternative energy sources, and targeted capacity building that encompassed Multilateral Environmental Agreements (MEAs) and other issues relevant for establishing a longer-term Iraqi Marshlands management framework. The specific activities included the following:

1. Pilot project to provide drinking water utilizing alternative energy
2. Pilot project for water quality/wetland improvement
3. Training course on sustainable management of Iraqi Marshlands
4. Continued initiatives at the local community level
5. Monitoring of pilot activities and dissemination of results
6. Project evaluation meeting

Detailed descriptions of project activities and outputs for each phase are described in the following chapters and summarized in Appendices I through IV. Web links to reports and summaries of specific activities are also included in the Appendices.

### **1.5 Key Project Partners**

The line ministry for the project was the Ministry of Environment, which was first established in 2003. A number of institutional partnerships were established throughout the implementation of the project. Key national partners included the following:

- Ministry of Environment (MOE)
- Ministry of Water Resources (MOWR)  
Centre for Restoration of the Iraqi Marshlands (CRIM)
- Ministry of Municipalities and Public Works (MMPW)

The Ministry of Planning and Development Cooperation (MPDC) was also instrumental in project clearance and coordination, and participated in key meetings. As the majority of on-the-ground initiatives took place in the three southern Governorates, cooperation was also established with the Governorate Councils of Basrah, Missan and Thi-Qar. In addition, the project featured extensive cooperation with local community groups, mainly the Marsh Arab Forum, non-governmental organisations (NGOs) and Iraqi universities.

In order to ensure Iraqi involvement and ownership, the project supported activity implementation in communities that were endorsed by local, governorate and national institutions. The primary mode of project operation was to implement activities in communities only when the following three conditions were met:

1. A demonstrated demand and support for interventions from community leaders
2. A clear pledge of security provision by the local communities
3. An endorsement of implementation by all stakeholders including ministries, governorates and local communities

By including the provision of security and the commitment of local communities to assist in implementation in the pilot community selection criteria, the project minimized security and

staff constraints. The sense of local ownership and responsibility was also more assured in communities which met these three conditions.

## **1.6 Project Implementation Structure**

The project implementation structure included both domestic and international components, as described below:

UNEP project team: The International Environmental Technology Centre of UNEP's Division of Technology, Industry and Economics (UNEP-DTIE-IETC) was responsible for overall project implementation from its offices in Shiga and Osaka, Japan. The Project team was established within UNEP-DTIE-IETC with a full time Project Coordinator and a cadre of staff responsible for various technical, information management and capacity-building tasks as well as administration. The team held regular progress review meetings and discussions to facilitate project implementation, and maintained an integrated programme approach that addressed capacity building, policy and institutional changes, as well as practical EST implementation. The team also maintained daily communications with the National Coordinator and regular consultations with other key partners. Significant managerial input and oversight was received from the Division Director and Deputy Director throughout the project's duration. In addition, the UNEP Regional Office for West Asia (ROWA) was closely associated with the project, particularly in coordinating with the Iraqi government institutions and providing help and guidance to organize specific project activities in the region. The UNEP Post-Conflict and Disaster Management Branch (PCDMB) was responsible for the establishment and management of a data system for marshland vegetation and water coverage (Iraqi Marshlands Observation System) as well as related training, and represented UNEP at the UN Country Team in Amman, Jordan until 2006.

National Project Coordinator: The project contracted a National Coordinator to facilitate project activities within Iraq and to assist with local and international coordination. A senior official with extensive environmental and wetland ecology experiences was appointed following a selection process conducted in cooperation with the Ministry of Environment. The National Coordinator maintained constant dialogue with ministries, local community groups and contractors inside Iraq to monitor progress, share information on the project implementation, and to solicit dialogue with partners to facilitate action. Whenever the security situation allowed, he also traveled to the southern governorates to meet and follow up on activities with local partners. The National Coordinator separated from the Ministry to enable full time engagement with the project, and was provided with the necessary guidelines and training, including security training, to enable him to operate safely.

Project Implementation Unit (PIU): The PIU was established within the Ministry of Environment to provide technical support, facilitate the liaison with national and governorate institutions, and help oversee the project at the local level. As the project line ministry, the Ministry of Environment had the responsibility to coordinate in-country activities with the Ministry of Water Resources, the Ministry of Municipalities and Public Works and the southern governorates. Due to security concerns, the National Coordinator initially operated out of a home office as the PIU during the project duration, which was also common practice in other international projects. He maintained regular contact with ministry personnel assigned to the project.

Contractors: Both domestic and international contractors and consultants were engaged to provide support for various tasks associated with the project, including pilot project equipment installation and management, capacity building, monitoring and evaluation, and data management. The project has worked with contractors that have demonstrated experience in delivering necessary services inside Iraq on similar projects. These contractors have the know-how to address various constraints such as delays, security issues and logistical challenges. Whenever possible, the project utilized Iraqi institutions including government agencies, universities, local groups and NGOs, to carry out activities such as water quality and biodiversity monitoring, secondary training and field assessments. In order to facilitate the participation of Iraqi institutions in international competitive bidding for tasks, Iraqi institutions were notified whenever expressions of interest, requests for proposals and other procurement notices were made public.

UNOPS implementation support: Implementation support was provided by the United Nations Office for Project Services (UNOPS) in particular to assist in administering procurement and local contracts. UNEP had substantive responsibilities for project planning and implementation, while UNOPS had the responsibility to carry out the timely provision of project inputs, local contracting, expenditures, procurement, evaluation and reporting. UNOPS was engaged due to the organisation's extensive implementation support experience in Iraq, as well as its presence in Amman to assist UNEP in a timely and efficient manner.

## **1.7 Donor Coordination**

Reflecting the international interest in the Iraqi Marshlands, several donor-supported initiatives started in the post-conflict period. Recognizing the need to coordinate initiatives, several donors began meeting in 2003 to discuss ongoing initiatives and to identify activity gaps that need to be addressed by donors and Iraqi institutions. UNEP was nominated to serve as a liaison for donor coordination by both Iraqi and donor institutions on the occasion of the third donor coordination meeting on the Iraqi Marshlands in October 2004, organized by the Government of Italy. UNEP organized a donor coordination meeting in November 2005 in Paris, and participated in others held in 2006 and 2007. Donor coordination initiatives provided a forum for discussing the contributions and status of various Iraqi-led and donor-supported initiatives supporting/facilitating the establishment of a longer-term Marshlands management plan structure, as well as for policy coordination.

## **1.8 Security Situation in Iraq**

The period of project implementation coincided with significant changes in Iraq's security situation. After the bombing of its office and loss of staff members in August 2003, the UN withdrew its international staff from Iraq. When the project started in 2004, the UN security management classification in Iraq was in Phase V (Evacuation). The UN Secretary General's authorization to declare Phase V signified that the security situation has deteriorated to such an extent that all international staff were required to leave without exception.

The security situation impacted the UNEP operations in the following ways:

1. Terrorism claimed the lives of several Iraqi government officials associated with the project. Others resigned from their positions citing security concerns. Key

counterparts for the Iraqi Marshlands project and other high-level officials within the Ministry of Municipalities and Public Works were killed in terrorist attacks inside the Ministry premises in early 2007. This tragic loss of human life destroyed an important part of the much-needed human and institutional capital for rebuilding Iraq. UNEP operations were put on hold while the Ministry regrouped and appointed new personnel. While activities were continued with new resolve, the loss of dedicated individuals and colleagues inevitably had an impact upon project personnel.

2. Field activities incurred delays due to security problems. Work hours were often shortened to enable safer movement of personnel. Border closings, curfews and other restrictions also impeded customs clearance and the movement of equipment into Iraq, and impacted personnel movements for the duration of their installation.
3. Some project activities were modified and adapted in design and delivery to address security concerns and minimize time and effort inside Iraq. For example, water treatment equipment for the pilot EST implementation was delivered in prefabricated modular containers that were then installed in the field to reduce the further need for shelter constructions and security provisions. All meetings and training that required the participation of international staff took place outside Iraq. As operations progressed into 2005 and 2006, even road travel between Baghdad and Amman to participate in training and meetings became unacceptably dangerous. As the only remaining travel option was by air, the unit costs of training and meeting increased substantially. To address this challenge, UNEP organized meetings in lower-cost locations wherever feasible; shortened the training by fitting more hours into each day and condensing lectures, schedules and meetings; and, as a last resort, by reducing the number of trainers and participants.
4. UNEP staff could not travel to Iraq to supervise the national experts undertaking various assessment activities. However, this may have had a positive outcome as it led to national experts and partner institutions taking more ownership of the process.
5. The mobility of the national experts inside Iraq was also greatly restricted. Consequently, some experts could not make full use of the various skills imparted to them for some project activities.
6. Installation and commissioning of some equipment took a disproportionate amount of time due to the difficulty experienced by some suppliers in gaining access to ministry premises.

The fact that the project objectives were achieved in the face of such difficult conditions is a testament to the dedication of the Iraqi partners, and to the flexibility of the project team.

While the security situation has improved somewhat since 2008, the project's implementation was still under a security threat. The UN security phase remained as Phases IV and V as of January 2010. Phase IV is emergency operations, limiting the number of international staff to those vital for emergency, humanitarian relief, security operations and any other operations deemed essential by the UN Secretary General.

## **1.9 Report Structure**

This report has been prepared with the following objectives:

1. To provide detailed descriptions of activities undertaken by UNEP within this project



2. To make an assessment of impacts and benefits of UNEP's interventions through this project
3. To document the lessons learned by UNEP in implementing activities in a complex post-conflict environment

In this chapter, the project overview and implementation structure are described in detail. The key activity components across the three project phases are also presented. Chapter 2 focuses on pilot EST implementation for water, sanitation and marshland management and rehabilitation. Chapter 3 presents capacity-building and awareness-raising activities, and Chapter 4 describes community level initiatives. Chapter 5 presents data and information management. Chapters 6 and 7 highlight project achievements and benefits, as well as evaluations. Future initiatives and additional challenges are highlighted in Chapter 8.

## **2. Pilot Projects in Drinking Water, Sanitation and Wetland Rehabilitation**

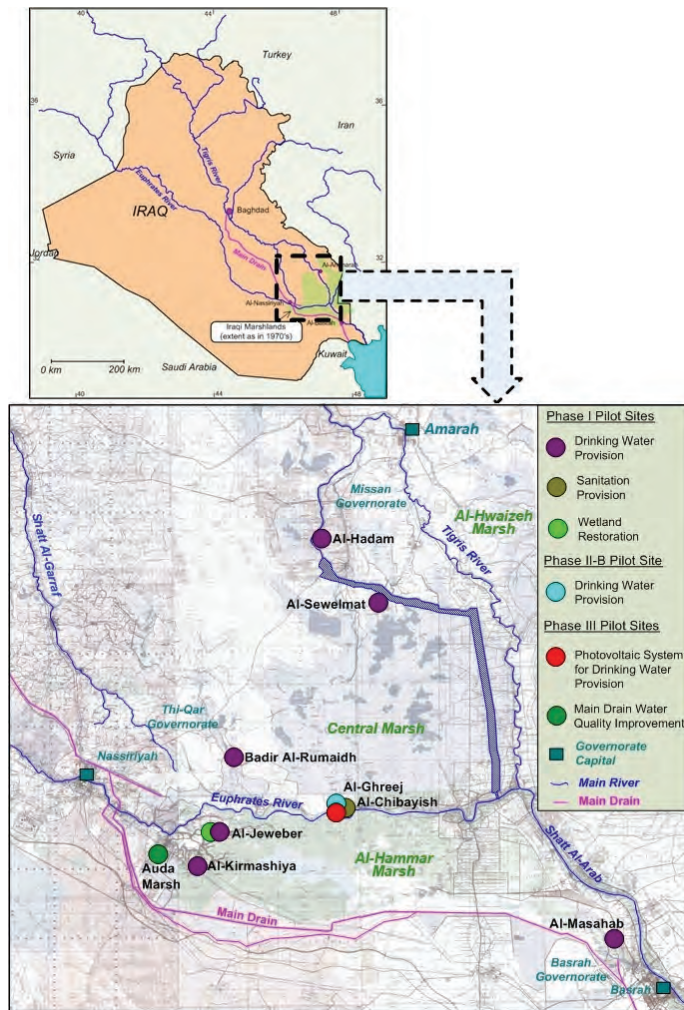
Among the various activities carried out within the framework of this project, pilot projects entailed the most significant field-level implementation and directly addressed the priority needs for interventions in the local communities. UNEP carried out several pilot projects to demonstrate and assess the suitability of environmentally sound technologies (ESTs) with the aim of addressing environmental priorities in the Marshlands, which could also potentially be utilized in other parts of Iraq. The three categories of pilot EST implementation included: drinking water provision, sanitation and wetland rehabilitation. Different pilot projects were conducted during Phase I, Phase II-B and Phase III, with more comprehensive efforts undertaken during Phase I. Each category of pilot EST implementation is described below. Figure 3 shows pilot project sites for all three phases.

### **2.1 *Drinking Water Provision Pilot Projects***

Access to safe drinking water was the number one priority for residents of communities in the Marshlands, many of whom returned to the region in the post-conflict period after being displaced for more than a decade. A large percentage of residents in the small communities have re-established their livelihoods through traditional activities such as agriculture, fishing, animal-rearing, harvesting reeds and making reed products. These activities tend to be small-scale, with residents residing in small tribal clusters located along the fringe of the Marshlands. Due to an increase in the salinity levels of the water in the Marshlands and the absence of infrastructure for water provision and other public services such as electricity, securing safe drinking water became increasingly difficult, especially in small communities.

To gain access to drinking water, treated water had to be transported to the marshland villages by truck from nearby town centres. The water supply that reached the villages in this mode tended to be both unreliable and of inadequate quantity and quality due to the debilitated water treatment and transport infrastructure that generally prevailed in the area. In addition, it was also costly to many residents. Surface water and tanker truck-hauled water are classified as unimproved drinking water sources, and replacing them with improved drinking water source options is necessary to meet Target 10 of the Millennium Development Goals (WHO and UNICEF, 2006). As such, one of the main challenges addressed by the UNEP project was to find suitable options for the communities to access safe and improved drinking water supplies in an environmentally sound manner. Collecting drinking water is traditionally the responsibility of women. By helping communities to gain access to drinking water, the project also sought to provide benefits to rural women.

The main objectives of the pilot projects on drinking water provision were to identify and evaluate suitable environmentally sound technologies (ESTs) through field implementation, while providing immediate relief to residents in those communities where pilot projects were implemented. Emphasising the local priority, the drinking water pilot projects were conducted in Phases I, II-B and III.



**Figure 3 Pilot project sites for drinking water provision, sanitation provision and wetland restoration**

## Pilot Site Selection

Two of the early key tasks for the pilot EST implementation were to identify candidate sites and select a small number for interventions based on criteria agreed on by all partners. The process to select Phase I candidate sites for pilot implementation included the following steps:

1. Soliciting proposals from the Ministry of Environment, Ministry of Municipalities and Public Works, Ministry of Water Resources and Marsh Arab Forum, with a fact sheet on each candidate site
2. Applying technical criteria developed by UNEP
3. Utilizing data gathered from other sources, such as external data from other donor-supported activities
4. Considering geographical distribution over the three southern governorates
5. Reaching consensus on the pilot sites upon discussion.

In February 2005, UNEP organized a technical meeting with the objective of discussing priority sites proposed by Iraqi institutions for interventions to provide water, as well as for sanitation and marshland management pilot projects. Participants included representatives from the Ministry of Environment, Ministry of Municipalities and Public Works, Ministry of Water Resources, Marsh Arab Forum and Iraq Foundation. Representatives from relevant UN agencies including FAO, UNESCO, UNICEF, UNOPS and WHO, as well as the Italian Ministry of Environment, also participated in the meeting.

The ministries and the Marsh Arab Forum proposed 18 candidate sites with two duplicate sites. The participants then discussed and analyzed the information provided in the fact sheets. A summary of all candidate sites was presented to the group, including site suitability based on technical criteria as well as geographical distribution among the three governorates. After an in-depth discussion, the group reached consensus on six candidate sites for the pilot implementation. The selected sites were: Al-Kirmashiya, Badir Al-Rumaidh, Al-Masahab, Al-Jeweber, Al-Hadam and Al-Sewelmat. The local community representatives participating in this meeting pledged to facilitate access and provide security for pilot implementation.

For Phase II-B, resources were only available to support one site. As such, UNEP requested the Iraqi institutions to jointly nominate a community for the drinking water project. Based on the Iraqi nomination, the village of Al-Ghreej in Thi-Qar Governorate with a population of approximately 3,000 persons, was selected for pilot implementation.

### **EST Selection and Water Supply System Design**

Planning for the water supply system was carried out based on the following criteria:

- Per capita water supply of 50 litres per day (L/d). Allowances were also made for uncertainty about the number of displaced persons expected to return to the communities following the restoration of basic services. The facilities were designed to address the needs of a larger population with a minimum supply of 20 L/d.
- Long-term per capita water supply target of 160 L/d
- Modular design of intake and water treatment facilities to enable expansion while accounting for the long-term water supply target
- Distribution system also taking into account the long-term target
- Water quality to fulfill Iraqi drinking water standards and WHO drinking water guidelines

Detailed descriptions of the selection process are available on the project website.

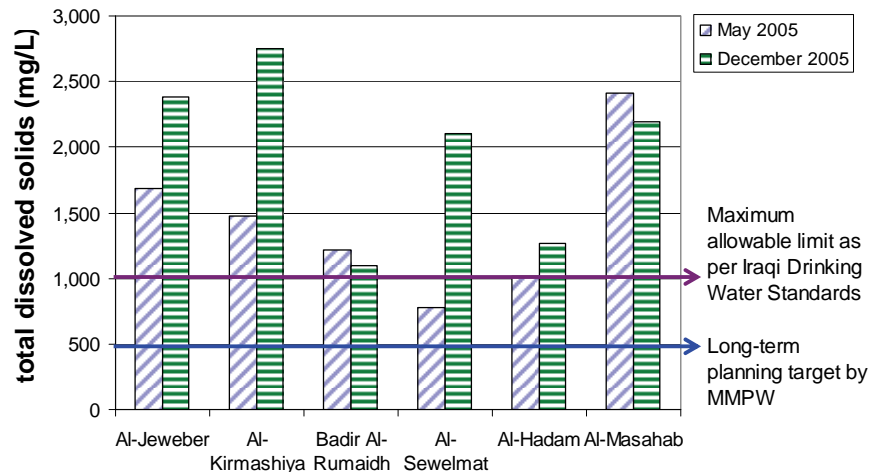
**Treatment technology selection:** Surface water from the Marshlands' canals and rivers is brackish, with a concentration of total dissolved solids (TDS) in the range of 1,000 to 5,000 mg/L according to previous studies. Water quality at the pilot project sites also showed high concentrations of TDS, ranging from over 500 to 2,500 mg/L as shown in Figure 4. Such high concentrations necessitated the application of technologies for the removal of dissolved salts to meet the Iraqi drinking water standards. Conventional water treatment, based on sedimentation to remove suspended solids and filtration, is not effective for water with a high dissolved salt content. The salt-removal process known as desalination can be achieved by using reverse osmosis membranes or thermal distillation. For this project, the membrane treatment technology was selected as it was considered to be a more viable option for smaller scale operations. This EST was utilized in five of the six Phase I pilot facilities as well as in the Phase II-B facility. One of the Phase I pilot facilities rehabilitated an existing compact unit with conventional treatment, as the TDS concentration was relatively low.

A comparison of conventional and membrane treatments reveals that water production costs are higher for membrane treatment due to the energy required to overcome osmotic pressure caused by dissolved salts, and due to the cost of equipment. The membrane treatment also requires chemical pre/post-treatment to prevent filter contamination and membrane damage. Actual operating costs of these processes are also dependent on the raw water quality.

**Water supply system selection:** The project also assessed two water supply systems for the pilot facilities as follows:

- Within each community, comparisons were made between a centralized water treatment plant to supply the entire community and multiple smaller treatment plants distributed throughout the community.
- Comparisons between a conventional single supply system and a dual water supply system with potable and non-potable quality water were also made.

Dual systems utilize two separate networks for water distribution, accounting for the fact that certain water uses (such as washing, flushing etc.) do not require the high standard of treatment and associated costs, compared to that of drinking and cooking water. The conventional system distributes treated drinking water through a single network covering all water uses. An analysis of the applicability of the above systems indicated that the topographic and settlement patterns were not suited to the adoption of the dual water system in the pilot villages. The analysis also indicated that multiple small treatment plants were not suitable from operational and management perspectives. As such, a centralized treatment plant with a single water distribution network was selected.



**Figure 4 Total dissolved solids (TDS) concentration at pilot project sites from 2005 water quality monitoring**

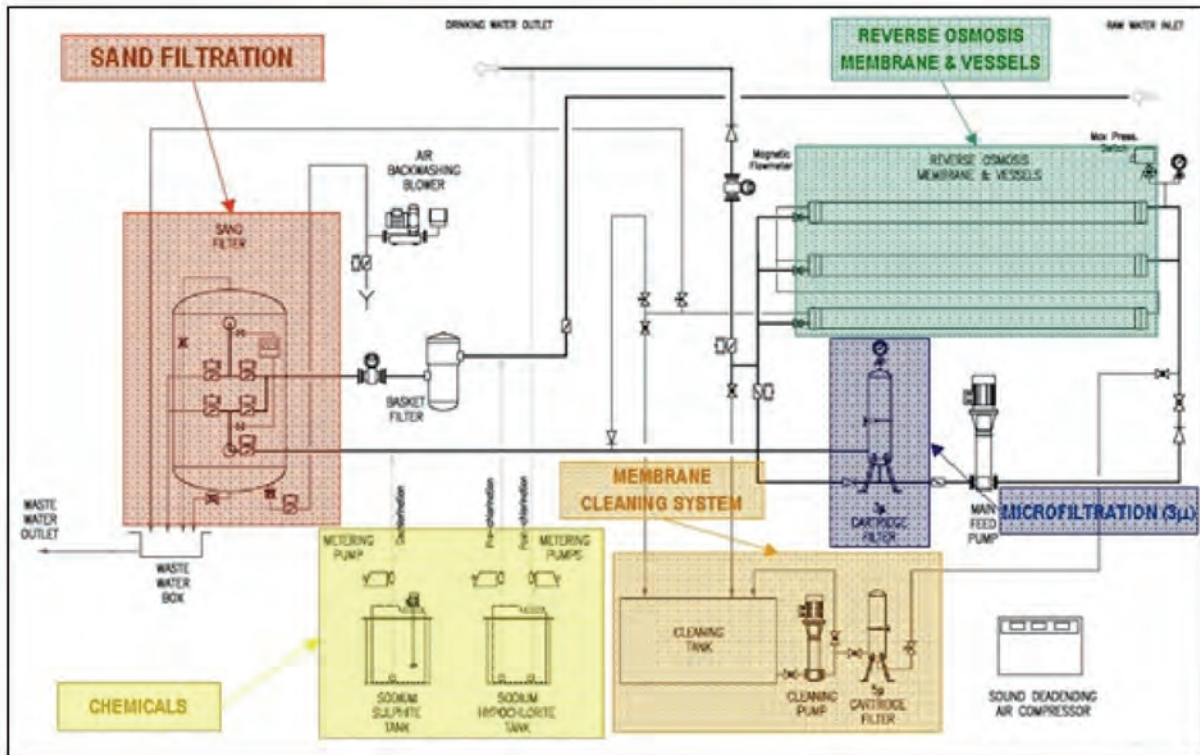
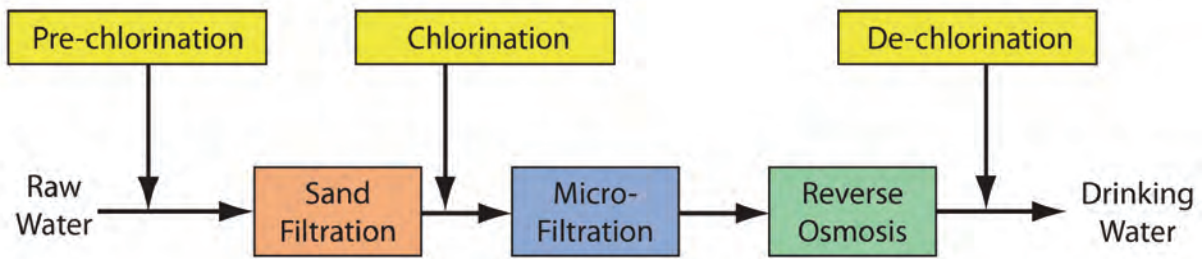
**Implemented system:** The reverse osmosis water supply system implemented under Phase I and Phase II-B comprised the following elements, also shown in Figure 6:

1. Direct withdrawal of water from marshland rivers and canals
2. Water treatment system using packaged low-pressure reverse osmosis process consisting of the following unit processes:
  - Pre-chlorination (with sodium hypochlorite, NaOCl)
  - Pressurized sand filtration
  - De-chlorination (with sodium sulphite,  $\text{Na}_2\text{SO}_3$ )
  - Microfiltration (cartridge filter)
  - Low-pressure reverse osmosis membrane filtration
  - Post-chlorination (with sodium hypochlorite, NaOCl)
3. Distribution of drinking water through common taps along the roads.



**Figure 5 Water treatment equipment installations**

The reverse osmosis water treatment system was packaged into modular containers outside Iraq and then transported to the sites for installation. One of the Phase I pilot facilities rehabilitated an existing compact unit using the conventional sedimentation-filtration-chlorination process.



**Figure 6 Schematic of packaged low-pressure reverse osmosis technology**

The Phase I plants began to operate and provide water by January 2006. The distribution network was designed to enable future expansion to accommodate village growth when the funds become available. Altogether, investments for implementing Phase I EST pilot project for water supply for six sites totaled US\$4.68 million. For Phase II-B, the drinking water plant began full operations in May 2009, with investments of over US\$500,000.

In all three phases, contracts for the procurement of goods and services for the pilot project on drinking water provision were administered by the UNOPS Office in Amman, Jordan under the supervision/coordination of UNEP-DTIE-IETC. In Iraq, the Ministry of Environment was the line ministry for the overall project. As the public water supply in Iraq is entrusted to the Ministry of Municipalities and Public Works, close coordination was maintained with this ministry throughout implementation of the pilot projects. UNOPS was responsible for contracting services for the field assessment and design, as well as for contracting the supply, delivery, installation, construction and commissioning of water supply treatment and distribution facilities.

## Facility Completion and Transfer to Iraqi Authorities

The Phase I facilities became operational in January 2006 and UNEP continued to support their operation and maintenance for over a year. A summary of the completed facilities for Phase I and Phase II-B is shown in Table 1.

In June 2007, UNEP completed the official hand-over of the six facilities to the Ministry of Municipalities and Public Works. To prepare for the hand-over, technical dossiers were created to enable the Water Directorate of the Ministry of Public Works to continue operations and maintenance of the facilities. Two sets of documents were provided to the Ministry for each of the five drinking water supply facilities using packaged low-pressure reverse osmosis technology.

The documents in Set 1 provided an overall description of the water supply system including plant specifications, inventory and ‘as-built’ drawings as shown below:

1. Plant specifications and inventory:
  - Description of the water treatment plant and detailed description of water treatment and distribution unit
  - Equipment data sheets for water treatment and distribution units
2. As-built drawings of drinking water supply facilities:
  - Water treatment and distribution system – general plan
  - Water intake and water treatment plant – plan views, sections, foundations and structural drawings
  - Water treatment and distribution system – process and instrument diagram
  - Water treatment and distribution system – electrical flow chart
  - Water treatment and distribution system – piping arrangement for container 1
  - Water treatment and distribution system – mechanical arrangement for containers 2, 3 and 4

The documents in Set 2 provided information from the manufacturers of the water treatment equipment on the operation and maintenance of the water supply system as follows:

1. Operation and maintenance manuals, information on spare-part and chemical suppliers, and personnel requirements for operation and maintenance:
  - Installation instructions and general description,
  - Start-up procedure
  - Drawings and electrical schemes
  - Machinery manuals
  - Additional items and spare parts



Figure 7 Water treatment facility during construction



**Figure 8 Residents accessing water from a common tap**

Relevant information was also included within the technical dossiers for the rehabilitated water treatment unit in Badir Al-Rumaidh, which was based on conventional flocculation and sedimentation using compact units.

The plant manufacturer also organised technology and management training for Ministry officials. Operator training was provided prior to establishment of the plant. In Phase II-B, similar arrangements were made with the Ministry of Municipalities and Public Works for the seventh water treatment and distribution system at Al-Ghreej in the Thi-Qar Governorate.

**Table 1 Summary of drinking water pilot facilities**

Project Phase	Phase I						Phase II-B
Pilot Project Site	Al-Kirmashiya	Badir Al-Rumaidh	Al-Masahab	Al-Jeweber	Al-Hadam	Al-Sewelmat	Al-Ghreej
Estimated population (persons)	1,500	3,000	2,000	2,500	2,500	3,500	2,150
Target service population (persons)	2,000	3,100	2,200	4,500	4,600	5,700	3,000
Water source	Al-Kirmashiya River, Euphrates River system	Gharraf River, Tigris River system	Al-Hammar Lake, Shatt Al-Arab system	Garmat Hassan River, Euprates system	Al-Hadam River, Tigris River system	Tigris River system	Euphrates River, Euphrates River system
Water treatment process	Packaged low-pressure reverse osmosis (RO) process	Conventional sedimentation/ filtration (Existing compact unit)	Packaged low-pressure reverse osmosis (RO) process	Packaged low-pressure reverse osmosis (RO) process	Package d low-pressure reverse osmosis (RO) process	Packaged low-pressure reverse osmosis (RO) process	Packaged low-pressure reverse osmosis (RO) process
Treatment capacity	100 m <sup>3</sup> /d	1,650 m <sup>3</sup> /d (estimated)	150 m <sup>3</sup> /d	200 m <sup>3</sup> /d	100 m <sup>3</sup> /d	200 m <sup>3</sup> /d	165 m <sup>3</sup> /d
Length of distribution pipeline	3,416 m	4,050 m	3,711 m	4,068 m	4,040 m	3,725 m	300 m
Water distribution method (No. of water taps)	Common water taps along the road at approximately 200m to 500m intervals						3
	13	26	17	18	25	28	



## **EST Assessment**

The project assessed the environmental soundness of ESTs applied in the provision of drinking water during Phase I. The assessment aimed to generate data to facilitate wider implementation of the pilot ESTs within the area, and to inform the development of a management plan for the Iraqi Marshlands. The project utilized an assessment methodology that was being developed and piloted by IETC in late 2005 (UNEP, 2005a). This methodology was further refined and later became known as the Sustainability Assessment of Technologies (SAT) methodology.

The assessment comprised the following three tiers:

- Tier 1: compliance screening with yes/no questions
- Tier 2: scoping based on qualitative and quantitative data to rank criteria for different technologies for technical suitability, environment, health and safety risks, resource use and emissions, economic/financial analysis and social cultural aspects
- Tier 3: detailed assessment encompassing qualitative and quantitative indicators to rank criteria for environmental aspects including resource use and emissions, economic and financial aspects, and economic viability.

In addition, a number of EST parameters were monitored during the construction and operation of the facilities. These parameters included the materials used for construction, the employment opportunities generated, the amounts of fuel and chemicals used, the amount of water produced, the beneficiary population and the resultant emissions.

The results of the assessment can be summarized as follows:

- Tier 1: the plants and facilities were found to fully comply with national laws and requirements, and also with applicable international agreements.
- Tier 2: the overall performance of the selected ESTs was found to be sufficient for the local environmental and socio-economic conditions. The high level of process automation was deemed to be beneficial in ensuring maximum reliability and in reducing the need for specialized personnel for operation and maintenance, thereby justifying the high initial investment cost.
- Tier 3: The overall environmental impacts of construction and operation were not considered to be significant, and were adequately offset by the project's environmental and socioeconomic benefits such as the reduction of health risks and generation of employment opportunities (SGI and Nature Iraq, 2007).

One of the key concerns for reverse osmosis technology is its energy intensity. An assessment of energy usage was therefore carried out and compared to previous technology applications. The electrical power consumption for the five reverse osmosis (RO) systems was found to be in the range of 4.1 to 8.2 kWh per cubic meter of water produced, with a median value of 5.5 kWh/m<sup>3</sup>. This value includes the energy required for water distribution. The average adjusted energy use for the treatment facility alone was 2.2 kWh/m<sup>3</sup>, with a range of between 1.6 and 3.3 kWh/m<sup>3</sup>. The treatment facility energy usage for this pilot project was found to be comparable to values reported for other applications. For example, a reported value from a pilot plant in Kuwait for brackish water desalination was 2 kWh/m<sup>3</sup> (Murakami, 1995). For seawater desalination, which is generally more energy intensive due to the higher salt concentration, reported values were 7-12 kWh/m<sup>3</sup> for small plants (less than 500 m<sup>3</sup>/day) and 2-3 kWh/m<sup>3</sup> for larger plants (greater than 100,000 m<sup>3</sup>/day) (Pizzichini and Russo, 2001).

The diesel fuel consumption of the pilot facilities was also assessed. For the five RO facilities, the median fuel consumption value was 2.6 L of diesel per 1 m<sup>3</sup> of drinking water produced, with a range of 1.3 to 4.0 L/ m<sup>3</sup>. While the fuel consumption values are not widely available in the literature, a recent study of seawater desalination plants in US Virgin Islands using RO reported an average value of 34.4 L/m<sup>3</sup> (Stevens, 2003).

The complete report of the EST assessment of water and sanitation provision can be accessed from the project web site.

### Drinking Water Pilot Project using Alternative Energy Sources

During Phase III, additional pilot projects were conducted to provide an insight into the feasibility of alternative energy options for drinking water provision in the marshland villages. These pilot projects were developed because assessments from earlier phases found that providing access to drinking water was often hampered by the increasingly limited availability of electricity and other sources of power in Iraqi communities. One pilot project focused on the use of a photovoltaic (PV) system to augment diesel power for a community-scale water treatment and distribution system, while another pilot project focused on the evaluation of a household solar still EST which could operate without any additional energy requirements. These additional pilot projects are described in further detail below.

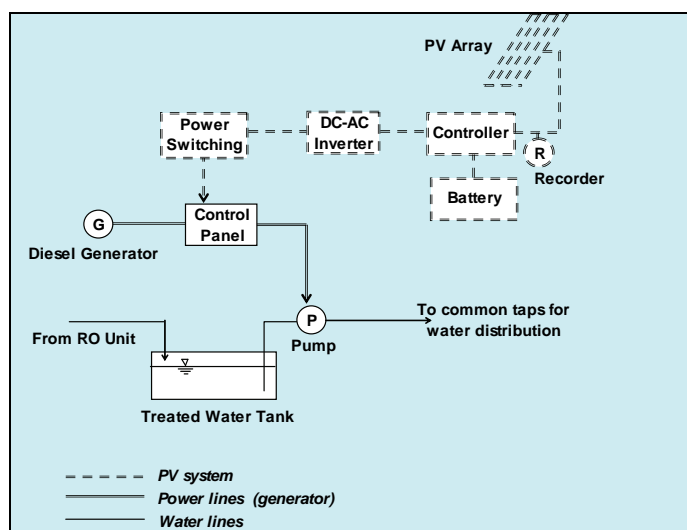


Figure 9 Photovoltaic system at Al-Ghreej water treatment plant

### Pilot project for photovoltaic energy augmentation for water treatment (Phase III):



Figure 10 Photovoltaic system installation at Al-Ghreej water treatment plant

The pilot project was conducted to implement and evaluate the use of solar energy in augmenting the conventional power supply for drinking water provision in the village of Al-Ghreej village, which was the Phase II-B pilot community. In 2008, UNEP undertook the design, procurement and installation of a photovoltaic (PV) augmented water distribution system with 3 kilowatts at peak capacity (kWp). The schematic of the PV installation and a photograph taken upon completion are shown as Figure 9 and Figure 10. The system was set up to enable water distribution using either a diesel generator or the PV system. Completed facilities were handed over to the Ministry of

Municipalities and Public Works in mid 2009. Operational data on power generation and usage from the PV system are being studied by personnel assigned by the Ministry of Municipalities and Public Works to inform the feasibility of harnessing solar energy for drinking water provision in similar applications in the future.

**Pilot project for household solar stills (Phase III):** During Phase III, UNEP also conducted household-level demonstrations of solar still devices to assess the capacity and suitability of a household-level EST for drinking water without the need for either fuel or electricity. A solar still is a box-like device which distills water by harnessing the heat of the sun, as shown in Figure 11. Untreated water is fed into the device and evaporated by the sun. The water vapor condenses on a clear surface, and the condensate is collected for potable use. As this EST does not require any additional power source such as electricity or diesel generator, there was interest in testing its applicability in rural areas without basic power services. The equipment was procured by international bidding administered by UNOPS.



**Figure 11 Model of solar stills (SolAqua, 2009)**

The first set of equipment delivered in 2008 was found to have manufacturing defects and did not fulfill the terms of references established by UNEP for their procurement. After lengthy negotiations, commercially manufactured solar stills were imported from the United States for installation and testing in nine households in December 2009. The Ministry of Environment assumed the responsibility for their installation and monitoring.

### **Implementation Achievements**

Some of the key achievements of the drinking water EST pilot projects across the three phases were as follows:

- Installation of modular reverse osmosis water treatment units in six villages, with a total nominal daily capacity of 915 m<sup>3</sup> per day.
- Rehabilitation of an existing conventional water treatment plant in one village, with an estimated daily capacity of 1,650 m<sup>3</sup> per day
- The treatment facilities in the seven villages can serve a total population of up to 25,000
- Installation of a water distribution pipeline measuring a total length of 23.3km, with 130 common water distribution points in seven villages
- Augmentation of conventional energy with photovoltaic system for water distribution in one village
- Procurement of solar stills for nine households participating in the pilot testing
- Training of local residents to operate the water treatment plants
- Support for operation and maintenance for a one-year period following installation, with a central warehouse for spare parts and chemicals
- Total investment of US\$4.68 million for the six Phase I facilities, approximately US\$500,000 for the Phase II-B facility and US\$250,000 for the photovoltaic system and solar stills
- Official hand-over of the Phase I facilities to the Ministry of Municipalities and Public Works in June 2007
- Official hand-over of the Phase II-B facility and Phase III photovoltaic system to the Ministry of Municipalities and Public Works in 2009



**Figure 12 Residents gaining access to safe drinking water**

## **Recommendations for Future Applications of Drinking Water Pilot Projects**

Experiences garnered from the drinking water pilot projects generated insights into the future planning of water treatment plants and water distribution modes in an environmentally sound manner to a larger number of villages in the Iraqi Marshlands. The insights reflect the numerous special challenges to the provision of safe drinking water in small rural communities in the area, due partly to the unique settlement patterns of Marshlands villages, the flat topography criss-crossed with canals and embankments, the seasonal variations in water quality and quantity, and the energy constraints. Communities are relatively small in size, with a median population of 1,100 according to a UNEP survey of 199 villages (see Section Data and Information Management).

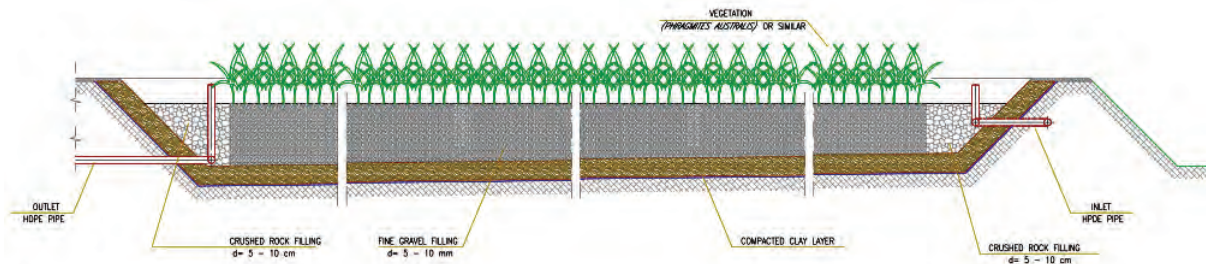
One key insight was the need for analysis in siting water treatment plants and their treatment capacity (i.e. the extent of communities served by a particular plant). Detailed assessment is recommended for future applications in order to compare the use of a large-scale centralized water treatment plant to that of several small-scale treatment plants located closer to the communities. In general, large treatment plants have the advantages of scale and efficiency in terms of water treatment and operation, but necessitate the transport of treated water over long distances with additional energy and resulting emissions. Additional factors to be considered and evaluated in planning large-scale interventions include the following:

- Quantity of available water and reliability of water sources
- Impacts on the local water cycle due to extraction of marshland water and discharge of concentrated effluent generated by brackish water desalination
- Energy availability and requirements for water treatment such as diesel fuel, electricity and solar, and resulting green house gas emissions
- Energy availability and requirements for treated water transport and resulting emissions, as the transport of treated water can constitute a significant portion of total energy required for drinking water provision
- Operation and maintenance arrangements and their ease of implementation based on local conditions

The continued operation and management data of the pilot facilities is expected to provide local field data to further inform the future planning process.

## **2.2 Sanitation Pilot Project**

During Phase I, UNEP conducted a pilot project to demonstrate an EST suited to rural marshland conditions. A demonstration system for sanitation was constructed to serve a small community in Al-Chibayish within the Thi-Qar Governorate. The facility implemented an EST called “constructed wetlands” to serve approximately 170 inhabitants facing potential health hazards from untreated wastewater discharged into a nearby canal. The facility was designed with a surface area of 540 m<sup>2</sup> to utilize the sub-surface wetland in which water flows through gravel beds planted with native species of reeds. This EST removes organic nutrients and pollutants from the wastewater through biochemical processes in the root zone of the reed plants as well as through uptake by the plants. Reed stems from nearby marshes were used for planting. The schematic of the EST is shown in Figure 13. Contracts for procurement of goods and services for the sanitation pilot project were administered by the UNOPS Office in Amman, Jordan under the supervision and coordination of UNEP.



**Figure 13 Schematic of constructed wetland EST for sanitation pilot project**

The community in Al-Chibayish was selected for implementation of the sanitation demonstration system for two main reasons. First, the project received the understanding of and support from community residents. Such support is considered to be an important criterion for UNEP pilot project implementation. Second, the selected EST has been effectively demonstrated in other parts of the world in addressing wastewater problems similar to those encountered in Al-Chibayish. The demonstration of this EST in Al-Chibayish had the potential to generate relevant data and management experience for wider implementation within the Marshlands and beyond. Construction of the facility was completed by the end of December 2006 as shown in Figure 14.

The project also assessed the environmental soundness of the sanitation EST pilot project, as was the case in the Phase I drinking water treatment facility assessment. The assessment found that the overall performance of the selected process and EST satisfied local environmental and socio-economic conditions, and produced positive environmental and socio-economic benefits, particularly through the reduction of health risks, reduction of wastewater discharge and increased employment opportunities (SGI and Nature Iraq, 2007).



**Figure 14 Constructed wetland facility for sanitation pilot project at Al-Chibayish**

The facility was managed and operated with UNEP's support following its completion, and was officially handed over to Thi-Qar University for further research and management in October 2007.

Reports on the facility design and management are available from the project web site.

### **2.3 Marshland Rehabilitation and Management Pilot Projects**

One of the priority needs in the Marshlands area was the rehabilitation of wetland conditions and water quality management. To address this need, UNEP carried out two pilot projects in Phases I and III of the project.

#### **Wetland Restoration Pilot Project (Phase I)**

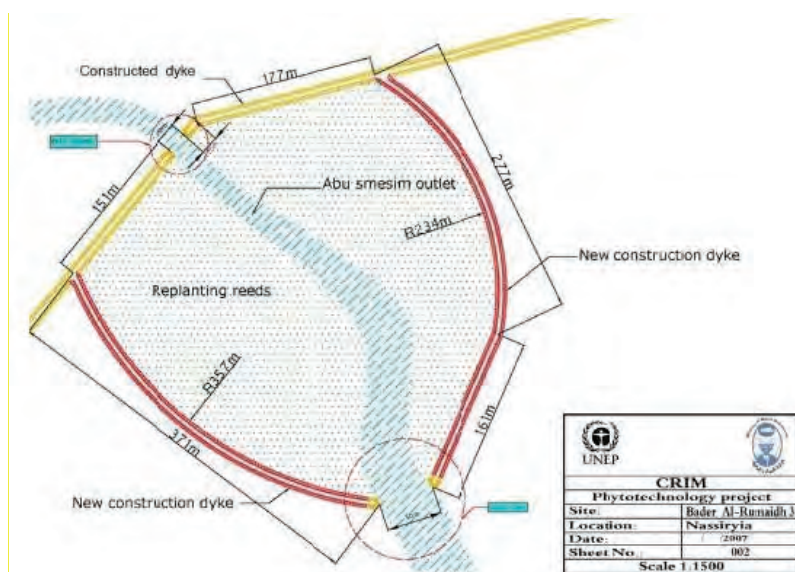
The Phase I pilot project focused on wetland rehabilitation initiatives including field assessments, design and construction supervision. The field implementation work for this pilot project was carried out by the Centre for Restoration of the Iraqi Marshlands (CRIM) within the Ministry of Water Resources based on a Memorandum of Understanding (MOU) with UNEP signed in December 2005. The engagement of the Ministry of Water Resources and CRIM reflected the responsibilities and mandate of this ministry to manage, coordinate

and monitor the implementation of marshland restoration programmes through partnerships with national and international institutions.

In order to prepare for and initiate the design and field work, the project organized a technical workshop in May 2005 to build capacity on the application of phytotechnology and modeling software to design surface and subsurface artificial wetlands and conduct wetland restoration assessments. The workshop provided technical support to experts from the Ministry of Water Resources, Ministry of Environment, Ministry of Municipalities and Public Works and the Iraq Foundation. The training featured two numerical models prepared for the project: one for wastewater treatment using constructed wetlands with sub-surface flows (SubWet) and surface flows (SurfWet); and the other for wetland rehabilitation and reconstruction assessment (WetRestore). To complement the models, the 'Handbook on Phytotechnology for Water Quality Improvement and Wetland Management through Modeling Applications' was made available to the Iraqi partners (UNEP, 2005b).

The project supported a field assessment and organized a meeting of experts to review the assessment results and recommend follow-up action. Two sites were subsequently selected for follow-up groundwork to assess the effectiveness of technological approaches such as reflooding, planting, building and/or restoration of canals to rehabilitate degraded or destructed wetland areas. Additional assessments by the Ministry of Water Resources identified Al-Jeweber for on-the ground rehabilitation pilot work.

The selected site of Al-Jeweber had been de-watered, with 80% of the original marsh area remaining dry. Options identified for the marshland rehabilitation at this site included: regulating the flow of water in an existing outlet from a nearby marsh; construction of dykes; and replanting the area with *Phragmites australis*. While most local residents and community leaders extended positive support and cooperation, a small fraction



**Figure 15 Wetland rehabilitation pilot schematic**

threatened the CRIM staff near the end of the pilot project in 2006. Such security problems temporarily halted the implementation. Upon the conclusion of the project and hand-over of management to CRIM, the pilot project was functioning well, although below the design capacity. The Iraqi implementing partners continued dialogue with the local stakeholders to ensure longer-term management.

Further descriptions of this pilot project are available from the project website.

### **Main Drain Wetland Management Pilot Project (Phase III)**

During Phase III, a pilot project was conducted to demonstrate viable options to minimize further damage to the wetland and to assess the feasibility of increasing the availability of

water for longer-term marshland restoration utilizing constructed wetland technology. The pilot project targeted the Main Outfall Drain, otherwise referred to as the Main Drain, which is used to drain wastewater from Baghdad and upstream areas and has diverted water that previously flowed into the Marshlands. The Ministry of Environment led the implementation in order to utilize the natural and constructed wetland technology for improving the wetland and water quality, and to monitor water quality as well as biodiversity.

The pilot activities started with monitoring of the Main Drain water quality at key locations in 2008. The results of the Main Drain sampling surveys showed that the collected samples did not meet some of the parameters included in the Iraqi standards for wastewater discharged to water courses, or the Iraqi standards for raw water sources for drinking. Such results indicated the need to improve the water quality of the Main Drain flow itself in order to use this water for reflooding of the Marshlands.



**Figure 16 Water quality monitoring at the Main Drain**

Preliminary surveys of potential sites were also conducted to identify a pilot site. The Auda Marsh in the Thi-Qar Governorate, which was being re-flooded with overflow from the Main Drain, was subsequently identified as the pilot site. The site had natural inlets, outlets and vegetation growth so it did not require replanting of reeds or construction of new flow controls. The pilot project therefore featured natural wetland system management, as the Ministry of Environment and UNEP agreed that management practices that are natural and require minimal construction/human interventions were suitable as ESTs for the area and merited careful assessments. The site was also experiencing flow changes associated with rehabilitation work being carried out at the nearby Main Draining Siphon-Pumping Station, thus rendering any additional flow control measures difficult to manage.



**Figure 17 Field survey by the Ministry of Environment**

The pilot natural system featured five monitoring locations to determine the potential for water quality and biodiversity improvements. In all, 18 water quality parameters and 2 biodiversity monitoring parameters were collected and analyzed three times over a seven month period in 2008 by the Ministry of Environment. The pilot system exhibited a reduction in concentrations of some pollutants such as total suspended solids, nitrates and phosphates, with some inconsistencies. Considering the variability of the natural system used for the pilot activities, longer-

term monitoring and control of operating conditions was deemed to be necessary to reach definitive conclusions. Such wetland improvement activities also require longer-term sustained availability of water flow through cooperation and coordination with the Ministry of Water Resources. The Ministry of Environment subsequently requested such cooperation.

The final report of the pilot project and monitoring is available for downloading from the project website.

## **2.4 Lessons Learned**

Some of the main lessons learned from the pilot EST implementation projects are as follows:

- The project demonstrated that EST implementation can be carried out in a post-conflict environment by selecting options that address infrastructure limitations and security concerns. For example, modular container water treatment units which can be expanded to meet growing needs with minimal construction were successfully implemented. These interventions had the additional benefit of building a solid foundation for trust and partnership towards the longer-term management needs including sustained activities and support.
- The overwhelming priority for the local residents was, and still remains, the restoration of basic services, particularly drinking water provision. While necessary, data collection and assessment initiatives conducted prior to this project had not directly improved the situation on the ground. The delay in the provision of relief by Iraqi and international institutions, both perceived and real, created anxiety and wariness towards additional assessment work among the local residents when the UNEP project commenced. Until the drinking water facilities were put into operation, such anxiety and wariness continued to be voiced. Well-intentioned interventions may fail to garner community support for long-term support and replication if the immediate basic needs of the communities are not first adequately addressed.
- The involvement of local communities, governorates and national ministries in various activities was fundamental in securing the support and active engagement of stakeholders. They were engaged in key project activities, including the decision of where to carry out pilot projects and how to divide responsibilities for plant operations. Many stakeholders remarked that it was their first time to exchange ideas or discuss matters among the national, local and/or governorate representatives, and that the initiative of UNEP to support direct interactions was greatly appreciated. Such dialogue is necessary because each institution has different priorities and responsibilities as well as distinct insights and resources to offer. There is also a need to diminish mistrust and maintain realistic expectations placed on other stakeholders, which can only be achieved through direct interactions and dialogue. Implementation and operations of the EST facilities experienced a delicate balancing act, as the communities and tribes sometimes competed for the limited resources, such as employment opportunities and additional water pipeline layouts. The project's policy and practice of involving and seeking the approval of various stakeholders helped to resolve most of these issues. Future interventions are recommended to continue using this model of promoting dialogue and interaction.
- EST implementation faced procurement and custom clearance difficulties. Equipment was procured by international competitive bidding and was transported to Iraq for installation and operations. Customs clearance procedures and associated release arrangements became quite complex and time-consuming, resulting in significant delays in the clearance and plant installation. These issues also impacted subsequent procurement, with limited interest and poor responses to the procurement notices. These constraints should be evaluated and acknowledged in programme frameworks to the extent possible, so that realistic goals and timelines can be developed.



- Some Iraqi institutions, particularly at the governorate and local levels, expressed concerns about the limited availability of procurement information in the Arabic language, which they perceived as a constraint upon Iraqi contractors in filing applications or submitting supporting information. The publication of information in Arabic in the procurement and tender processes is therefore needed to increase the participation of qualified vendors and service providers.
- Difficulties and delays were encountered in implementing the sanitation system for demonstration. Implementing sanitation systems for demonstration involved working with individual households in a cluster within the community. While sanitation conditions in many villages were in need of improvement, convincing the communities of the need to improve sanitation presented a challenge since other issues were perceived as more important priorities. Measures to articulate the need for sanitation and to address reluctance based on cultural and local customs need to be addressed in the future.
- The project experienced significant challenges in administering contracts, agreements and fund transfers within Iraq. To ensure the efficient implementation of the project, it is crucial that government policies and regulations are transparent and understood by all personnel and that adequate provisions are made for decision making and processing without significant delays.
- National and local conditions can jeopardize project results if they deteriorate beyond original expectations during and after the project period. For this project, deteriorating security during the project implementation and unprecedented drought and climate change after the project period are two such examples. It is important to maintain communication channels with the local partners so that reasonable measures can be taken to provide continued support, and to request additional interventions from the international community as need arises.

### **3. Capacity Building and Awareness Raising**

Identifying and implementing technical and policy responses for sustainable Iraqi Marshlands' management requires adequate human and institutional capacity. To help address this need, the project provided targeted capacity-building opportunities in subject areas deemed necessary to develop a crosscutting response in all three project phases. For each training programme, the project selected participants from key government agencies, governorates and representatives of communities based on the profiles of suitable candidates developed by the project for individual training objectives. Detailed descriptions of capacity-building activities are described in the following sections and summarized in Appendix V with gender balance information.

Courses were designed using the 'train the trainers' model so that participants could impart knowledge acquired to their colleagues and organize secondary training courses. UNEP also provided support for such secondary training courses inside Iraq including the provision of training materials and funding for course organisation. Training manuals were prepared in Arabic and English. The training manuals were published in hard copy versions and are also available to download in both languages from the project website.

In addition, the project supported various initiatives to raise awareness about the plight of the Marshlands and national and international efforts to address Iraqi Marshlands management and rehabilitation.

#### **3.1 International Training Courses**

The project organized courses with international lecturers and relevant case studies outside Iraq, to provide opportunities for the Iraqi participants to gain first-hand knowledge about the latest international management and technical practices, most of which were not utilized inside Iraq. Some courses emphasized policy-making and management, while others mainly addressed technical aspects. Security considerations also restricted the travel of international lecturers to Iraq, necessitating a larger percentage of training courses to be held outside Iraq.

Courses consisted of lectures, demonstrations and group exercises conducted in both English and Arabic. The project engaged and cooperated with various leading institutions in the West Asia region, Japan and at the international level to organize the training courses and to expand the human and institutional networks for marshland management. Most courses included site visits. For example, during a Phase I course on wetland management organized in Cairo, a field trip was organized to Egypt's Lake Manzala which is one of the Middle East's largest artificially-constructed wetlands. In Japan, participants visited a water treatment plant in Maibara City (Shiga Prefecture) where they learned about reverse osmosis technology, and Toyono Town (Osaka Prefecture) where they were introduced to EST options for household sanitation. Participants took an active part in discussions and other activities. The UNEP Regional Office for West Asia (ROWA) was instrumental in providing guidance and assistance for organizing capacity-building initiatives with key institutions in the region.

The 314 training course participants included nominated officials from the Iraqi Ministry of Environment, Ministry of Water Resources and Ministry of Municipalities and Public Works,

together with representatives from the southern governorates, marshland communities and academic institutions. Among them, 73 were women (23% female participation rate). To strive for gender balance, the project requested the ministries to maintain gender balance in nominating training course participants and other initiatives.

### **Policy and Institutional Training**

Sound environmental management of the Marshlands requires policy and institutional frameworks that incorporate water and wetland management based on the integrated water resource management (IWRM) approach. The Iraqi authorities, community decision-makers and NGOs all had a limited understanding of such frameworks and how to formulate practical policies and strategies. The project also recognized that initiatives for marshland management must be anchored in local communities. To address this need, the project conducted the following training courses.

1. **Water Quality Management (Phase I):** This course provided participants with relevant policy and institutional information on how to manage water quality including: standard setting, monitoring, enforcement and management plan development. It was held from 6 to 17 December 2004 in Shiga, Japan in partnership with the International Lake Environment Committee (ILEC), WHO-Iraq, UNEP GEMS-Water and Shiga Prefecture.
2. **Integrated Water Resource Management Policy and Integration (Phase I):** The course was organized to improve the understanding and capacity of national experts, government officials and local authorities to work with the IWRM concepts, principles and applications at the local level. The course was held from 4 to 9 April 2005 in Amman, Jordan, in partnership with the American University of Beirut and the United Nations Economic and Social Commission for Western Asia (UN ESCWA).
3. **Community Level Initiatives (Phase I):** The course introduced various ways to raise public awareness of Iraqi Marshlands environmental issues and how to engage and support communities. Participants included community leaders and officials involved in community outreach. The participants were also given instructions on how to develop proposals for community level initiatives, which could then be evaluated by the project for support. The course was held from 11 to 16 June 2005 in Alexandria, Egypt in partnership with UNEP ROWA and Center for Environment and Development for the Arab Region and Europe (CEDARE).



**Figure 18 Participants in discussion during training course**



**Figure 19 Site visit to a phytotechnology application site**

- Wetland Management (Phase I):** This course examined policy and management topics for sound wetland management including institutional, legal, conservation, socio-economic and economic elements, basin-level management and community participation. The course was held from 19 to 26 June 2005 in Cairo, Egypt in partnership with Cairo University, the Secretariat of the Ramsar Convention, Wetlands International and International Agricultural Centre.



**Figure 20** Site visit to a treatment facility

- Sustainable Management of the Iraqi Marshlands (Phase III):** This was a final training course organized within the project framework, with the overall objectives of increasing the capacity and knowledge of Iraqi government officials on key aspects of sustainable management of the Iraqi Marshlands, and strengthening Iraqi ownership and coordination for the longer-term sustainability of the Iraqi Marshlands' management. A special focus was placed on multilateral environmental agreements (MEA), as the project recognized a clear linkage with MEAs for the development and implementation of a longer-term management structure. Reflecting this focus, the course featured lecturers from the Secretariat for the Convention for Biodiversity, an UNEP officer responsible for the Desertification Convention, as well as officials from UNESCO responsible for the World Heritage Convention. Experiences with national communications, reporting and management requirements were also shared by regional lecturers. The course was held from 7 to 15 April 2008 in Damascus, Syria in cooperation with UNEP ROWA and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD).

### Technical Training

Identification, implementation and management of suitable EST options to provide water, sanitation and marshland water quality management require the development of specific skills. The project organized several training courses to help build such specific skills.



**Figure 21** Group training exercise

- Sustainable Sanitation (Phase I):** The course provided the practical, technical information needed to organize the pilot implementation of ESTs, including site visits to large-scale, community-scale and household-level treatment facilities as well as an industrial reuse facility. The course was held from 6 to 17 December 2004 in Osaka, Japan in partnership with the Global Environment Centre Foundation (GEC), Osaka City and Prefecture and the Japan International Cooperation Agency (JICA) Osaka International Centre.
- Phytotechnologies for Wetland Management (Phase I):** This course provided technical guidance on the application of plants and vegetation to manage wetland conditions and water quality in preparation for the pilot implementation of this technology in the marshland communities for the purpose of water quality management and sanitation. The course was held from 6 to 16 December 2004 in Cairo, Egypt in partnership with Cairo University.

8. **ESTs for Drinking Water Provision (Phase I):** The course provided an introduction to the application of ESTs for safe drinking water, thereby responding to the need to equip Iraqi engineers, public officials and other stakeholders with adequate knowledge and tools to implement appropriate ESTs. The course was organized from 16 to 27 May 2005 in Osaka and Shiga, Japan in partnership with the Global Environment Centre Foundation (GEC) and the municipal governments of Osaka and Maibara.
9. **EST Assessment Methodology and Implementation (Phase I):** This training course built the capacity of national experts, government officials and local authorities on the methodology for pilot assessment and evaluation to analyze the suitability of the EST options according to multiple criteria. These criteria included technical suitability, environmental impacts, community acceptance, maintenance needs and ease of operations. The course was held from 1 to 3 December 2005 in Damascus, Syria in partnership with UNEP ROWA and the Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD).
10. **Drinking Water Provision with Environmentally Sound Technologies (ESTs) and Water Quality Management (Phase II-B):** This course was organized to increase the capacity, skills and knowledge of Iraqi government officials on water quality standards for drinking water, desalination technologies used for water treatment and water quality management. It was convened from 6 to 15 December 2006 in Shiga, Japan in partnership with the Global Environment Centre Foundation (GEC).

#### **Data Management Training**

The project also supported the following data management training initiatives.

11. **Application of Remote Sensing and GIS for Marshland Assessment and Monitoring (Phase I):** This course taught participants how to provide timely information on restoration activities using remotely sensed satellite imagery and Geographic Information System (GIS). It highlighted the benefits of this approach in monitoring, assessing and empirically quantifying changes on a near real-time basis including its cost effectiveness, global perspective and repeatable and systematic survey methods. The course was held from 6 to 10 February 2005 in Amman, Jordan in partnership with International Institute for Geo-Information Science and Earth Observation (ITC). The UNEP Post Conflict and Disaster Management Branch (PCDMB) coordinated this course.
12. **Marshlands Information Network – MIN (Phase I):** This course targeted information managers, information technology officers, technical editors and engineers, and provided training on how to use the EST Information System developed by IETC. Each organisation represented at the training created its own website, which could then be used for information sharing through the MIN. It was held from 27 to 31 March 2005 in Amman, Jordan.
13. **Marshlands Information Network – MIN (Phase II-A):** This second course on the MIN provided technical information on MIN management and data uploading to information technology managers and data analysts from various ministries and NGOs. The course was held in April 2006 in Bahrain in partnership with UNEP ROWA.

14. **Advanced Marshlands Information Network – MIN (Phase II-A):** This training and technical meeting provided instructions and hands-on exercises on how to set-up and operate the MIN servers, to assist the ministries to effectively analyze, present and share available data on the MIN, and to develop a strategy for initial data collection efforts on basic demographic and socio-economic data and solid waste management in the Iraqi Marshlands. It was held from 27 to 30 June 2006 in Shiga, Japan.

### **Study Tours**

The project also conducted two study tours to provide first-hand opportunities to examine various community level actions and capacity-building activities as well as EST applications. The study tour participants included senior level government officials and community leaders.

1. **Study Tour 1 (Phase I):** This study tour was organized to evaluate examples of Japanese ESTs pertaining to ecosystem management and water-sanitation, which may also be applicable in conditions encountered in the Iraqi Marshlands. The tour was held in conjunction with the Public Symposium in Tokyo. The delegation included chairpersons from the Governorate Councils of Missan, Thi-Qar and Basrah, as well as heads of the Marsh Arab Council, two Members of Parliament and senior officials from the relevant Ministries. The tour was conducted from 25 to 31 August 2005 with the close cooperation of GEC and the Government of Japan.
2. **Study Tour 2 (Phase I):** This study tour was organized in conjunction with the International Workshop on Iraqi Marshlands Management organized by UNEP. The participants visited a large-scale water treatment facility in Osaka, toured areas of phytotechnology applications, and visited community initiatives for marshland management in Shiga. The participants were also given an opportunity to sit-in and interact with organizers and participants from another training initiative organized by UNEP for JICA, which covered community participation and integration management issues. The delegation was headed by the Deputy Minister of Environment, who also took part in a press conference and made courtesy visits in Tokyo, Japan. Representative from the Ministry of Planning and Development Cooperation (MOPDC) and the State Ministry for the Marshlands (SMOM) participated in the tour. The tour was held from 4 to 9 December 2006.

### **3.2 Training Courses inside Iraq**

The project organized ten training courses inside Iraq in cooperation with the Ministry of Environment, the Ministry of Water Resources, the University of Basrah and Thi-Qar University. Persons who have participated in the international training courses organized by the project were engaged to implement in-country training. UNEP provided financial support as well as the training materials in Arabic and English to enable successful replication of training courses inside Iraq. The following is a list of courses and organizers of training held in Iraq.

1. **Integrated Water Resource Management (IWRM) Policy and Integration (Phase I):** organized by Thi-Qar University from 13 to 19 December 2005
2. **Community Level Initiatives (Phase I):** held by Thi-Qar University from 21 to 24 December 2005

3. **Phytotechnology for Wetland Management (Phase I):** held by University of Basrah from 4 to 11 December 2005
4. **Water Quality Management (Phase I):** held by the Ministry of Water Resources from 27 December 2005 to 10 January 2006
5. **Marshlands Information Network (Phase I):** held by the Ministry of Environment in Baghdad from 4 to 8 December 2005
6. **Marshlands Information Network (Phase I):** held by the Ministry of Environment in Thi-Qar from 18 to 22 December 2005
7. **Marshlands Information Network Server Management (Phase II-A):** held by the Ministry of Environment in Basrah from 10 to 28 September 2006
8. **Marshlands Information Network Server Management (Phase II-A):** held by the Ministry of Environment in Missan from 10 to 28 September 2006
9. **Marshlands Information Network Server Management (Phase II-A):** held by the Ministry of Environment in Thi-Qar from 10 to 28 September 2006
10. **Pre-training on Drinking Water Provision with ESTs and Water Quality Management (Phase II-B):** held by Thi-Qar University from 29 to 31 October 2006



**Figure 22 Site visit to the project drinking water treatment facility during in-country training**

These courses supported Iraqi institutions in increasing their internal capacity to organise and deliver such training programmes with multiplier effects. Some courses also provided opportunities for participants to visit the actual sites of the pilot project implementation. For Phase II-B, the local training served as a pre-training course to provide basic information and also to select participants for follow-up international training. This approach provided a performance incentive to the training participants and also enabled the project to identify suitable candidates for in-depth follow-up training. In total, 141 Iraqis participated in training courses held inside Iraq. Among them, 44 were women (31% female participation rate).

### **3.3 Awareness Raising Activities**

In addition to formal training activities, the project supported various other initiatives to raise awareness and to analyze the status of the marshland environmental and socioeconomic conditions. Some of the key activities and initiatives are described below.

1. **Public Symposium on Iraqi Marshlands (Phase I):** An international symposium was held at the United Nations University in Tokyo, Japan in August 2005 to report on the progress



**Figure 23 International Workshop on Iraqi Marshlands Management (8 December 2006, Kyoto, Japan)**

of the project as well as to discuss achievements and emerging needs. Participants included Her Excellency Ms. Yuriko Koike, the Minister of Environment of Japan, and high level delegation from Iraq, including heads of Governorate Councils and Members of Parliament, and representatives from the governments of France, Iran, Italy, and the United States. A press conference was also organised to promote worldwide coverage of marshland issues.

2. **Communication Booklet (Phase I and Phase II-B):** The booklet titled '*Back to Life*' was developed to introduce the project and its results in a concise manner. Published in Arabic, English and Japanese, it was made available as a hard copy and an electronic copy, and was revised to reflect the project's progress (UNEP, 2005c, 2006b).
3. **Supporting Production of BBC 'Eden Reborn' (Phase II-B):** Utilizing extensive film footage collected during Phase I, the project supported the production of a documentary for international broadcast on the British Broadcasting Corporation (BBC). This effort was part of the Earth Report series by the Television Trust for the Environment (TVE). A short Video News Release was also prepared for distribution to international news broadcasts. The BBC Earth Report on the Iraqi Marshlands titled 'Eden Reborn' was broadcast around the world, including Japan, Europe and African countries, from November 2006.
4. **International Workshop on Iraqi Marshlands Management (Phase II-B):** This workshop was held on 8 December 2006 in Kyoto, Japan to take stock of the conditions of the Iraqi Marshlands from environmental, water resource and socio economic perspectives. The workshop provided an opportunity to analyze the results and achievements of various management initiatives on the ground, to receive feedback from Iraqi stakeholders on these initiatives, and to discuss options to further support sustainable marshlands management practices. Participation included the Deputy Minister of Environment and the Iraqi Ambassador to Japan. A press conference was also held in Tokyo in conjunction with this event. The event was hosted with the cooperation of the United Nations Information Centre (UNIC) of Japan.
5. **Press Conferences and Press Coverage:** UNEP held three press conferences to promote press coverage of the project and its outputs. They were organized to coincide with visits of Iraqi dignitaries, and were held in August 2005, December 2006 and September 2008. Speakers featured at the various press conferences included Her Excellency Mrs. Narmin Othman, Minister of Environment, the Deputy Minister of Environment, Members of the Iraqi Parliament, the National Coordinator and UNEP personnel. Press releases were also made available at the project's commencement as well as at these three press conferences. Press coverage of the project has been significant, with over 280 instances of newspaper and journal articles, television and other media coverage internationally. In addition to raising awareness about the Iraqi Marshlands and international environmental cooperation, the press coverage has also contributed to raising the profile of UNEP and IETC worldwide.

The project also supported other information and awareness-raising initiatives inside and outside Iraq, for instance, through its support for publication of an environmental magazine by the Iraqi Ministry of Environment, a public meeting to commemorate Environment Day in



Iraq in 2005 and inform Iraq's general public of the state of the Iraqi Marshlands, and UNEP staff participation in public lectures and conferences. The project information has also been circulated at the UNEP Governing Council, World Water Week and other major events.

### **3.4 Lessons Learned**

The project took care to organize targeted training so as to correspond with substantive activities to be implemented and organized inside Iraq. Linkages were established to pilot project implementation, policy analysis and development, and data management, so that trained personnel could facilitate, take part in and/or analyze various tasks undertaken within the project framework. At project commencement, Iraqi partners raised concerns that many meetings and training programmes were organized by international organisations with little visible change inside Iraq, and that few opportunities were created to put the newly-gained knowledge to work. As such, the project sought to outline the project tasks to be implemented inside Iraq, and how training can enhance the Iraqi capacity to address such project tasks.

The key lessons learned from capacity-building initiatives included the following:

- Using trained personnel to organize training inside Iraq is effective in allowing UNEP to reach a larger number of participants in need of practical knowledge on Iraqi Marshlands management.
- Unless specifically requested as a priority with clear explanations, stand-alone training activities (i.e. training when there are little potential opportunities available to apply the newly-gained knowledge in the near future) should be avoided.
- While the project provided a trainee profile for each course to be used for nominating personnel by Iraqi institutions, not all participants fit the profile or had direct association with the project. While this may have been a reflection of the limited number of qualified personnel, it also reflected the perception that training opportunities were a reward for loyalties or long-term service. Additional efforts are needed to identify and raise the capacity of suitable personnel with responsibilities and knowledge which are relevant to the subject area being addressed by the courses.
- Efforts should be made to use Arabic training materials and lectures to improve learning. The use of Arabic is required particularly for training targeting local level officials and communities.

The project also carried out an analysis of participant evaluations from the training courses. The training participants identified the following factors as important for suitable capacity-building initiatives: (1) courses should contain a large proportion of case studies and hands-on exercises and less direct lectures; (2) the participants should be provided with additional training in response to interest in learning more about the subject; and (3) courses should be longer in duration, preferably two weeks or longer.

UNEP made continual adjustments to the capacity-building initiatives throughout the project period, partially reflecting the above factors and lessons learned within the resource constraints. In addition, the project sought to enhance gender balance in capacity-building opportunities, achieving a 25% female participation rate overall including study tours.

## **4. Community Level Initiatives**

Sustainable development of the Iraqi Marshlands from environmental, water resource, socio-economic and other dimensions must include community support and initiatives, as communities and residents must be an integral part of marshland management framework. UNEP undertook support for small-scale community level initiatives in rural communities in the three governorates throughout the project period. During Phase I, the project supported initiatives based on proposals submitted by each governorate. During Phase II-B and Phase III, additional community level initiatives were implemented and targeted rural women.

### **4.1 Environmental Awareness Campaigns**

UNEP supported environmental awareness initiatives in the three governorates. The proposals for these initiatives were developed by local groups. To build capacity for proposal development and implementation management, community leaders first participated in an organisational community training initiative, and subsequently submitted proposals to UNEP and the Ministry of Environment for support. The Ministry of Environment, local Governorate Councils, Marsh Arab Forum and other local institutions were engaged to implement initiatives in the three governorates.

#### **Basrah Environmental Awareness Campaign (Phase I)**

The environmental awareness campaign launched in Basrah for the Marsh Arabs consisted of 10 public meetings focusing on building awareness of key environmental problems facing the Marshlands. These meetings took place over a one-month period and were organized by the Ministry of Environment (Basrah division) in collaboration with the University of Basrah, religious leaders, tribal chiefs and local organisations. The Basrah Governorate Council provided oversight and support as needed. This initiative made use of the Ministry of Environment's public outreach expertise and its ability to coordinate with the local community. Funding stimulated the establishment of partnerships with a wide range of entities in Basrah in order to fully engage the community from different angles, such as religious, scientific and political perspectives. The common goal of conveying a coherent message that the Iraqi Marshlands are an invaluable environmental resource was present throughout the campaign. The series of public meetings, followed by further discussions, provided the indirect benefit of making community members aware of the wide range of organisations with which they could work in the future.

#### **Thi-Qar Environmental Awareness Campaign (Phase I)**

The Marsh Arab Council of Thi-Qar undertook an initiative to raise awareness of the dangers of fishing using poison within the marshland environment. Work was carried out in cooperation with the Ministry of Environment (Thi-Qar division). The use of poison as a means of fishing was widespread within the Marshlands, as a large numbers of fish could be killed cheaply and quickly utilizing this method. However, since poison is a pollutant, the practice posed a threat to human health and biodiversity.

To address this important issue, the Marsh Arab Council launched a public awareness campaign. Short training courses were given to tribal chiefs and religious leaders. The Marsh Arab Council and Ministry of Environment sought the assistance of the newly trained tribal chiefs and religious leaders to help explain the adverse affects associated with fishing using

poison to local fishermen and their families. The rationale behind the campaign was to begin to create an atmosphere in which using poison for fishing will become unacceptable within marshlands societies and eventually lead to the elimination of this practice.

### Missan Training Courses for Religious Leaders and Youth (Phase I)

The initiative to develop a better understanding of the importance of the marshland ecosystem among marshland residents in Missan had two components. The first component was a project for religious leaders, consisting of an intensive five-day course in which participants were introduced to the environmental problems facing the Marshlands. Issues addressed included the adverse affects on human health inflicted by fishing with poison, and the damage caused by dumping waste directly into the marshes. The goal of the course was to make religious leaders aware of these environmental problems which can be improved through behavioral changes. Religious leaders were targeted as their daily interaction with the larger community could help spread environmental issues to a wider audience.



**Figure 24** Poster for environmental awareness campaign produced by the community level initiative



**Figure 25** Community Initiatives for Women in the Marshlands

The second component was a training course for young people on the importance of the marshland environment. It was organized to stimulate interest in environmental issues and to begin the process of viewing the Marshlands as a common good requiring trans-generational management.

The Ministry of Environment Missan Division took the lead on this project, working closely with Missan's Marsh Arab Council. The Missan Governorate Council provided oversight and support as needed.

## 4.2 Community Initiatives Targeting Women

### Practical Workshops on Environment and Health for Rural Women (Phase II-B)

In partnership with the Women and Environment Organization (an Iraqi NGO) and the University of Basrah, UNEP carried out local initiatives targeting rural women. They were organized to address special concerns for women and impacts of their daily actions on the environment, and also in response to requests raised by community leaders, who highlighted limited opportunities to raise practical awareness about the environment among women in rural areas. The initiatives had the aim of educating them on practical means to protect their health and the environment, the importance of the Iraqi Marshlands and its link to the economy and human health, and impacts of people's actions on the Marshlands.

A total of 712 women from 15 villages in the Governorates of Thi-Qar, Missan and Basrah participated in the awareness-raising workshops. In each village, workshops including lectures, demonstrations and the provision of health kits were held over four to five days. A second visit was made to the villages one month after the workshops to assess how the women had applied the information and tools to their daily lives. The workshops were well received by the communities, many of which have never received any assistance from the UN or other agencies, and there have since been requests for similar activities targeting children.



**Figure 26 Environmental awareness workshop for women**

### **Practical Workshops on Environment and Health for Rural Women (Phase III)**

In Phase III, the project organized additional community initiatives targeting women in rural villages not covered by the Phase II-B initiatives. The workshops were held in nine communities; three each in the Governorates of Basrah, Thi-Qar and Missan. Most of those communities lacked basic services such as access to safe drinking water, sanitation, health services, schools and electricity. The programme was initiated under the training course to “train the trainers” and utilized female instructors, tribal/religious leaders and female volunteers. Trained instructors gave practical demonstrations and lectures in each village, including how to collect water from areas less likely to be polluted, how to treat water for safe drinking, sustainable reed harvesting practices, and basic health and hygiene measures. The participants expressed great interest and enthusiasm, and received practical information materials as well as practical items and equipment to enable them to improve their basic environmental and health practices.



**Figure 27 Environmental awareness workshop for women**

Follow-up visits were conducted one month after the workshops to assess the impacts of the programme, and it was recognized that the initiative had helped to change the attitudes of participating rural women, who have acquired knowledge and information about the environment and the Marshlands as a result. A total of 400 women (133 in Basrah, 134 Thi-Qar and 133 in Missan), some with their children, benefited from the workshops.

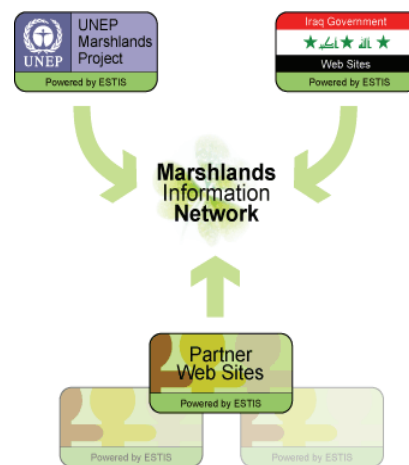
### **4.3 Lessons Learned**

The key lesson learned from the community-level initiatives is that small projects at the local level have a considerable impact. While these community-level activities and awareness-raising programmes were carried out with modest budgets and were both labour and time-intensive to administer, they generated significant, visible and positive impacts within the communities. They were effective in fostering a better understanding and support for larger

UNEP project components, particularly the water and sanitation pilot projects. They also helped to address specific gender concerns of rural marshland women. In addition, as these community initiatives were targeted to build better awareness about marsh environments among the local population, they also contributed to the longer-term goal of marshland management and local sustainability.

## 5. Data and Information Management

The project supported various data and information management activities under Phases I, II and III to address the need for objective and reliable data as well as the need to establish information management systems. Phase I entailed the establishment of the Marshlands Information Network (MIN) platform for data collection and analysis, along with necessary hardware and training for the key Iraqi institutions to use and manage the system. The Iraqi Marshlands Observation System (IMOS) was also established. Phase II-A supported the expansion of the MIN network by increasing the number of institutions with access, and supporting additional data collection and analysis as deemed necessary for further interventions by UNEP and other institutions. Phases I and III supported the collection of water quality and biodiversity data required in the pilot sites and along the Main Drain. These activities are described in further detail below.



**Figure 28 Marshlands Information Network schematic**

### 5.1 Marshlands Information Network (MIN)

The Marshlands Information Network was established to help solve the problem of limited availability of environmental and social information about the Iraqi Marshlands. The system provided a forum for information and data sharing, and utilized an Internet-based tool called the Environmentally Sound Technology Information System (ESTIS) in Arabic. ESTIS is an innovative, multi-language e-service developed by IETC in 2003.

#### MIN Server Set-up in Iraqi Institutions

To facilitate active engagement of local stakeholders and data sharing/management, Phase I supported the procurement and set-up of MIN server equipment in five locations – four in the Ministry of Environment offices in Baghdad, Basra, Missan and Thi-Qar, and one in the Centre for Restoration of the Iraqi Marshlands (CRIM) of the Ministry of Water Resources. Under Phase II-A, the project established additional MIN nodes at key Iraqi institutions, such as the Ministry of Municipalities and Public Works and Thi-Qar University.

Network users included: officials from the Ministry of Environment, Ministry of Water Resources, Ministry of Municipalities and Public Works; experts including those involved with academic institutions; representatives of the southern governorates; and individual communities.

The MIN set-up and management included significant capacity-building initiatives both inside and outside Iraq as described in Chapter 3 on Capacity Building and Awareness Raising.



**Figure 29 Iraqi and UNEP technical experts during MIN data management exercise**

### **MIN Data Management Support**

Phase II-A supported data collection and assessments and efforts to convert existing data and results that are relevant for the Iraqi Marshlands' management by partner institutions. The Ministry of Environment focused on water quality and biodiversity data, while the Ministry of Water Resources targeted hydraulic and hydrological data. The Ministry of Municipalities and Public Works selected land use, demographic and other related data.

In June 2006, the project organized a meeting with technical experts from these three ministries to assist Iraqi ministries in effectively analyzing, presenting and sharing available data using the MIN, and to develop a strategy for initial data collection efforts concerning basic demographic and socio-economic data and solid waste management in the Iraqi Marshlands. At the meeting, the Iraqi officials accomplished the following in collaboration with project staff:

- Developed plans for each ministry to: coordinate data collection inside the Marshlands; continue the upkeep and updating of the MIN; further develop effective reports using existing and forthcoming data; and expand use of the MIN as a tool for sharing and managing data
- Used existing data provided by ministries as examples of how to analyse, share, manage and upload effective reports
- Completed reorganisation and streamlining of the MIN site structure for the ministries' MIN web sites.

UNEP and each of the ministries subsequently signed an MOU to carry out the data analysis and manage the MIN sites with additional data. The ministries uploaded numerous reports and analyses which were previously unavailable for review. For example, the Ministry of Water Resources made available various reports on project field surveys such as historical changes using remote sensing, a report on the restoration of the Al-Hwaizeh Marsh and updates on the reflooding of the marshes.

The project also conducted an evaluation of data-sharing tools and methodologies that have been utilized by various multilateral and bilateral initiatives for marshland management. The aim of this evaluation has been to understand the systems in use and to evaluate their compatibility and comparability. The analyses formed the basis of recommendations on how to share data according to a three-tier data system. The project has also explored the feasibility of integrating the MIN platform with the web-based GIS system which was established at the Iraqi ministries with support from the Government of Italy.

UNEP organized an evaluation meeting on 20 April 2007 to assess the activity gaps for marshland management filled by Phase II-A and other ongoing initiatives and to identify additional activity gaps to be prioritized. The meeting was chaired by Her Excellency Mrs. Narmin Othman, Iraqi Minister of Environment, and included representatives from the Government of Italy. The project activities carried out were presented and received a positive evaluation from the participants. The meeting recommendations included the continuation of capacity building to utilize the information and data management systems, support for initiatives with tangible positive impacts on the social conditions, and coordination and cooperation among donors and Iraqi institutions.

## **5.2 Iraqi Marshlands Observation System (IMOS)**

The Iraqi Marshlands Observation System (IMOS) monitored the extent and distribution of reflooding developments and associated changes in vegetation cover. The system was developed to address the need for systematic assessment of ongoing changes to obtain a better understanding of the dynamics and, ultimately, the level of success, of the wetland recovery process. The IMOS was designed as a pragmatic decision-making support tool to assist stakeholders in modifying and adapting restoration plans in a timely manner based on valid scientific information.

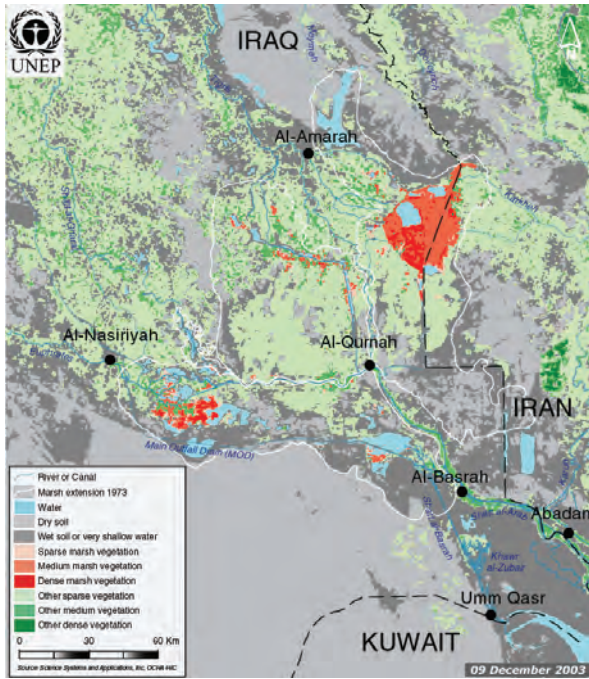
The origins of the IMOS stem from UNEP's scientific analysis of satellite imagery to articulate the plight of the Iraqi Marshlands and to alert the world about the potential disappearance of the area (Partow, 2001). This analysis, with the use of before and after satellite imagery, is considered as an exemplary early warning work carried out by UNEP, and was one of the driving forces behind the development of this project. Recognizing the expertise gained from the earlier assessment, the IMOS design and coordination were carried out by the UNEP Post Conflict and Disaster Management Branch (PCDMB) in collaboration with the GRID-Europe of the UNEP Division for Early Warning and Assessment. The system utilized an approach that combined satellite sensors to collect data at various scales, with multi-temporal analysis to observe the evolution of marshland reflooding. Its methodology used an object-oriented approach based on initial image segmentation, followed by a multi-criteria classification to MODIS, IRSP6 LISS-III and Landsat ETM+ imagery.

The major IMOS findings and results include the following:

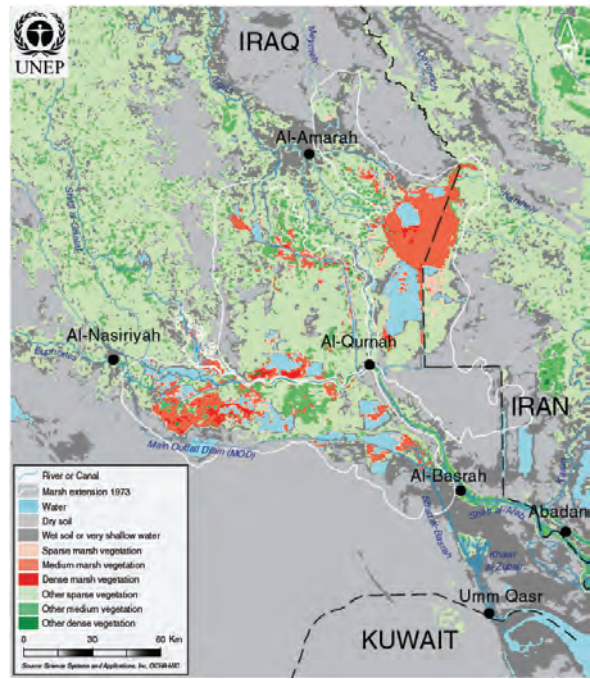
- During the IMOS monitoring period from early 2003 to 2006, the surface area of water and vegetative cover showed a remarkable increase, thus indicating a partial recovery of the Marshlands. The progress of the recovery was updated in a trend graph generated with surface area statistics of wetland vegetation and water bodies as shown in Figure 31. With seasonal variability, the Marshlands' surface area reached almost 50 percent of the 1973 area by May 2005, with rapid establishment of emergent wetland vegetation.
- 94 synoptic map sets were developed over a three-year period to illustrate the temporal distributions of marshland reflooding and wetland vegetation development on a weekly/bi-weekly basis from January 2003. Representative maps showing changes in the Marshlands area from 2003 to 2006 are shown as Figure 30.
- 7 semi-detailed seasonal vegetation maps were prepared for spring and autumn to analyze maximum and minimum extents of the Marshlands for the analysis period.
- Iraqi partners conducted three field data collection campaigns in 2005 to help verify the results of the satellite image classification.

The IMOS fully achieved the following two objectives: (1) to conceive and implement a monitoring concept to systematically acquire, analyze and exchange data and information on the rapid changes taking place in the marshland environment; and (2) to develop information products and services based on the collected data to support the management of the restoration process. The third objective to evaluate the magnitude and character of wetland rehabilitation was partially achieved. While the magnitude of the restoration was quantified by the IMOS, the nature of the wetland restoration required more detailed assessment of wetland functions.

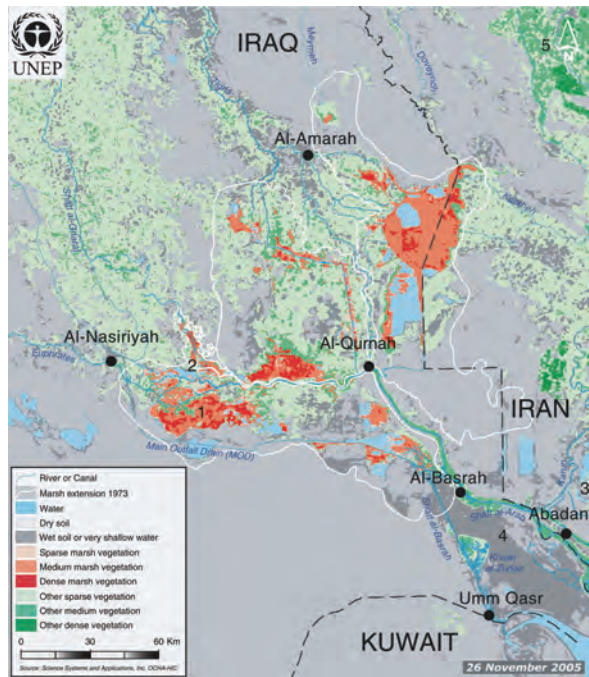




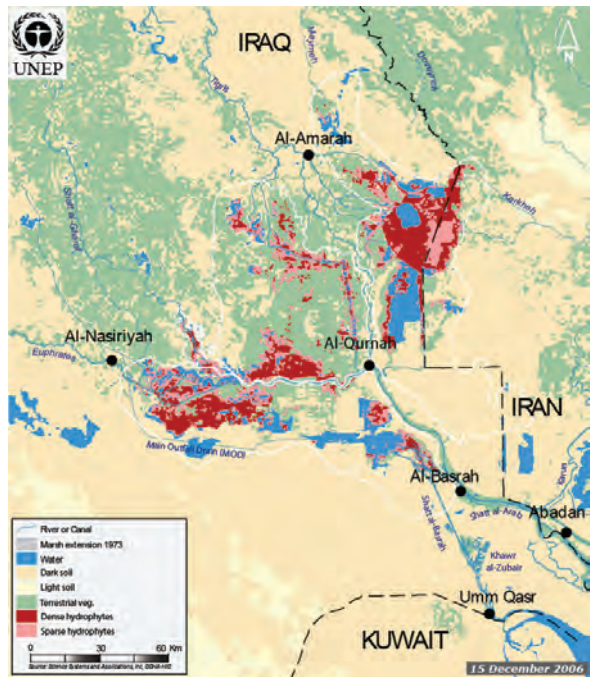
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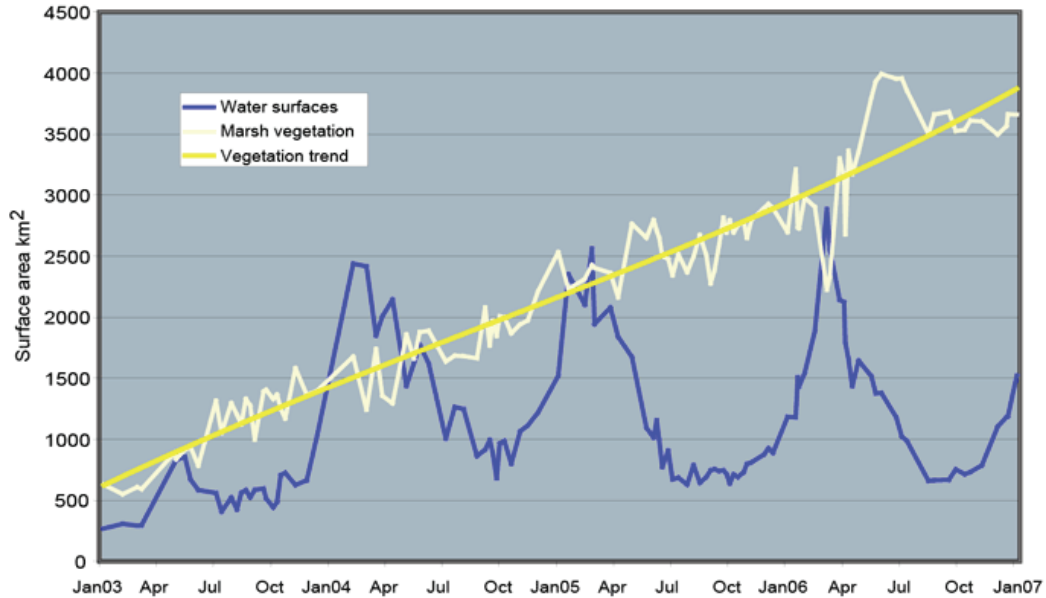


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15 December 2006

Figure 30 Marshlands reflooding maps generated by IMOS



**Figure 31 Graph of Iraqi Marshlands water and vegetative cover trends from 2003 to 2007 generated by IMOS**

In the spring of 2006, UNEP organized a two-week training and hand-over workshop to transfer scientific knowledge obtained using the IMOS to partner organisations in Iraq. These included the Centre for Restoration of the Iraqi Marshlands and the Nature Iraq/Iraq Foundation. The purpose of the hand-over activities was to enable Iraqi experts to operate the monitoring system and produce up-to-date maps, as well as systematic statistical analysis of evolving environmental conditions and trends. Monitoring results are intended to assist in measuring restoration targets and to help guide rehabilitation planning. The Technical Report on Iraqi Marshlands Observation System has been published to provide detailed descriptions about the methodology, outputs, issues for further discussion and recommendations (UNEP, 2006a). For more information on IMOS, see <http://imos.grid.unep.ch>

### 5.3 Water Quality and Biodiversity Monitoring

The project carried out water quality and biodiversity monitoring in a select number of monitoring locations during Phases I and III. To facilitate field data collection and analysis, potable water quality monitoring equipment was also purchased for the Ministry of Environment. The monitoring equipment was identical to those purchased by another UNEP project to minimize discrepancies and simplify training and maintenance needs, and also to enable the Ministry to simultaneously carry out large-scale field assessments.



**Figure 32 Water Quality and Biodiversity Monitoring**

**Water Quality Monitoring Programme (Phase I):** The Water Quality Monitoring Programme was implemented in 2005 to collect and analyze baseline data for environmental conditions within the Iraqi Marshlands, especially in the six communities selected for drinking

water provision. The work was implemented through an MOU with the Ministry of Environment. The Ministry of Environment carried out the work in collaboration with the Ministry of Water Resources, Marsh Arab Forum and Nature Iraq/Iraq Foundation.

Sampling surveys were conducted five times between April and December 2005, as also summarized in Chapter 2. High levels of total dissolved solids (TDS) and fecal coliform were reported in all samples. The concentrations of these pollutants were above the drinking water quality limits, indicating the need to treat the marshland water for human consumption. Efforts to provide treatment facilities for drinking water provision in the Marshlands are therefore recommended in order to protect human health.

Trace pollutants including polycyclic aromatic hydrocarbons (PAHs), pesticides and heavy metals in the water samples were found to be within the WHO and U.S. Environmental Protection Agency (EPA) raw water quality limits. No radiation was detected in the samples.

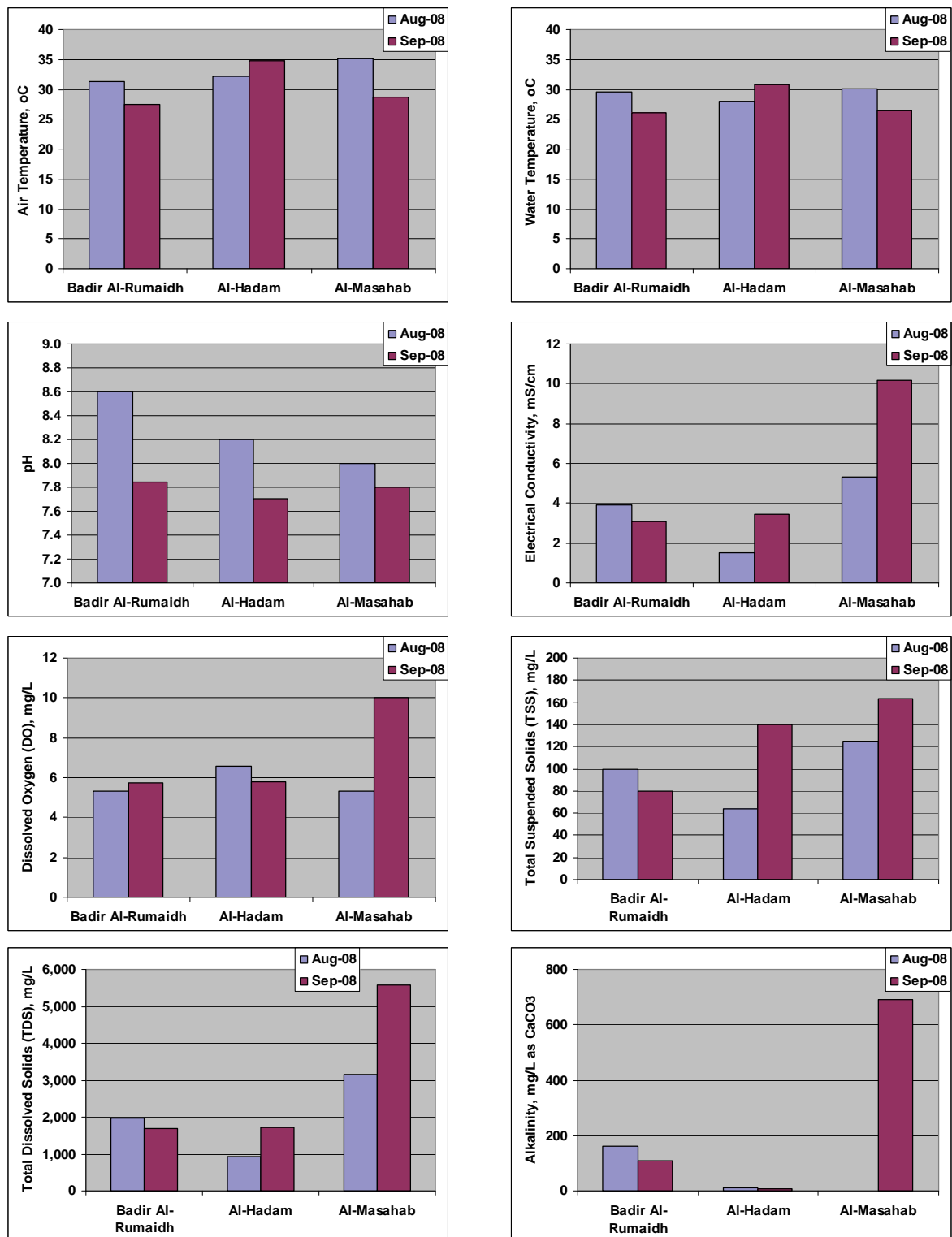
The diversity and richness of phytoplankton, fish, macrophytes and macrobenthos populations showed an increasing trend in all sites between May and September 2005, indicating an increase in the number of biological communities. While longer-term monitoring and analysis is necessary to determine the level of recovery of the Marshlands, these results provided an encouraging snapshot of the environmental conditions of the area, and may be indicative of the recovery and improvement of biological communities in the Iraqi Marshlands.

The heavy metals content in the sediment samples were found to be within the acceptable limits stipulated by the European Union soil standards for heavy metals (EC Directive 86/278/EC). Detected concentrations of pesticides and PAHs were low, and no radiation was detected in any of the samples. This extensive analysis was carried out during a relatively short period, and helped to form a basis for improvement of subsequent monitoring and for the monitoring of ecosystem recovery in the Marshlands.

**Follow-up Water Quality and Biodiversity Monitoring Programme (Phase III):** Water quality testing and biodiversity analyses were performed for the purpose of comparison with results obtained in 2005. The work was implemented under an agreement with the Iraqi Ministry of Environment. The Ministry of Environment collaborated with the Ministry of Water Resources, the Marsh Arab Forum and the governorate offices to conduct the field work. Sampling surveys were conducted at three water treatment pilot sites, namely Badir Al-Rumaidh in the Thi-Qar Governorate, Al-Haddam in the Missan Governorate and Al-Masahab in the Basrah Governorate. The surveys were conducted twice in August and September 2008, and included 19 water quality parameters and two biodiversity parameters.

The results of the 2008 sampling surveys at the three water treatment facilities showed higher concentrations of TDS and nutrient loading compared to the 2005 sampling results. Figure 33 shows the results of the 2008 water quality monitoring at the three sites. The results may have been impacted by the drought conditions in the area. Both biodiversity and species richness increased between 2005 and 2008 in all sites for phytoplankton, zooplankton and macrobenthos. While there was no significant variation in the biodiversity of fish from 2005 to 2008, its richness has been observed to increase during this period. Figure 34 shows graphic comparisons of 2005 and 2008 biodiversity and species richness figures at the three monitoring sites.

As the marshland reflooding and re-vegetation conditions continue to change, periodical monitoring of water quality and biodiversity is recommended to assess the conditions and trends of marshland ecosystem recovery, and to protect the health of marshland residents who have returned to these villages.



**Figure 33 Water quality parameters observed in 2008 at three monitoring sites (Badir Al-Rumaidh, Al-Hadam and Al-Masahab)**

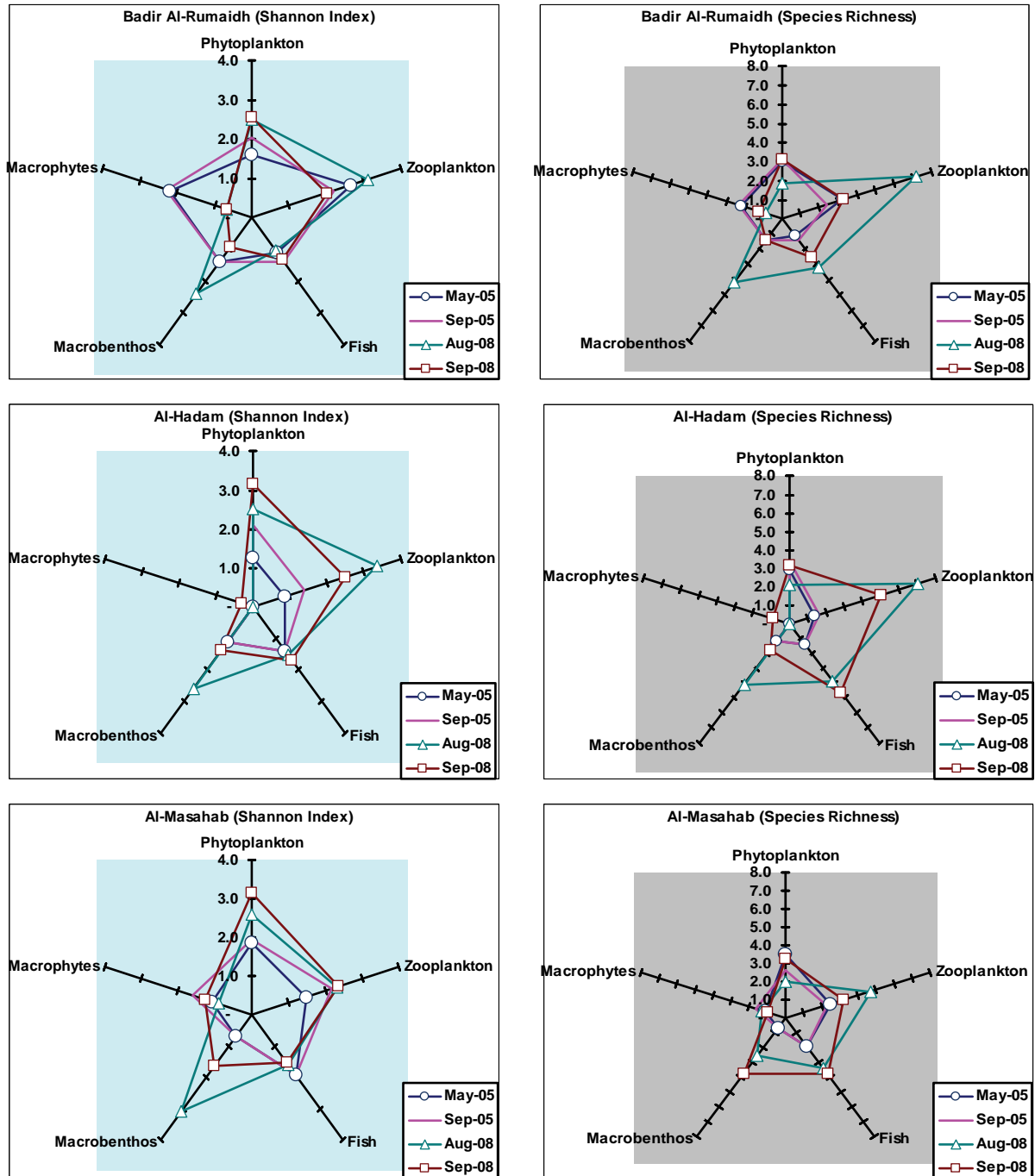
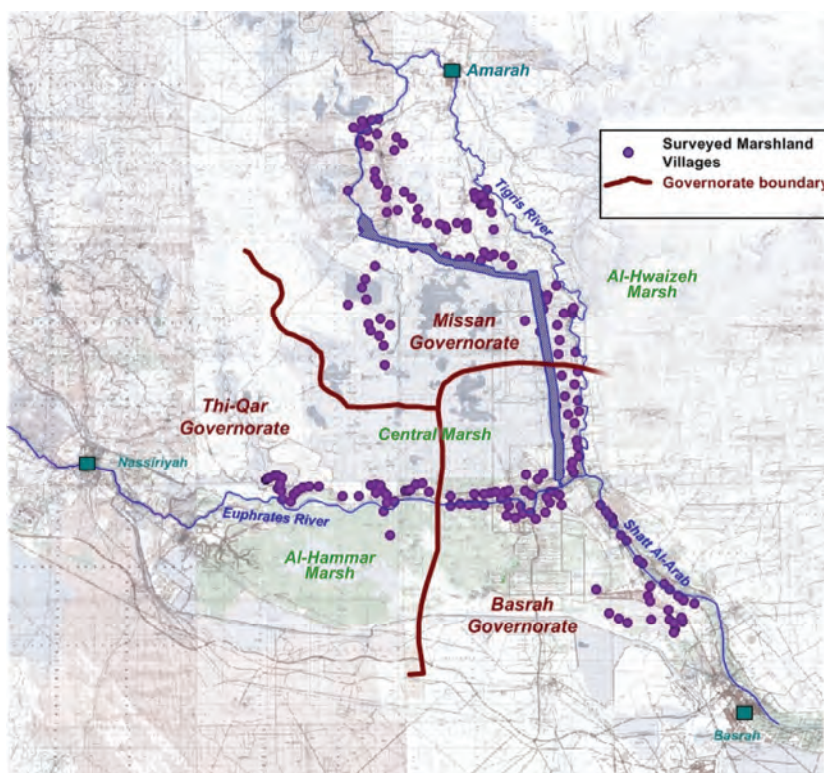


Figure 34 Comparison of biodiversity and species richness observed in 2005 and 2008 at three monitoring sites (Badir Al-Rumaidh, Al-Hadam and Al-Masahab)

#### 5.4 Demographic and Socio-economic Survey

Under Phase II-A, UNEP carried out a survey to collect and analyze data on the current demographic, social and economic conditions of the villages in the Marshlands. This work was identified as a key priority during consultation with the Iraqi stakeholders, who recognized that the development and implementation of a management structure and activities need to be based on objective and current data. With the Ministry of Municipalities and

Public Works, UNEP developed the terms of reference for this work. The fieldwork was carried out by Thi-Qar University in 2007 under the overall supervision of UNEP and in consultation with the Ministry of Municipalities and Public Works.



**Figure 35 Marshland villages included in 2007 UNEP demographic and socio-economic survey**

The survey covered 199 marshland villages in sixteen sub-districts in the Thi-Qar, Missan and Basrah Governorates, as shown in Figure 35. The survey was conducted from June to September 2007 by visiting all of the 199 villages and conducting interviews and meetings with village representatives using a questionnaire developed for this purpose.

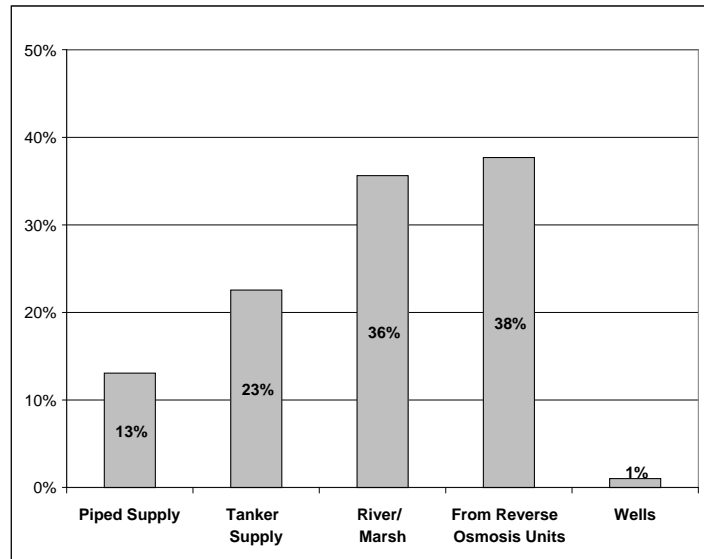
While the survey covered only a representative sample of communities in the three governorates, it highlighted challenging socioeconomic conditions faced by the marshland

residents in terms of access to water, sanitation, education and health services. The survey also found that the ecosystem degradation has resulted in changes to lifestyles as well as economic activities. Some of the key findings are shown below:

1. The total population of the 199 villages surveyed was estimated at 346,291 persons. 47% of villages had less than 1,000 persons, while those having less than 2,000 persons constituted 72% of the total number of villages surveyed.
2. Villages were classified into “Deep”, “Border” and “Outskirts” relative to their location within the Marshlands. There were only seven “Deep” villages, which were generally associated with the traditional way of life in the Marshlands. 59% of the total population lived in the “Border” villages, while 39% of them lived in “Outskirts” villages. The small number of villages classified as “Deep” may be indicative of the slow return to the traditional lifestyle. The results also found a shift towards a “country” lifestyle based more on agriculture in the environs of the Marshlands.
3. In terms of flooding, 5 villages were situated in permanently flooded areas, and 164 villages were located in areas with either seasonal or occasional flooding. 30 villages were situated in dry areas with no flooding.
4. Livelihood activities in Thi-Qar were limited, with only 72% of the inhabitants engaged in activities such as agriculture, fishing, livestock rearing, handicrafts, small-scale commerce and other activities. In Missan and Basrah, nearly all of the villagers were found to be engaged in two livelihood activities on average. In the villages in Missan, major activities were agriculture and livestock rearing, while people in the Basrah Governorate were engaged in livestock rearing, agriculture, fishing and

handicrafts.

5. Significant changes in the types of animals reared in marshland villages were observed compared to the pre-drying period. The total number of buffaloes, cattle and sheep was estimated at 606,900, with nearly equal distribution among the three animal types. In the pre-drying period, buffaloes were the sole animals reared. Sheep were previously not found in this area, as they are generally reared in 'dessert or semi-arid' areas. The large number of sheep may signal the consequences of the ecosystem destruction and resultant shift in animal rearing and associated community lifestyles.



**Figure 36 Drinking water sources of Marshlands villages from 2007 UNEP demographic socioeconomic survey**

6. More than one third of the villages used untreated river or marsh water for drinking. Only 13% of the villages surveyed had a piped water supply, while 23% received their water from tankers and 38% of villages received desalinated water from reverse osmosis units and delivered by special vehicles. The national average of the Iraqi population in rural areas having access to improved drinking water sources, as reported by UNICEF, was 56% in 2006. In the marshland villages, approximately 11% of the population, or 13 % of the villages surveyed, had access to piped water which could be considered as sources of improved drinking water. The Marshlands area was thus found to be lagging in terms of access to safe drinking water compared to the national average. These water sources were found to be scarce and difficult to access and were not deemed to be reliable.
7. In terms of sanitation, the survey highlighted the lag in access as well as public health concerns. In 61% of the villages, no specific sanitation method was practiced, and the residents used the areas near their houses for human feces and domestic wastewater. The national average of the Iraqi population having access to improved sanitation in rural areas was 69% in 2006, according to UNICEF. As more than one third of the villages used untreated water from the river or marsh for drinking, the limited access to improved sanitation raises serious public health concerns. Only 39% of the villages used pit latrines, and sewerage was available in 23% of the villages.
8. Health services were found to be in a critical condition. There were 35 health centres located in 18 of the surveyed villages. Doctors were only available in five hospitals serving the surveyed area. These five hospitals were found to have 117 doctors on staff to serve 1,105,686 persons, which is equivalent to 9,500 persons per doctor. The national average as of 2005 was seven physicians per 10,000 persons, or approximately 1,500 persons per doctor (WHO, 2008), showing that the Marshlands area was underserved.
9. The survey revealed that the Marshlands area had only limited power supply. While 176 villages were connected to the national grid, the reliability of this service was found to be limited. These findings are consistent with the electricity supply issues in

Iraq in general. The use of private generators was prevalent in 171 villages (86%).

While the region has critical needs and suffers from limited basic service access well below the national average, actual assistance received thus far to implement on-the-ground measures has been inadequate. Limited availability of basic services impedes the return of displaced inhabitants. Additional initiatives to improve access to basic services are recommended to re-establish communities and livelihoods (UNEP, 2007a).

## **5.5 Solid Waste Management Survey**

Under Phase II-A, UNEP carried out a Survey on Solid Waste Management in the Southern Governorates of Iraq to investigate the current solid waste management practices and solid waste characteristics. This work was identified as a key priority during consultation with Iraqi stakeholders, who recognized that improvement of solid waste management needs to be based on objective and current data. With the Ministry of Municipalities and Public Works, UNEP developed the terms of reference for this work. The fieldwork was carried-out by Thi-Qar University under the overall supervision of UNEP and in consultation with the Ministry of Municipalities and Public Works.

Surveys were conducted in nine large, medium and small cities and towns in the Thi-Qar, Basrah and Missan Governorates, which were identified by the Ministry of Municipalities and Public Works. Specifically, Al-Nassiriya, Suq Al-Shuyuk, Al-Nasr, Basrah Central, Al-Zubayr, Al-Deyr, Ammara Central, Qal'at Al-Salih and Al-Maymuna were covered in the survey. Fieldwork was conducted from June to September 2007. The survey consisted of two main components, namely: a) collection of information on solid waste management practices and; b) solid waste characterization surveys, the details of which are described below.

### **Solid Waste Management Practice Survey**

The survey on current solid waste management practices was conducted using a questionnaire and meetings to collect information from local officials and observation through site visits. The findings of the survey are outlined below

1. In large urban areas and towns in the Thi-Qar and Missan Governorates, municipalities are responsible for the collection, storage, transport and final disposal of solid waste. In the Basrah Governorate, solid waste has traditionally been collected by local authorities. Recently, the local authorities have entrusted some of the collection tasks to private contractors. Limited facilities were found to be available for solid waste collection and transport, and were situated mostly in major centres. Outskirt areas did not have such services and tended to dump their waste on the nearest available land.
2. The survey found no specific controls for the collection, transportation, treatment or disposal of industrial waste. Moreover, there was a lack of legal measures to control the handling of dangerous/ hazardous industrial waste.
3. Most industrial waste generated in cities came from small or medium-scale industrial operations, and these were usually disposed of along with the municipal waste.
4. Larger industries were found to be located outside the city centre, and the responsibility for disposing of solid waste rested primarily with the industries themselves. Most solid waste generated by industry contained a significant amount of valuable materials such as steel, aluminum, copper and other metals, some of which were recovered and reused by the industry or sold as scrap. The remainder was

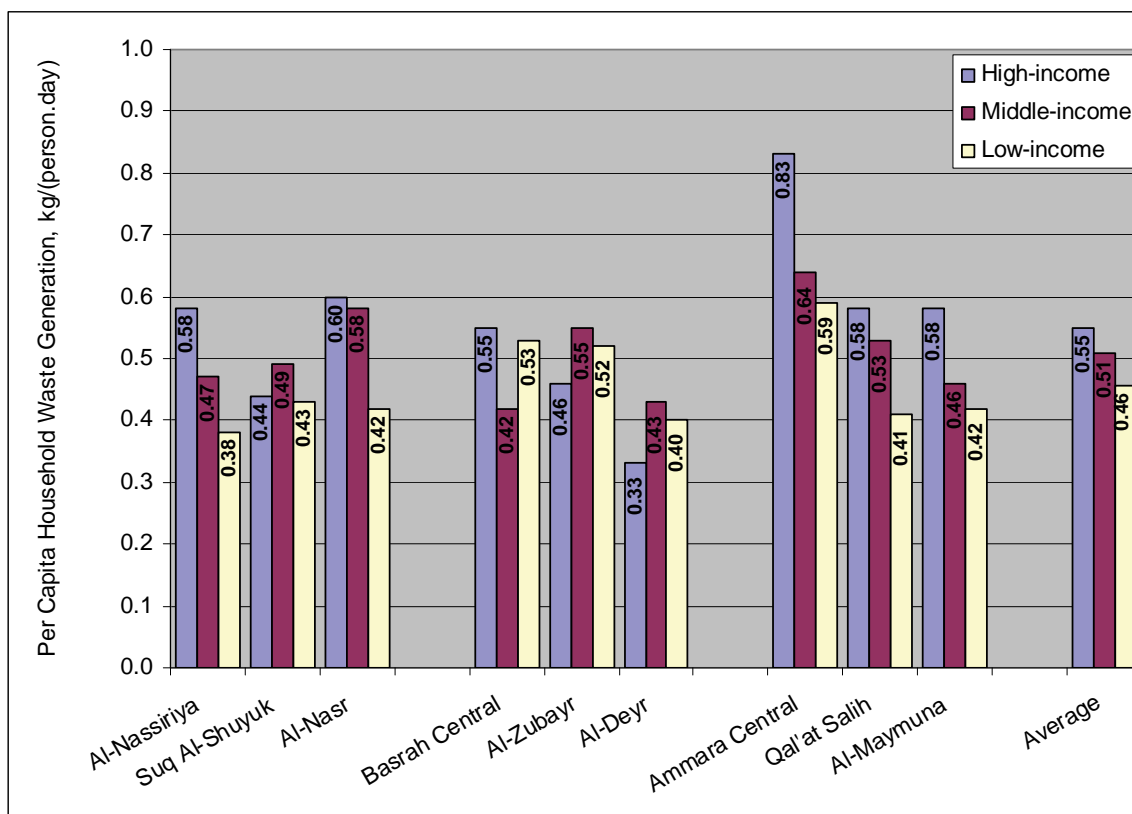


- disposed of at the municipal dump.
- Commercial waste included waste generated by groceries, restaurants, markets, offices, hotels, motels, printing shops and pharmacies. Both commercial waste and institutional waste was collected together with household waste. The survey also found that recycling was taking place in the form of manual sorting of materials such as paper, plastic, glass, metals, textiles and animal bones. Recovered materials were then baled and transported to factories for use as raw materials.
  - Hospitals were generally equipped with incinerators for the management of contaminated clinical waste. Some incinerators, especially in large hospitals in Basrah, were often not functioning due to the non-availability of spare parts, the lack of maintenance and the absence of skilled technicians. Clinical waste from hospitals without access to incinerators were found to be mixed with municipal solid waste, and eventually disposed in open dumps.
  - The majority of waste collected by municipalities or by private contractors was disposed of in open dumps and often burned. Large heaps to small mountains of refuse were observed on the outskirts of the major cities.

### **Solid Waste Characterization Survey**

The solid waste characterization survey addressed household, industrial, commercial and clinical waste generation. Household waste generation was investigated by collection and measurement of samples in high-income, middle-income and low-income sub-areas in each of the nine cities and towns. A total of 997 samples were collected for a period of seven consecutive days to determine per capita rates of household waste generation, waste density and waste composition. Waste generation from commercial entities and small and medium-scale industries as well as clinical waste were also estimated. Estimates from these sources were compared with published estimates of the quantity of waste disposed in open dumpsites. The survey generated the following findings:

- The average daily per capita household waste generation rate was 0.55kg for high-income households, 0.51kg for middle-income households and 0.46kg for low-income households respectively.
- The daily per capita household waste generation rates from this survey were comparable to a recent surveyed figure of 0.42kg in Al-Najaf (2004), which was higher than the 0.32kg in Al-Falluja (2005) and lower than the 0.70kg reported for Baghdad in 1978. At the regional level, the survey results were also comparable to the 0.63kg generation rate for Amman, Jordan in 1993. Caution must be exercised in this comparison, as it is not clear if the reported per capita generation rates were only for the household waste, as was the case in this survey, or they included all municipal waste types.
- Organic material was the main component of household waste at 46 to 71%. Plastics comprised 5 to 8%, and metal, glass, paper and textile each accounted for 3 to 5%. Rubber was approximately 1% and miscellaneous combustibles were less than 2%. Miscellaneous incombustibles were exceptionally high at more than 10%, especially in Al-Zubayr, Al-Deyr, Ammara Central, Qal'at Al-Salih and Al-Maymuna for all income levels. The source and origin of the miscellaneous incombustible waste needs to be investigated in the future.
- The survey collected data on the number of small and medium scale industries by type of industrial activity in all surveyed areas. There were a total of 3,750 such industries classified into 24 categories and generally located in specific industrial sites. Large-scale petrochemical complexes in Basrah were not covered by this survey.



**Figure 37 Per capita household waste generation rates from 2007 UNEP waste survey**

- The surveyed data on the number of commercial entities was classified according to business activity in all surveyed areas. There was a total of 12,250 such entities classified into 34 categories and generally located in the town's main market area. The survey found a large number of entities categorized as groceries, slaughterhouses, general restaurants and special (barbecue) restaurants, which were also found to have high rates of unit waste generation. Although mills were few in number, they had the highest unit waste generation rates.
- The number of hospitals and public health centres and their respective waste generation volumes were documented. The survey found that there were only a small number of hospitals and public health centres. While the small sampling size makes the characterization analysis difficult, there was a general correlation between the size of the facility (i.e. the number of beds) and the volume of clinical and non-clinical waste generated.

The estimates of total waste transported to dump sites were higher than the total estimated waste generation from household, commercial and industrial sources. The difference in the estimates may have been due to several factors. First, the disposal estimates contained waste types not categorized in this survey, such as bulk waste from construction and demolition activities, discarded electrical equipment, cleared garden waste transported directly to dump sites, and waste from large institutions. The estimation of disposal volume was also based on operator knowledge, as written data was limited thus giving rise to the potential for error. Furthermore, the waste generation estimates were based on the results of the survey conducted during the dry season only. Further investigation is therefore recommended to account for and refine the estimates of waste generation and disposal (UNEP, 2007b).

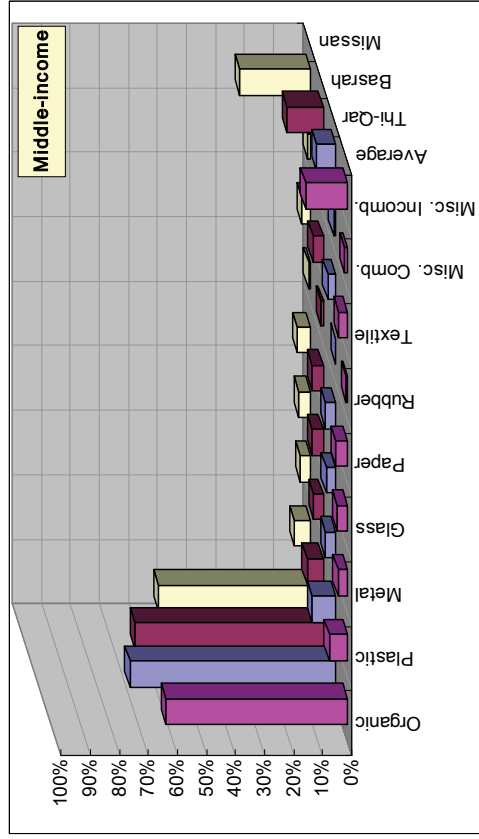
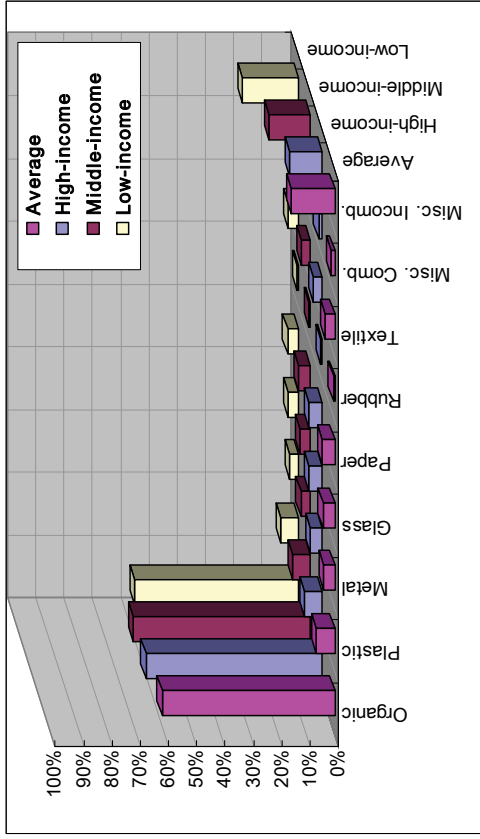
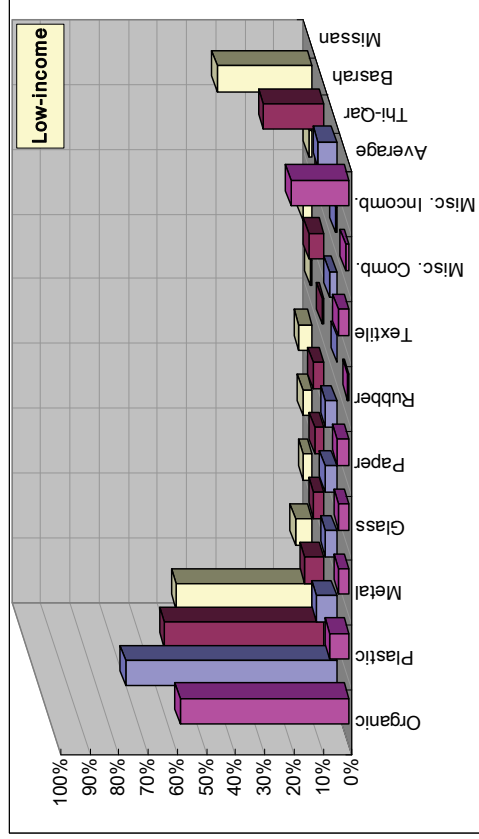
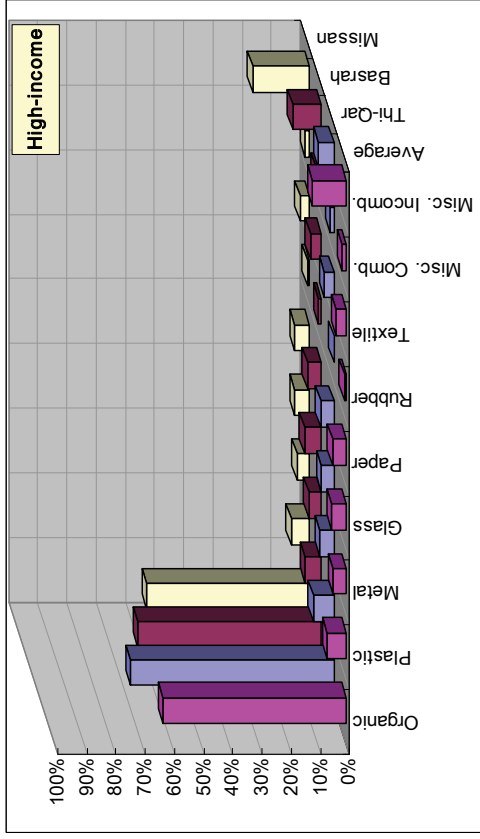


Figure 38 Average composition of household waste from 2007 UNEP waste survey

## **5.6 Lessons Learned**

UNEP has carried out water quality and biodiversity analysis, conducted assessments of reflooding and vegetative recovery as well as socioeconomic conditions and waste generation, and supported an information system to share such data and analytical tools. While such activities are time-consuming and are sometimes not adequately recognized as part of local implementation track record, the project has still adopted the strategy of allocating adequate resources and time to undertake these tasks and to publicly share the information.

While these initiatives began to address the critical lack of basic data and scientific analysis, support is still insufficient for such work, thus limiting the opportunities for sound policy and strategy formulation based on objective data analysis. Specific lessons learned include the following:

- Longer-term efforts to collect and analyze basic scientific and technical data for the purpose of evaluating marshland conditions are needed along with consistent methodologies and tools in order to inform policies and strategies to mitigate negative conditions based on sound science and longer-term trends.
- A comprehensive scenario analysis of environmental and socioeconomic response to policy interventions is needed, including an assessment on: the feasibility of vegetative and biodiversity recovery in certain areas where the Iraqi government may be considering ways to re-establish basic services; what further measures can be taken to achieve a certain level of water quality and flow in a given location; and what population level can be served by such interventions.
- The extent of fluctuations in ecosystem conditions such as water quality, flow and magnitude of change should be analyzed carefully to facilitate the assessment and implementation of robust technological interventions.
- Care should be taken to assess the complexity and maintenance needs of the information and data management systems in order to address the on-the-ground realities of hardware and software availability as well as communications infrastructure limitations. The longer-term viability of the data management systems should be clarified and determined by implementing agencies.
- Assessments on the impacts of drought and climate change need to be carried out.

The above lessons address fundamental issues for the sustainability and medium to longer-term fulfillment of development goals of Iraq and its people. Failure to support such activities or require more thorough analysis of individual projects may ultimately undermine the viability of many fast-track and short-term interventions.

## 6. Project Achievements and Benefits Realized

Through this project and other initiatives, UNEP has taken an active role in providing assistance to Iraq to promote sustainable management in the post-conflict period. Even during a period of great security constraints and political changes, UNEP has managed to complete major project activities in Iraq, which is an achievement in itself.

The project identified nine anticipated benefits at the inception of Phase I, many of which were also relevant for the subsequent phases. Specific descriptions of achievements and benefits realized are highlighted below.

**Benefit 1:** Contributed to the restoration and management of the Iraqi Marshlands through identification of suitable mitigation options, particularly for water, sanitation and marshland management

- The project identified and implemented EST options on a pilot basis to evaluate their performance and suitability under local conditions, including the following:
  - Water: modular reverse osmosis water treatment technology; distribution with common standpipes; solar stills for small-scale household water provision
  - Sanitation: constructed wetlands
  - Marshland management: natural wetland system management; replanting with native species; monitoring of water quality and biodiversity; civil works for water flow restoration; restoration of marsh interconnections; flow regulation through channel connection and irrigation management

**Benefit 2:** Improved access to drinking water and sanitation/wastewater for residents and improved ecosystems and biodiversity in communities participating in the pilot projects

- In Phase I, up to 22,000 people in six pilot communities gained access to safe drinking water supplied by common distribution taps. 23 kilometres of water distribution pipes and 127 common distribution taps were installed.
- Phase II-B supported drinking water provision in a community of 3,000 people.
- Phase III addressed the feasibility of utilizing alternative energy for water provision. In one community, a photovoltaic system was installed to augment conventional energy supply for pumping and distributing treated drinking water. In addition, household-level drinking water provision was piloted in nine households utilizing solar stills.
- A sanitation system utilizing constructed wetland was installed to serve approximately 170 inhabitants facing health hazards from untreated wastewater discharges.
- Wetland rehabilitation and reconstruction initiatives were implemented in a community in cooperation with the Centre for Restoration of the Iraqi Marshlands (CRIM) of the Ministry of Water Resources.
- Feasibility of utilizing the Main Drain water as a water source for reflooding the Marshlands was investigated through the application of engineered and natural wetlands for water quality/wetland improvement.
- Biodiversity monitoring conducted in 2005 and 2008 indicated that both biodiversity and species richness increased over this period in the water treatment pilot sites monitored for phytoplankton, zooplankton and macrobenthos. While there was no

significant variation in biodiversity of fish over this period, its richness has been observed to increase during this period. The results of water quality sampling surveys at three water treatment facilities showed higher concentrations of TDS and nutrient loading compared to the 2005-2006 sampling results. The results may have been impacted by the drought conditions in the area.

**Benefit 3:** Extensive data (water quality, satellite image analysis and remote sensing), experience on suitable options (what options worked where, and how) and policy and institutional needs assessments, which will serve as inputs when formulating a long-term management plan to benefit the people and ecosystems of Southern Iraq

- In Phase I, the following assessments were conducted to generate the data and perform the analysis required to inform Iraqi Marshlands' management practices and policies:
  - Water quality and biodiversity assessments carried out in cooperation with the Ministry of Environment
  - Iraqi Marshlands Observation System (IMOS) developed to monitor reflooding and change in vegetation in cooperation with UNEP Post-Conflict and Disaster Management Branch (PCDMB) and UNEP Division of Early Warning and Assessment. Land cover data and vegetation maps utilizing satellite image analysis and remote sensing for the period commencing January 2003 were made available.
  - Marshlands Information Network (MIN) was established with Arabic and English interface to share data among various Iraqi institutions, with training on system management.
  - Assessment reports of pilot EST implementation were produced. In addition, third party monitoring and evaluation of pilot EST implementation was also carried out.
  - Institutional capacity assessment for the Ministry of Environment was conducted by UNEP PCDMB.
- In Phase II, the following assessment and analysis were conducted:
  - A demographic and socioeconomic survey of 199 Iraqi Marshlands villages was conducted in partnership with Thi-Qar University.
  - A solid waste management survey was also carried out in nine cities with Thi-Qar University. These surveys generated previously unavailable data on local conditions that impact environmental management, and provided useful inputs for local and national level policymakers to identify local needs and priorities for interventions.
  - Support for data collection and assessments were provided to: the Ministry of Environment for water quality and biodiversity data; the Ministry of Water Resources for hydraulic and hydrological data; and the Ministry of Municipalities and Public Works for land use, demographic and other related data.
  - An evaluation of data sharing tools and methodologies was conducted and recommendations on how to share data were made based on a three-tier data system.
- In Phase III, the following assessments and analysis were conducted:
  - Environmental monitoring on water quality and biodiversity was carried out at a select number of Phase I pilot sites to assess the changes from 2005 to 2008.
  - Water quality and biodiversity monitoring was also carried out to determine the feasibility of utilizing water from the Main Drain for water quality and wetland management.

**Benefit 4:** Improved the capacity and knowledge of Iraqi decision makers, technical experts and communities on various aspects of marshland management, including policy and institutional aspects, technical subjects and analytical methods

- The capacity and knowledge of Iraqi decision makers, technical experts and community members were enhanced through 14 international and 10 domestic training courses and 2 study tours, with 477 training placements. Among them, 119 (25% of participants) were for women. Policy and institutional elements, technical knowledge, community engagement and analytical methods were among the aspects addressed. Training materials in English and Arabic were developed and distributed in hard copy, electronic form and as CD-ROM.
- More than 1,100 women in marshland communities benefited from community initiatives to raise practical knowledge about environmental conservation and personal hygiene. Over 1,000 additional persons took part in other community level initiatives.

**Benefit 5:** Employment opportunities for professional and community level tasks related to assessment, pilot applications and monitoring

- At least 52,000 person-days of employment were generated for assessments, pilot applications, awareness raising, monitoring, training organisation and security provision at professional and community levels. Close linkages between capacity building and project implementation were crucial in building capacity of Iraqi personnel and institutions for tasks associated with project activities. By training and utilizing personnel from institutions at the national, governorate and local levels with mandates on specific aspects of marshland management, the project succeeded in enhancing the longer-term sustainability of institutional capacity and gainful employment of their staff.

**Benefit 6:** US\$3 million worth of ESTs introduced and implemented in Iraq, with Iraqi expertise

- In total, more than US\$5.4 million worth of ESTs were procured and implemented in the region, including six modular reverse osmosis water treatment facilities, one rehabilitated treatment facility, distribution networks, one photovoltaic power supply unit to augment conventional power supply in one water treatment facility, one constructed wetland EST, one wetland rehabilitation facility, one pilot facility for natural wetland system and nine solar stills for household water provision.
- Many of the installation and management tasks were carried out with Iraqi expertise and under contract with government and academic institutions. The facilities have also been officially handed over to Iraqi institutions.

**Benefit 7:** Greater commitment and capacity for marshland management, water and sanitation issues

- National institutions including the Ministry of Environment, Ministry of Municipalities and Public Works, and the Ministry of Water Resources carried out and coordinated various project activities within the framework of this project with financial and substantive support from UNEP. Through such direct engagement, capacity and institutional commitments for marshland management, water and sanitation provision and overall sustainable development were enhanced.

- Coordination of donor-supported activities and domestically-led activities inside the Marshlands was facilitated to foster coordination and cooperation while minimizing waste. UNEP served as a liaison for donor coordination for marshland issues upon request from donors and Iraqi institutions.

**Benefit 8:** Improved dialogue and access to information and management tools

- Marshlands Information Network (MIN) server hardware and software were procured and installed in four locations within the Ministry of Environment, as well as in the Ministry of Water Resources, Ministry of Municipalities and Public Works, Nature Iraq and UNEP-DTIE-IETC. MIN information was uploaded to the Marsh Arab Forum, Thi-Qar University and other local institutions.
- Exchange of information, discussion of results and coordination of initiatives were supported through the Roundtable of Iraqi Marshlands Management, kick-off and evaluation meetings, an International Workshop on Iraqi Marshlands Management, as well as the final project evaluation meeting.

**Benefit 9:** Contribution to overall rebuilding efforts for the region and the country

- An external evaluation has found that the project's provision of drinking water has contributed to the return of formerly displaced residents. As community stability was re-established, possibilities for finding employment and rebuilding life in the marsh ecosystem tended to increase.
- Iraqi stakeholders and beneficiaries requested extension of the project with additional activities after recognizing the project's contributions to local and national level development.
- This project served as a foundation for UNEP to launch a new initiative with UNESCO in 2009 to establish and implement a longer-term management and preservation plan based on the World Heritage Convention. Building on the results of UNEP's Marshlands interventions, the new initiative addresses the need to transition from short-term post-conflict interventions towards longer-term sustainable re-development initiatives in the Marshlands with the potential for generating income and rural employment. The initiative also seeks to promote sustainable production and consumption. The project is important for the country, as it is the first initiative to recognize the importance of natural heritage in Iraq.

In addition to the above nine benefits, the project provided yet another benefit by validating UNEP's track records on field project implementation. The project team was awarded the 2007 UN21 Award commendation from the UN Secretary General. The project was also considered as a model of international environmental cooperation by the Iraqi Minister of Environment and was lauded by community groups for making a real effort at engaging and benefiting local communities.



## 7. Project Evaluation

To assess the project results and impacts, UNEP organized several project evaluation meetings with stakeholders and donors. In particular, the evaluation meeting in Kyoto in September 2008 was organized to review the outcomes and results achieved by all project phases, and to formulate recommendations for future work to be undertaken by the Iraqi government and the international community in order to mainstream environmental issues into a sustainable development agenda for Iraq.

The Iraqi Minister of Environment, Her Excellency Mrs. Narmin Othman, headed the Iraqi delegation and participated in the meeting together with high-level officials from the Iraqi ministries. The workshop was also attended by representatives from the Government of Japan, the Government of Italy and UNESCO. The Iraqi Minister of Environment indicated her satisfaction with the project outcomes and benefits, especially concerning the implementation of ESTs in the Marshlands' ecosystem and capacity building for the ministry staff. In summary, the project has addressed the objectives set forth at the commencement of the initiative, and generated tangible results thus far. This has been made possible with continuous dialogue and partnership with Iraqi institutions.

For Phase I pilot projects, third party monitoring and evaluation was also conducted, with site visits and consultations with stakeholders. Their findings are summarized below.

**Drinking water pilot project:** The final monitoring and evaluation report of pilot projects for drinking water provision for Phase I was released in September 2006. The monitoring and evaluation was carried out by a third party organisation through a series of four site visits to each pilot community. Monitoring and evaluation activities included interviews with local residents and project personnel, as well as review and analysis of relevant documents. The final report concluded that the project, which was successfully implemented under very difficult circumstances, has made “a tremendous impact in confidence building within the communities”, and that “the contribution and support given to the returning families of the Iraqi Marshlands through this project is deeply appreciated by the beneficiaries and has to a great extent alleviated suffering and covered the basic humanitarian need for sustaining life”. The report also found “an increased confidence and desire on reviving life within the Marshlands' ecosystem, encouraging many households to return to their village and begin their livelihood in their ancestral lands, in turn resulting in an increased number of livestock, active production and supply of dairy products, reed-related crafts, and other commodities for the major urban market, thus adding to income generation, employment and general prosperity of the community” (PRODEV Resources and Associates, 2006).

**Sanitation and wetland restoration pilot projects:** An assessment of the pilot projects on sanitation provision and wetland restoration in Phase I was released in January 2008, with overall positive evaluations. The evaluators concluded that the selection of the pilot projects' concepts and technology was appropriate, and that similar projects might be implemented in other parts of Iraq. The short-term benefits identified included the enhancement of water quality and the Marshlands' environment, and the reduction of waterborne diseases and infections. The long-term benefits included: encouraging the original marshland population to return; increasing biodiversity such as fish, livestock and bird reserves; rehabilitation of the agricultural sector, boosting of the economy; creation of job opportunities; as well as

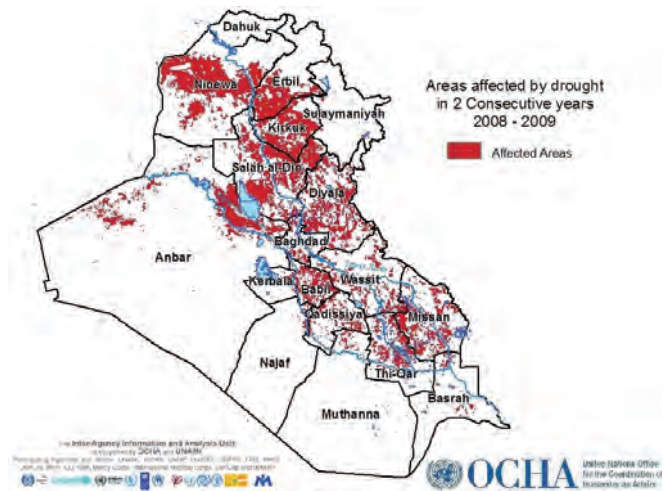
contributing to the enhancement of the Marshlands' environment and restoration of the original wetlands (Stars Orbit Consultants, 2007).

Finally, UNEP plans to carry out an independent evaluation of the project to be completed by mid 2010.

## 8. Future Initiatives for Sustainable Development of Iraq

While the specific initiatives of the UNEP Iraqi Marshlands project have been successfully implemented as described above, there is a need to continue to manage this important area “back to life”. Ecosystem rehabilitation and re-development is a long-term process, requiring various measures and interventions. Sustainable development of this area needs to be prioritized in the national development agenda over the long term.

Despite the commencement of promising longer-term initiatives, emerging environmental threats could undermine the improvements in natural resource management made to date. The Marshlands are experiencing the negative impacts of a two-year drought, which has significantly reduced the water and vegetative cover of the wetlands and availability of water nationwide. The drought and desertification, attributed to climate change and the reduction in water availability, are having a negative impact on the economic development and quality of life of its citizens.



**Figure 39 Areas affected by 2008-2009 drought (UN OCHA, 2009)**



**Figure 40 Drought impacts in the Marshland area (Al-Asadi, 2009)**

The Common Country Assessment (CCA) for the United Nations Development Assistance Framework (UNDAF) conducted in 2009 stated that Iraq's environmental problems are defined by "declining natural resources, exacerbated by their unsustainable use by a population which lacks awareness of environmental issues" (United Nations, 2009). The CCA also articulated additional factors contributing to environmental issues, including the drought, desertification and elevated soil salinity, increasing carbon emissions, loss of biodiversity, and unsuitable rural water supply for agriculture, livestock and drinking purposes. Iraq now shares issues which are common to many middle-income and industrializing countries, such as urbanization-related air, noise and water pollution, a lack of housing, limitations in industrial waste management and accident response, and chemical and other waste-related pollution. It also highlighted the need to diversify Iraq's economy and to use the wealth arising from resources towards sustainable development.

The Government of Iraq has requested urgent assistance from the international community and cooperation from neighbouring countries, including discussions during the special agenda item on the Iraqi Marshlands during the Substantive Session of the United Nations Economic and Social Council held in July 2009. The Government of Iraq has also acceded to key Multilateral Environmental Agreements (MEAs) in 2009, including the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change, highlighting its commitment to the objectives of these international agreements.

Reflecting the need for continued interventions as well as the need to address emerging environmental priorities, UNEP has a number of relevant initiatives planned within the 2010 – 2011 Programme of Work.

- Within the Ecosystem Management Sub-Programme, UNEP will continue to cooperate with UNESCO on a joint project on Natural and Cultural Management of the Iraqi Marshlands, which started in 2009. This initiative has been developed in recognition of the need to transition from short-term post-conflict interventions towards longer-term sustainable re-development initiatives in the Marshlands with the potential for generating income and rural employment. The project aims to establish a preservation and management plan for the cultural and natural heritage in the area utilizing the World Heritage Site inscription process, to identify and implement key sustainable production and consumption practices that utilize local materials and heritage on a pilot basis, and to build capacity and raise awareness among the local institutions to ensure their participation in the site preservation and ecosystem management. The Marshlands area has been listed by the Government of Iraq in the national Tentative List for the World Heritage sites as a mixed natural and cultural heritage since 2003. This tentative listing of the Marshlands marks Iraq's first recognition of the importance of natural heritage for World Heritage. Recognizing the need to build experiences and capacity for natural resource and environmental management related to the World Heritage programme, the Iraqi Ministry of Environment has endorsed this project as a priority.
- UNEP also plans to undertake additional project activities on tools and methodologies for assessing and maintaining freshwater ecosystems within the Ecosystem Management Sub-Programme. Specifically, the project plans to identify and implement ESTs to enhance the delivery of water regulatory services in the Iraqi Marshlands area and beyond.

- The UNEP Iraqi Marshlands project made contributions towards biodiversity management and served as a foundation for the Government of Iraq to accede to the Convention on Biological Diversity in 2009. To commemorate the Iraqi accession, to report back on results of UNEP interventions thus far, and to take stock of ecosystem conditions and management needs, UNEP and the Government of Iraq plan to organize a symposium for the 10<sup>th</sup> Meeting of the Conference of the Parties of the Convention on Biological Diversity to be held in Nagoya, Japan in 2010.
- Within the Disasters and Conflicts Sub-programme, UNEP will implement a new project entitled “Support for the Environmental Rehabilitation of Iraq”. The project aims to support Iraq in mainstreaming the environment into the national development process through full integration into the United Nations Development Assistance Framework (UNDAF) process, which is being implemented in Iraq from 2011 to 2014. By working as part of the United Nations Country Team for Iraq, The project will develop and implement relevant priority projects such as land and water resources management, environmental governance and climate change. MEA-relevant activities will also be included in this project. This work will be led by the UNEP Regional Office for West Asia.

From its initial early warning of the demise of the Marshlands area in the early 2000s, UNEP’s interventions in the Iraqi Marshlands have provided much-needed assistance to address environmental priorities. The successful completion of this project has enabled the transition to new initiatives towards environmental mainstreaming and implementation of the longer-term sustainable management plan described above. UNEP is thus making progress in completing the circle from early warning and environmental management on-the-ground to meet immediate needs, towards the implementation of a longer-term management plan. UNEP is committed to continuing its cooperation with the Government of Iraq and its people towards sustainable development.

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## Appendix I Summary of Phase I Activities

**Project Duration:** August 2004 – December 2007

**Project Budget:** US\$11,000,000

**Funding Source:** United Nations Development Group (UNDG) Iraq Trust Fund (by the Government of Japan)

### Project Objectives:

The development goal of this project is to support the sustainable management and restoration of the Iraqi Marshlands, with the following immediate objectives:

1. To monitor and assess baseline characteristics of the Marshlands conditions, to provide objective and up-to-date information, and to disseminate tools needed for assessment and management
2. To build capacity of Iraqi decision makers and community representatives on aspects of marshland management including: policy and institutional aspects; technical subjects; and analytical tools
3. To identify EST options suited to the immediate provision of drinking water and sanitation, as well as wetland management, and to implement them on a pilot basis
4. To identify needs for additional strategy formulation and coordination for the development of a longer-term marshland management plan based on pilot results and cross-sectoral dialogue.

### Activities and Outputs:

Component 1: Support for strategy development and coordination	
Project Activity	Output
a) Establish the Project Implementation Unit (PIU) within Ministry of Environment (MOE)	<ul style="list-style-type: none"> <li>• Project Implementation Unit (PIU) was established in November 2004 and has been staffed by the National Coordinator in Iraq. Coordination and support to the project activities within Iraq has been provided by PIU including the subsequent phases of the project.</li> </ul>
b) Conduct a policy and institutional survey to assess the frameworks for marshland management, and identify stakeholders	<ul style="list-style-type: none"> <li>• Stakeholders within and outside Iraq were identified, and their roles, supported initiatives for environmental, water resources as well as socio-economic initiatives were mapped out in a matrix to be utilized for donor coordination.</li> <li>• Coordination was established and cooperation was maintained with all partners. The project established a framework for maintaining cooperation and for collaboration in marshland management activities.</li> </ul>



Component 1: Support for strategy development and coordination	
Project Activity	Output
c) Organize a roundtable meeting to discuss the state of marshland-related activities and the development of a national marshland restoration strategy involving key line ministries, community representatives, UN agencies and other key stakeholders	<ul style="list-style-type: none"> <li>The Roundtable on Iraqi Marshlands was organized in September 2004 in Amman, Jordan. The Iraqi delegation included the Minister of Environment as well as participants from the Ministry of Water Resources, Marsh Arab Forum, UN agencies, ministerial delegation from Japan and other donor countries. The report has been prepared and can be downloaded from <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=47007BD9-CD1F-4E34-B4EB-0E62F7885B58">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=47007BD9-CD1F-4E34-B4EB-0E62F7885B58">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=47007BD9-CD1F-4E34-B4EB-0E62F7885B58</a>).</li> </ul>
d) Organize a coordination meeting with Iraqi authorities and international donors to discuss the status of various initiatives and to facilitate collaboration. Participate in other coordination meetings.	<ul style="list-style-type: none"> <li>UNEP organized a donor coordination meeting in Paris, France in November 2005. Iraqi ministers of three key line ministries, namely Ministry of Environment, Ministry of Water Resources and Ministry of Municipalities and Public Works participated, along with representatives of Japanese, US, Italian and Canadian governments. Presentations, agenda and summery report are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=D896F936-DC78-4C5D-860E-A2BEB74FF0E3">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=D896F936-DC78-4C5D-860E-A2BEB74FF0E3">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=D896F936-DC78-4C5D-860E-A2BEB74FF0E3</a>).</li> <li>UNEP participated in other coordination meetings as follows: <ul style="list-style-type: none"> <li><u>Donor coordination meeting:</u> Venice, October 2004</li> <li><u>Italian coordination meeting:</u> Gerbil, February, 2006 Suleimaniya, Jul, 2006 Suleimaniya, February and April 2007</li> <li><u>Canadian coordination meeting:</u> Amman, September, 2006</li> </ul> </li> </ul>
e) Support initiatives that provide input for integration of environmental dimension into the national coordination mechanism for marshland management	<ul style="list-style-type: none"> <li>The project supported the identification of the domestic mechanism for marshland management, within the framework of the donor coordination mechanism. The mechanism was presented, discussed and agreed to during the donor coordination meetings.</li> </ul>
f) Based on project results and observations, conduct an assessment on policy and institutional strengthening for marshland management	<ul style="list-style-type: none"> <li>Institutional Capacity Assessment for Ministry of Environment was completed by UNEP Post-Conflict Assessment Branch and presented recommendations in 2005/6.</li> </ul>

<b>Component 2: Data collection and baseline analysis</b>	
<b>Project Activity</b>	<b>Output</b>
a) Provide technical support to on-going hydrological and biodiversity assessments	<ul style="list-style-type: none"> <li>• A technical meeting on data collection and analysis on water quality was organized in February 2005 and explored mechanisms for cooperation and data sharing with all stakeholders as a precursor to water quality and biodiversity assessments in the Iraqi Marshlands; Meeting summary can be downloaded from <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=95D3A1C-956B-4B4F-9A17-2B95980667BC">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=95D3A1C-956B-4B4F-9A17-2B95980667BC">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=95D3A1C-956B-4B4F-9A17-2B95980667BC</a>).</li> <li>• Water quality and biodiversity assessment was conducted in six selected sites in the Marshlands during 2005. Work was carried out through a Memorandum of Understanding concluded with Ministry of Environment. Pilot projects for drinking water provision were also carried out at the same sites where water quality and biodiversity assessments were conducted. The report was prepared and published, and can be accessed at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=78547CB6-F6BC-4C96-AF1A-32B3B6D7C549">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=78547CB6-F6BC-4C96-AF1A-32B3B6D7C549">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=78547CB6-F6BC-4C96-AF1A-32B3B6D7C549</a>).</li> </ul>
b) Provide portable water sampling equipment to PIU and partners, and carry out sampling to establish baseline data	<ul style="list-style-type: none"> <li>• Three sets of portable water quality equipment were procured by the project and provided to Ministry of Environment in 2005 to facilitate surveys in the Marshlands to collect baseline data.</li> </ul>
c) Establish Marshlands Information Network (MIN, including Arabic interface) and partner network with key institutions (Ministry of Environment, line ministries, governorates, etc.), and provide necessary equipment	<ul style="list-style-type: none"> <li>• ESTIS Builder (Environmentally Sound Technology Information System) was established with Arabic interface in January 2005, accessible from <a href="http://www.estis.net/default.asp?language=ar">ESTIS Homepage</a> (<a href="http://www.estis.net/default.asp?language=ar">http://www.estis.net/default.asp?language=ar</a>).</li> <li>• MIN server equipment were provided and installed in five locations, four in Ministry of Environment offices in Baghdad, Basrah, Missan and Thi-Qar and one in the CRIM (Centre for Restoration of the Iraqi Marshlands) / Ministry of Water Resources in Baghdad. Personnel trained during this project created web pages for these and other institutions and manage the sites. <a href="http://jp1.estis.net/communities/min_eng/">Marshlands Information Network English Homepage</a> (<a href="http://jp1.estis.net/communities/min_eng/">http://jp1.estis.net/communities/min_eng/</a>). <a href="http://jp1.estis.net/communities/MIN_Arabic/">Marshlands Information Network Arabic Homepage</a> (<a href="http://jp1.estis.net/communities/MIN_Arabic/">http://jp1.estis.net/communities/MIN_Arabic/</a>)</li> </ul>
d) Develop a satellite-based marshlands observation system to monitor and report on reflooding and ecological changes on near-real time basis	<ul style="list-style-type: none"> <li>• Iraqi Marshlands Observation System (IMOS) was developed to monitor reflooding and change in vegetation; Land cover data and vegetation maps for the period starting from January 2003 were made available for downloading from the IMOS website; Personnel trained during this project continued to maintain the system. The system can be accessed from <a href="http://imos.grid.unep.ch/">Iraqi Marshlands Observation System Homepage</a> (<a href="http://imos.grid.unep.ch/">http://imos.grid.unep.ch/</a>).</li> </ul>
e) Conduct satellite image interpretation support and provide equipment	

<b>Component 3: Capacity Building</b>	
<b>Project Activity</b>	<b>Output</b>
<p>a) Develop training materials and conduct training on: <u>Policy and institutional aspects:</u></p> <ol style="list-style-type: none"> <li>1. IWRM policy integration</li> <li>2. Wetland management</li> <li>3. Water quality management</li> <li>4. Community level initiatives</li> </ol>	<ul style="list-style-type: none"> <li>• Training kits consisting of participant's and trainer's handbooks were developed for each of the subjects in English and in Arabic; They were distributed in printed form and as CD-ROMs to Iraqi ministries and academic institutions; Training materials were made available for downloading at <u>UNEP Iraqi Marshlands Project Website</u> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=7D5C07F8-ABBA-487A-9A58-0D07B9FF9F01">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=7D5C07F8-ABBA-487A-9A58-0D07B9FF9F01</a>).</li> <li>• Over 300 Iraqi officials, researchers and community leaders have been trained on technical, policy and institutional aspects of wetland management. Training programmes were organized in cooperation and coordination with leading institutions in the region as well as Japan and Europe. Participants included officials from Ministry of Environment, Ministry of Water Resources, Ministry of Municipalities and Public Works, members of the local marshland community and academia.</li> <li>• Training was conducted as follows; <u>Policy and institutional aspects:</u> <ol style="list-style-type: none"> <li>1. IWRM policy integration: 4-9 April 2005, Amman, Jordan</li> <li>2. Wetland management: 19-26 June 2005, Cairo, Egypt</li> <li>3. Water quality management: 6-17 December 2004, Shiga, Japan</li> <li>4. Community-level initiatives: 11-16 June 2005, Alexandria, Egypt</li> </ol>           Training summary, agenda and presentations are available at <u>UNEP Iraqi Marshlands Project Website</u> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A</a>).         </li> </ul>
<p><u>Technical subjects:</u></p> <ol style="list-style-type: none"> <li>1. Drinking water provision options</li> <li>2. Sustainable sanitation management options</li> <li>3. Phytotechnology options</li> <li>4. EST assessment and implementation</li> </ol>	<p><u>Technical aspects:</u></p> <ol style="list-style-type: none"> <li>1. ESTs for Drinking water provision: 16-27 May 2005, Osaka and Shiga, Japan</li> <li>2. Sustainable sanitation: 6-17 December 2004, Osaka, Japan</li> <li>3. Phytotechnology for wetland management: 6-16 December 2004, Cairo, Egypt</li> <li>4. EST Assessment Methodology and Implementation: 1-3 December 2005, Damascus, Syria</li> </ol> Training summary, agenda and presentations are available at <u>UNEP Iraqi Marshlands Project Website</u> ( <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A</a> ).

<b>Component 3: Capacity Building</b>	
<b>Project Activity</b>	<b>Output</b>
b) Conduct study tours on: <ol style="list-style-type: none"> <li>1. Integrating capacity-building initiatives into policy and community action</li> <li>2. EST implementation examples</li> </ol>	<ul style="list-style-type: none"> <li>• A study tour was held in conjunction with the Public Symposium in Tokyo, Shiga and Osaka, Japan from 25-31 August 2005 to provide opportunities to visit and evaluate ESTs being implemented in Japan which may be applicable to the Iraqi Marshlands;</li> <li>• A high-level study tour was held in Tokyo, Shiga and Osaka, Japan in December 2006 in conjunction with the International Workshop led by the Deputy Minister of Environment. The study tour also had a joint session with a training programme organized by UNEP, with an opportunity to see another capacity-building initiative organized by JICA. Summary reports, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=8E8C558D-9305-493F-AECB-7EE28F1528B4">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=8E8C558D-9305-493F-AECB-7EE28F1528B4">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=8E8C558D-9305-493F-AECB-7EE28F1528B4</a>).</li> </ul>
c) Conduct data management and analysis training on: <ol style="list-style-type: none"> <li>1. Utilizing Marshlands Information Network</li> <li>2. Remote sensing data analysis</li> </ol>	<ul style="list-style-type: none"> <li>• Training programmes on data management and analysis were conducted as follows:               <ol style="list-style-type: none"> <li>1. Application of Remote Sensing and GIS for Marshlands Assessment and Monitoring: 6-10 February 2005, Amman, Jordan</li> <li>2. Marshlands Information Network (MIN): 27-31 March 2005, Amman, Jordan</li> </ol>               Summary report, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=1E2144B3-8186-41DE-B390-94EDF2C4E07A</a>).             </li> </ul>

Component 3: Capacity Building	
Project Activity	Output
d) Support course development for local institutions on wetland management, ESTs and community initiatives	<ul style="list-style-type: none"> <li>• The project organized six training courses inside Iraq in this Phase of the project, in cooperation with Ministry of Environment, Ministry of Water Resources and the Universities of Basrah and Thi-Qar as follows: <ul style="list-style-type: none"> <li>- Integrated Water Resource Management (IWRM): 13-19 December 2005, Thi-Qar University</li> <li>- Community Level Initiatives: 21-24 December 2005, Thi-Qar University</li> <li>- Phytotechnology for Wetland Management: 4-11 December 2005, University of Basrah</li> <li>- Water Quality Management: 27 December 2005-10 January 2006, Ministry of Water Resources</li> <li>- Marshlands Information Network: 4-8 December 2005, Ministry of Environment Baghdad</li> <li>- Marshlands Information Network: 18-22 December 2005, Ministry of Environment Thi-Qar</li> </ul> <p>Summary report, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E4ED5E6F-D056-490A-A274-5F5A8F6B856D">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E4ED5E6F-D056-490A-A274-5F5A8F6B856D">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E4ED5E6F-D056-490A-A274-5F5A8F6B856D</a>).</p> </li> <li>• Financial support as well as the training materials in Arabic and English were provided by the Project to enable successful replication of training courses inside Iraq. Persons who have participated in the project training courses held outside Iraq helped to organize and deliver lectures.</li> <li>• Establishment of this model for secondary training within Iraq was continued in the subsequent phases of the project.</li> </ul>

<b>Component 4: Pilot implementation</b>	
<b>Project Activity</b>	<b>Output</b>
a) Carry out a feasibility study to develop a portfolio of technological options for implementation	<ul style="list-style-type: none"> <li>Field assessment and preliminary design were carried out in the six sites in 2005 to study technological options identified for drinking water provision and sanitation provision.</li> </ul>
b) Organize a workshop to discuss implementation plan with stakeholders	<ul style="list-style-type: none"> <li>A technical meeting on pilot project implementation was conducted in February 2005 and reached consensus with Iraqi stakeholders on six pilot sites for implementation among the eighteen candidates sites with two duplicates proposed; Meeting summary, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A3AC3610-3981-4177-85A6-2B59FF630854">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A3AC3610-3981-4177-85A6-2B59FF630854">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A3AC3610-3981-4177-85A6-2B59FF630854</a>).</li> </ul>
c) Provide and implement pilot technologies at the local level for phytotechnology, sustainable sanitation and drinking water provision	<ul style="list-style-type: none"> <li>Drinking water provision was implemented in six villages, namely Al-Kirmashiya, Badir Al-Rumaidh, Al-Masahab, Al-Jeweber, Al-Hadam and Al-Sewelmat; Water treatment technology using packaged low-pressure reverse osmosis process was introduced in five locations and an existing compact unit using conventional sedimentation-filtration-chlorination was rehabilitated at another location, namely Badir Al-Rumaidh. Water distribution network with common taps were also installed. Water provision facilities worth of \$4.68 million have the capacity to serve up to 22,000 residents in the Marshlands. Further details can be referred at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6</a>).</li> <li>Sanitation provision was implemented in a community in Al-Chibayish serving 170 inhabitants. Constructed Wetland EST using submerged flow was introduced for wastewater treatment. Further details available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9FE1AF93-6FD0-4904-B492-A15C97B17AB5">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9FE1AF93-6FD0-4904-B492-A15C97B17AB5">UNEP%20Iraqi%20Marshlands%20Project%20Website.%20(http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9FE1AF93-6FD0-4904-B492-A15C97B17AB5)</a>).</li> <li>Wetland restoration was carried out through a Memorandum of Understanding with Centre for Restoration of Iraqi Marshlands of the Ministry of Water Resources and involved survey/investigation to select the sites, design and implementation. Restoration work was implemented at Al-Jeweber.</li> </ul>

<b>Component 4: Pilot implementation</b>	
<b>Project Activity</b>	<b>Output</b>
d) Provide training for on-site pilot implementation teams	<ul style="list-style-type: none"> <li>• Operators for drinking water provision facilities and sanitation facilities were provided with on-site training by the personnel trained abroad at the equipment manufacturer. Trained operators manned the facilities during the one-year operation management period from March 2006 to April 2007.</li> <li>• For wetland restoration, a technical workshop was held to provide training in the application of phytotechnology in Amman, June 2005. Workshop summary, agenda and presentations are available at: <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=81AD2149-FFDB-48F0-89C4-1C8DFB133CB7">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=81AD2149-FFDB-48F0-89C4-1C8DFB133CB7">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=81AD2149-FFDB-48F0-89C4-1C8DFB133CB7</a>).</li> </ul>
e) Develop an assessment and evaluation protocol for pilot implementation, and carry out pilot evaluations	<ul style="list-style-type: none"> <li>• Monitoring and evaluation of drinking water provision facilities by an independent entity was carried-out through on-site assessment during January-August 2006. The Final Report is available for downloading at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A30AC478-C721-448D-9DCA-302C13874C22">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A30AC478-C721-448D-9DCA-302C13874C22">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=A30AC478-C721-448D-9DCA-302C13874C22</a>).</li> <li>• Monitoring and evaluation of sanitation provision and wetland restoration pilot projects by an independent entity was carried out through on-site assessment during July-September 2007. The Final Report was forwarded to Iraqi ministries in January 2008.</li> <li>• Report on the Environmentally Sound Technology (EST) Assessment on the water provision and sanitation provision systems was finalized in August 2007, utilizing the EST assessment methodology (later reformulated as the Sustainability Assessment of Technologies) developed by UNEP. The Report evaluated various alternatives for the provision of water and sanitation for the area, and then carried out detailed analysis of the environmental soundness of the options actually implemented. The Report is available for downloading at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=FB801A6A-9E1F-4403-B357-F13BE9291DA6</a>).</li> </ul>

Component 4: Pilot implementation	
Project Activity	Output
f) Support operations and maintenance	<ul style="list-style-type: none"> <li>• Operations and maintenance support to drinking water provision and sanitation provision facilities were provided as follows: <ul style="list-style-type: none"> <li>- Operation and management of six drinking water provision facilities were supported for one-year period following commissioning of facilities from March 2006-April 2007 with personnel trained in the operation of facilities.</li> <li>- Operation of management of sanitation facilities after its commissioning in December 2006 was also carried-out with trained personnel; Operation and management support of sanitation provision was conducted during December 2006 and April 2007 due to change in the pilot site for implementation.</li> </ul> </li> </ul>
g) Provide support for community-level marshland management, water and sanitation initiatives	<ul style="list-style-type: none"> <li>• Community-level initiatives for marshland management were carried-out in Basrah, Thi-Qar and Missan governorates based on proposals submitted by local community NGOs, namely Marsh Arab Council in addition to the local Environment Directorates, and the Governorate Council of the three governorates:</li> <li>• <u>Basrah</u>: The Environmental Awareness Campaign for Marsh Arabs launched in Basrah consisted of ten public meetings that focused on building awareness of key environmental problems facing the Marshlands.</li> <li>• <u>Thi-Qar</u>: The Marsh Arab Council of Thi-Qar undertook the “Initiative to Raise Awareness of the Dangers of Fishing Using Poison within the Marshlands Environment”. Work was carried out in cooperation with the Ministry of Environment (Thi-Qar division).</li> <li>• <u>Missan</u>: The “Initiative to Develop an Understanding Among Marshland Residents in Missan on the Importance of the Marshlands Ecosystem” had two components, namely, an intensive five-day course for religious leaders and a training course for young people on the importance of marshland environment. Summary of community-level initiatives are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6FD1E532-D968-470A-A4D7-6BB55D15C31D">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6FD1E532-D968-470A-A4D7-6BB55D15C31D">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6FD1E532-D968-470A-A4D7-6BB55D15C31D</a>).</li> </ul>



<b>Component 5: Awareness raising and follow-up</b>	
<b>Project Activity</b>	<b>Output</b>
a) Prepare and distribute audio visual materials and other information materials	<ul style="list-style-type: none"> <li>• A five-minute video on the Iraqi Marshlands was prepared and distributed to relevant stakeholders.</li> <li>• An information brochure on the Iraqi Marshlands Project was prepared at the initial stage of the project and was distributed in print to relevant stakeholders. Materials are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9E56866A-0A4B-4005-9021-F876C504BE0E">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9E56866A-0A4B-4005-9021-F876C504BE0E">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=9E56866A-0A4B-4005-9021-F876C504BE0E</a>).</li> </ul>
b) Organize two public meetings on the state of Marshlands and responses	<ul style="list-style-type: none"> <li>• An international public symposium to report the achievements and progress of the project was held in Tokyo, August 2005; Participants included the Minister of Environment, Japan, high-level delegation from Iraq, representatives of Iranian and French embassies in Tokyo and representatives of USAID and Italian ministry of environment; A press conference was also held to achieve worldwide coverage for marshland issues. Meeting results can be obtained from <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E6083BAA-5C6D-42E2-BA04-3DE8785C9C4B">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E6083BAA-5C6D-42E2-BA04-3DE8785C9C4B">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=E6083BAA-5C6D-42E2-BA04-3DE8785C9C4B</a>).</li> <li>• Project supported a public meeting to commemorate Environment Day in Iraq in 2005 to inform the state of the Marshlands to general public in Iraq.</li> </ul>
c) Prepare general publications to raise awareness about marshland conditions and responses	<ul style="list-style-type: none"> <li>• A communication tool titled “Back to Life” was published in Arabic, English and Japanese to inform the public on the UNEP Iraqi Marshlands Project in August 2005; Printed copies were distributed and the publication was made available for downloading. This publication was updated in English, Arabic and Japanese with the progress made in the project in Phase II-B of the project in December 2006. It is downloadable from <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D</a>).</li> </ul>
d) Convene an international workshop on Iraqi Marshlands restoration	<ul style="list-style-type: none"> <li>• An International Workshop on Iraqi Marshlands management was held in Kyoto, Japan in December 2006; The Iraqi delegation, led by Deputy Minister of Environment, consisted of high-level officials from key ministries and representatives of communities and academia in southern Iraq. Further information on the workshop is available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C</a>).</li> </ul>

**Component 5: Awareness raising and follow-up**

Project Activity	Output
<p>e) Upon request, develop second phase of project for wider implementation</p>	<ul style="list-style-type: none"> <li>• Second phase of the project was developed and secured funding from the Italian government (Phase II-A) and the Japanese government (Phase II-B).</li> <li>• Phase II-A of the project was developed to support activities on strategy formulation and coordination, baseline data collection and assessment, and capacity building since its commencement in April 2006. Total budget was \$947,234. Project summary of Phase II-A can be referred at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=4EA174F3-0142-4C28-9C2F-EB56755CBBCD">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=4EA174F3-0142-4C28-9C2F-EB56755CBBCD).</li> <li>• Phase II-B of the project developed support activities on drinking water provision and water quality management, pilot implementation and community level awareness, and awareness-raising since its commencement in July 2006. Total budget was \$1 million. Project Summary of Phase II-B can be referred at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=11388C09-67A8-4F88-9DB5-8281385BA6B3">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=11388C09-67A8-4F88-9DB5-8281385BA6B3).</li> <li>• Phase III of the project received funding from the Government of Japan and commenced activities in September 2007. Project summary of Phase III can be referred at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=3BF600FF-0565-477E-8507-7DCC65ACD55F">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=3BF600FF-0565-477E-8507-7DCC65ACD55F).</li> <li>• A joint project with UNESCO to establish and implement management and conservation plan using the World Heritage commenced in March 2009 with Italian funding.</li> </ul>

# Appendix II Summary of Phase II-A Activities

**Project Duration:** February 2006 – March 2008

**Project Budget:** US\$868,178 (€17,115) – Original  
 US\$947,234 (€17,115) – Revised to reflect new exchange rate

**Funding Source:** Government of Italy

**Project Objectives:**

The overall objective of this project is to support the sustainable management and restoration of the Iraqi Marshlands, with immediate objectives as follows:

- To support data collection and analysis in water resource, environmental, and socio-economic and land planning categories, and share such information to help fill the recognized gap in data availability for marshland management
- To increase the number of Iraqi institutions with access to the platform for data and analytical tool sharing, promoting the network necessary to move towards marshland management plan development and implementation.
- To provide necessary hardware to major national and governorate-level institutions, and to strengthen capacity in data collection, management and analysis

**Activities and Outputs:**

Project Activity	Output
1. Organize kick-off and coordination meeting	<ul style="list-style-type: none"> <li>• UNEP held a kick-off and coordination meeting on 7 April 2006 to introduce the objectives of the second phase of the "Support for the Environmental Management of the Iraqi Marshlands" project, funded by the Government of Italy. The meeting also served as a platform for discussing the data gaps that need to be addressed to support environmental management of the Iraqi Marshlands. Summary, agenda and the presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=87581E52-1B7B-4675-8B4D-5E045BA97D0A">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=87581E52-1B7B-4675-8B4D-5E045BA97D0A">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=87581E52-1B7B-4675-8B4D-5E045BA97D0A</a>).</li> </ul>

Project Activity	Output
<p>2. Support data collection and assessments, to be shared on the Marshlands Information Network (MIN) platform, and convert existing data and results to be shared on the MIN</p>	<ul style="list-style-type: none"> <li>• UNEP Survey on Demographic, Social and Economic Conditions of Marshlands in Southern Iraq covered 199 marshland villages in sixteen sub-districts. Field work for the survey was conducted by Thi-Qar University. Summary of survey results are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=88D83D74-AACF-40BF-B3FF-FF7B4D0C92CF">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=88D83D74-AACF-40BF-B3FF-FF7B4D0C92CF">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=88D83D74-AACF-40BF-B3FF-FF7B4D0C92CF</a>).</li> <li>• UNEP Survey on Solid Waste management in the Southern Governorates of Iraq was conducted in nine cities and towns identified by MMPW, representing small, medium and large cities and towns in Thi-Qar, Basrah and Missan governorates. Field work for the survey was carried-out by Thi-Qar University. Summary of survey results are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=199315B6-6018-4343-BC77-DED8CCDEFA7F">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=199315B6-6018-4343-BC77-DED8CCDEFA7F">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=199315B6-6018-4343-BC77-DED8CCDEFA7F</a>).</li> <li>• The project supported data collection and assessments, and converted existing data and results relevant to marshland management by partners: <ul style="list-style-type: none"> <li>- Ministry of Environment: water quality and biodiversity data</li> <li>- Ministry of Water Resources: hydraulic and hydrological data</li> <li>- Ministry of Municipalities and Public Works: land use, demographic, other related data</li> </ul> </li> </ul>
<p>3. Carry out overall data analysis and management to ensure compatibility and comparability</p>	<ul style="list-style-type: none"> <li>• An evaluation of data sharing tools and methodologies was conducted and recommendations on how to share data, based on a three-tier data system were formulated.</li> </ul>
<p>4. Expand MIN to establish node at key Iraqi institutions and clarify the integration potential of MIN with the Italian web-GIS system.</p>	<ul style="list-style-type: none"> <li>• Project supported establishment of a MIN server at Ministry of Municipalities and Public Works with hardware and software set-up, and provision of training for the ministry personnel.</li> <li>• Modalities of integrating Italian web-GIS system were agreed upon with Italian partners, and UNEP provided necessary data and information on MIN to the Italian partners for integration.</li> </ul>

Project Activity	Output
<p>5. Organize two MIN workshops to train Iraqi partners on setting up the server, MIN operations and data management.</p>	<ul style="list-style-type: none"> <li>• Training course on “Marshlands Information Network” was held during 25-26 April 2006, Manama, Bahrain, with 15 participants. Summary, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=0A0541D3-EA66-471F-83C4-2C9231E8E271">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=0A0541D3-EA66-471F-83C4-2C9231E8E271).</li> <li>• The Project held the Advanced Marshlands Information Network Training and Technical Meeting from 27 to 30 June 2006 in Shiga, Japan. Participants from partner institutions were trained on how to set-up and operate the MIN servers. Discussions focused on how to assist the ministries to effectively analyze, present and share available data on the MIN, and developing a strategy for initial data collection efforts on basic demographic and socio-economic data, and solid waste management in the Marshlands. Summary, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=DB776A75-5866-4BC8-8D51-7E24387D788B">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=DB776A75-5866-4BC8-8D51-7E24387D788B).</li> </ul>
<p>6. Support in-country secondary MIN training</p>	<ul style="list-style-type: none"> <li>• The Project supported in-country training through an agreement with the Ministry of Environment. Three training sessions were held during 10-28 September 2006 in Basrah, Missan and Thi-Qar. Four participants from each Environmental directorate, with a total of twelve participants, were trained to manage the MIN servers in each governorate. Summary of in-country training is available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=737A8941-3C54-4878-BD81-B35E6C26D591">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=737A8941-3C54-4878-BD81-B35E6C26D591)</li> </ul>
<p>7. Organize an evaluation meeting</p>	<ul style="list-style-type: none"> <li>• The Evaluation Meeting was held on 20 April 2007 in Paris, France to assess gaps in marshland management activities filled by Phase II-A and other ongoing initiatives, and to identify additional gaps to be filled with priority action. The Iraqi delegation was headed by the Minister of Environment. Meeting summary, agenda and presentation are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=C31540C8-2EC6-4DC3-BE0F-5B97DCA80B4B">UNEP Iraqi Marshlands Project Website</a> (http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=C31540C8-2EC6-4DC3-BE0F-5B97DCA80B4B).</li> </ul>

## Appendix III Summary of Phase II-B Activities

**Project Duration:** July 2006 – June 2008

**Project Budget:** US\$1,000,000

**Funding Source:** Government of Japan

### Project Objectives:

The overall objective of this project is to support the sustainable management and restoration of the Iraqi Marshlands, with the following immediate objectives:

- To provide safe drinking water utilizing environmentally sound technologies (EST) on a pilot basis in an Iraqi community
- To build capacity of decision makers and community representatives on water quality management and safe drinking water provision
- To raise the capability and awareness of local communities, particularly women, on marshland environment and health impacts through local level initiative support

### Activities and Outputs:

Project Activity	Output
1. Implement a pilot project for drinking water provision	<ul style="list-style-type: none"> <li>• Al-Ghreej village with a population of 3,000 was selected for implementation. Field assessment and design were completed in October 2007. Procurement of reverse osmosis equipment was completed by late 2008. After the plant start-up in mid 2009, the hand-over to the Ministry of Municipalities and Public Works was completed.</li> </ul>
2. Organize a training course to training Iraqi partners on drinking water and sanitation provision through ESTs and marshland management	<ul style="list-style-type: none"> <li>• Training course on Drinking Water Provision with Environmentally Sound Technologies (ESTs) and Water Quality Management of the Iraqi Marshlands was held 6-15 December 2007 in Shiga, Japan. Summary report, agenda and presentation are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=355DAE61-82C5-44E5-A95C-45F1E91B8D70">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=355DAE61-82C5-44E5-A95C-45F1E91B8D70">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=355DAE61-82C5-44E5-A95C-45F1E91B8D70</a>).</li> </ul>
3. Organize an international workshop on Iraqi Marshland Management	<ul style="list-style-type: none"> <li>• UNEP organized “International Workshop on Sustainable Management of the Iraqi Marshlands” on 8 December 2006 in Kyoto, Japan. A high-level Iraqi delegation, headed by the Deputy Minister of Environment participated in this workshop. Workshop was also attended by senior level officials from the Government of Japan and representatives from the Government of Italy, the US Embassy, UNDP, UN-HABITAT, United Nations Information Centre (UNIC) in Japan and various other institutions. Summary report, agenda and presentation are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=59DC3B53-C398-4E29-9D94-9D5341B84D0C</a>).</li> </ul>

Project Activity	Output
4. Support in-country secondary training	<ul style="list-style-type: none"> <li>Pre-training was conducted from 29-31 October 2006 at the Marshes Research Centre of Thi-Qar University. Among the 24 participants attended this pre-training, nine were selected to participate in additional in-depth training in Japan conducted in this project phase.</li> </ul>
5. Support local community initiatives, focusing on women, marsh environment and health impacts	<ul style="list-style-type: none"> <li>Environmental awareness campaign focusing on women was conducted in fifteen villages in Basrah, Missan and Thi-Qar governorates, to provide practical guidance and demonstrations to help protect the marsh environment and clarify health impacts. The participating women were provided with practical kits, and were visited again 1 month later to see how they were utilizing the knowledge and kits provided. Summary of activities is available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=56372FCF-05A0-4059-B788-7C90656A6D3E">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=56372FCF-05A0-4059-B788-7C90656A6D3E">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=56372FCF-05A0-4059-B788-7C90656A6D3E</a>).</li> </ul>
6. Update awareness-raising materials	<ul style="list-style-type: none"> <li>The booklet titled "Back to Life" originally published in 2005 has been revised to include the latest information and results from the project. The revised booklet in Arabic, English and Japanese languages is available as an electronic copy for free downloading, and has been distributed as hardcopies to Iraqi stakeholders. The booklets in three languages are downloadable from <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=57249294-CB30-49E0-98ED-D489469AA93D</a>).</li> </ul>

## Appendix IV Summary of Phase III Activities

**Project Duration:** September 2007 – December 2009

**Project Budget:** US\$900,000

**Funding Source:** Government of Japan

### Project Objectives:

The overall objective of this project is to support the sustainable management and restoration of the Iraqi Marshlands in order to improve the ecosystem and sustainable livelihood, with the following immediate objectives:

- To investigate the potential for alternative energy sources in the pilot provision of safe drinking water utilizing environmentally sound technologies (ESTs) in an Iraqi community
- To improve water quality and wetland conditions by utilizing ESTs on a pilot basis
- To raise the capability and awareness of decision makers and local communities about marshland management by supporting targeted training and local level initiatives

### Activities and Outputs:

Project Activity	Output
1. Implement a pilot project for alternative energy utilization for drinking water provision	<ul style="list-style-type: none"> <li>• Pilot project for photovoltaic energy augmentation for water treatment was carried out at the Al Ghreej pilot site. The PV system with a peak capacity of 3kWp was installed to augment generator power supply. The system was handed over to the Ministry of Municipalities and Public Works in 2009.</li> <li>• Pilot project for solar stills at household level was carried out in nine rural households, with the Ministry of Environment. The first set of equipment delivered in 2008 had manufacturing defects and did not meet the procurement Terms of Reference. They were replaced with commercially manufactured devices.</li> </ul>
2. Implement a pilot project for water quality/wetland improvement	<ul style="list-style-type: none"> <li>• Auda Marsh was selected as pilot site to assess the performance of natural wetland system management with Main Drain water, and preliminary surveys have been completed. Field work was carried out under agreement with the Ministry of Environment. The pilot system showed reduction in concentrations of some pollutants, with inconsistencies. Analysis also indicated that water quality improvement of the Main Drain flow itself is needed before it could be used as a reliable source for marshland reflooding.</li> </ul>



Project Activity	Output
3. Organize a training course to train Iraqi partners on wetland restoration and solid waste management	<ul style="list-style-type: none"> <li>The training course on “Sustainable Management of the Iraqi Marshlands” was organized from 7-15 April 2008 in Damascus, Syria with 11 participants. As the final training course, it provided comprehensive overviews on how to strengthen Iraqi ownership and coordination for the longer-term sustainability of the Iraqi Marshlands’ management, also featuring lectures on MEAs. Training summary, agenda and presentations are available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6E0DC858-7BA2-4449-AA11-F65E5927F517">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6E0DC858-7BA2-4449-AA11-F65E5927F517">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=6E0DC858-7BA2-4449-AA11-F65E5927F517</a>).</li> </ul>
4. Support local community initiatives on marshland management	<ul style="list-style-type: none"> <li>Activities were launched in April 2008 in nine communities in Basrah, Missan and Thi-Qar governorates, targeting women in rural villages that have not yet received any support from UNEP. Workshops and follow-up visits were conducted with female trainers in all communities. The 400 participants were provided with practical demonstrations of marshland management and health linkages, and received basic kits. Summary of the community initiatives is available at <a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=466437E3-4307-40E7-854C-42F0707B99FD">UNEP Iraqi Marshlands Project Website</a> (<a href="http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=466437E3-4307-40E7-854C-42F0707B99FD">http://marshlands.unep.or.jp/default.asp?site=marshlands&amp;page_id=466437E3-4307-40E7-854C-42F0707B99FD</a>)</li> </ul>
5. Conduct monitoring of pilot activities and disseminate results	<ul style="list-style-type: none"> <li>Monitoring of water quality and biodiversity was conducted at three Phase I pilot sites (Badir Al-Rumaidh, Al-Hadam and Al-Masahab) under an agreement with Ministry of Environment. Higher concentrations of TDS and nutrient loading were reported compared to 2005 results, possibly impacted by the drought. Species richness and biodiversity increased for phytoplankton, zooplankton and macrobenthos compared to 2005 results.</li> </ul>
6. Organize a project evaluation meeting	<ul style="list-style-type: none"> <li>The project evaluation meeting was held on 3 September 2008 with attendance of the Minister of Environment. The project was evaluated positively by both Iraqi and donor representatives. Additional priority areas were identified, and support for follow-up initiative to establish management framework under the World Heritage inscription process received pledge of support from the Government of Italy. Summary of the evaluation meeting is available at <a href="http://www.estis.net/sites/marshlands/default.asp?site=marshlands&amp;page_id=BA3091A5-4D8A-46C1-8E8D-5691A2275877#">UNEP Iraqi Marshlands Project Website</a> (<a href="http://www.estis.net/sites/marshlands/default.asp?site=marshlands&amp;page_id=BA3091A5-4D8A-46C1-8E8D-5691A2275877#">http://www.estis.net/sites/marshlands/default.asp?site=marshlands&amp;page_id=BA3091A5-4D8A-46C1-8E8D-5691A2275877#</a>)</li> </ul>

## Appendix V List of Capacity Building Activities

### Training Courses

#### Phase I

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution							Gender Distribution	
				MOE	MOWR	MMPW	University	Southern Governorate	NGO	National Coordinator	Female	Male
1	Sustainable Sanitation (6-17 Dec 04, Osaka, Japan)	GEC	27	15	-	10	2	-	-	-	9	18
2	Water Quality Management (6-17 Dec 04, Shiga, Japan)	ILEC	28	15	5	5	2	-	-	1	10	18
3	Phytotechnology for Wetland Management (6-16 Dec 04, Cairo, Egypt)	Cairo Univ.	27	16	3	6	1	-	-	1	7	20
4	Wetland Remote Sensing (6-10 Feb 05, Amman, Jordan)	UNEP-PCDMB, UNEP-DEPI, ITC & RJGC	21	9	11	-	-	-	-	1	2	19
5	Marshlands Information Network (MIN) (27-31 Mar 05, Amman, Jordan)	-	29	14	7	4	1	-	2	1	8	21
6	Integrated Water Resources Management (IWRMPolicy Integration (4-9 Apr 05, Amman, Jordan)	AUB	30	12	10	5	-	-	2	1	7	23
7	ESTs for Drinking Water Provision (16-27 May 05, Osaka & Shiga, Japan)	GEC	30	15	4	7	1	2	-	1	5	25
8	Community Level Initiatives (11-16 Jun 05, Alexandria, Egypt)	UNEP-ROWA & CEDARE	20	3	3	1	-	8	4	1	1	19
9	Wetland Management (19-26 Jun 05, Cairo, Egypt)	Cairo Univ., RAMSAR Convention, Wetlands International & the International Agricultural Centre	29	14	7	3	2	1	1	1	4	25
10	EST Assessment Methodology and Implementation (1-3 Dec 05, Damascus, Syria)	UNEP-ROWA & ACSAD	29	11	6	7	2	2	-	1	5	24
Total			270	124	56	48	11	13	9	9	58	212

### Phase II-A

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution							Gender Distribution	
				MOE	MOWR	MMPW	University	Southern Governorate	NGO	National Coordinator	Female	Male
1	Marshlands Information Network (MIN) (25-26 Apr 06, Manama, Bahrain)	-	15	4	3	3	2	-	2	1	7	8
2	Advanced Marshlands Information Network (MIN) – Training and Technical meeting (27-30 Jun 06, Shiga, Japan)	-	8	2	2	3	-	-	-	1	4	4
Total			23	6	5	6	2	-	2	2	11	12

### Phase II-B

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution							Gender Distribution	
				MOE	MOWR	MMPW	University	Southern Governorate	NGO	National Coordinator	Female	Male
1	Drinking Water Provision with ESTs and Water Quality Management in the Iraqi Marshlands (6-15 Dec 06, Shiga, Japan)	GEC	9	3	2	3	-	-	-	1	1	8
Total			9	3	2	3	-	-	-	1	1	8

### Phase III

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution							Gender Distribution	
				MOE	MOWR	MMPW	University	Southern Governorate	NGO	National Coordinator	Female	Male
1	Sustainable Management of the Iraqi Marshlands (7-15 Apr 08, Damascus, Syria)	UNEP-ROWA & ACSAD	12	4	3	3	-	-	1	1	3	9
Total			12	4	3	3	-	-	1	1	3	9

## Secondary Training

### Phase I

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution							Gender Distribution	
				MOE	MOWR	MMPW	University	Southern Governorate	Local Government	NGO	Female	Male
1	Integrated Water Resource Management (IWRM) (13-19 Nov 05, Thi-Qar, Iraq)	Thi-Qar Univ.	14	3	3	1	5	-	-	2	5	9
2	Community Level Initiatives (21-24 Nov 05, Thi-Qar, Iraq)	Thi-Qar Univ.	12	1	-	-	2	1	1	7	2	10
3	Phytotechnology for Wetland Management	Basrah Univ.	20	3	1	4	10	-	-	2	8	12
4	Water Quality Management (27 Dec 05 – 10 Jan 06, Basrah, Iraq)	MOWR	20	-	20	-	-	-	-	-	10	10
5	Marshlands Information Network (MIN) 1 (4-8 Dec 05, Baghdad, Iraq)	MOE	14	12	2	-	-	-	-	-	5	9
6	Marshlands Information Network (MIN) 2 (18-22 Dec 05, Thi-Qar, Iraq)	MOE	25	14	3	2	2	-	-	4	3	22
Total			105	33	29	7	19	1	1	15	33	72

### Phase II-A

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution					Gender Distribution	
				MOE	MOWR	MMPW	University	NGO	Female	Male
1	Marshlands Information Network (MIN) 1 (10-14 Sep 06, Thi-Qar, Iraq)	MOE	4	4	-	-	-	-	4	-
2	Marshland sInformation Network (MIN) 2 (24-28 Sep 06, Missan, Iraq)	MOE	4	4	-	-	-	-	4	-
3	Marshlands Information Network (MIN) 3 (17-21 Sep 06, Basrah, Iraq)	MOE	4	4	-	-	-	-	2	2
Total			12	12	-	-	-	-	10	2

### Phase II-B

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution					Gender Distribution	
				MOE	MOWR	MMPW	University	NGO	Female	Male
1	Drinking Water Provision with ESTs and Water Quality Management in the Iraqi Marshlands (30 Oct – 3 Nov 06, Thi-Qar, Iraq)	Thi-Qar Univ.	24	7	6	7	2	2	1	23
Total			24	7	6	7	2	2	1	23

## Study Tours (Phase I)

No.	Training Course	Supporting Organisation	Total No.	Organisational Distribution										Gender Distribution	
				MOE	MOWR	MMPW	MOPDC	State Ministry for Marshlands	University	Southern Governorate	Parliament	NGO	National Coordinator	Female	Male
1	High-level Study Tour (27-30 Aug 05, Tokyo, Osaka and Shiga, Japan)	GEC	12	1	2	-			1	3	2	2	1	2	10
2	High-level Study Tour (4-9 December 2006, Tokyo, Osaka and Shiga, Japan)	ILEC	10	1	1	-	1	1	2	4	-	-	-	-	10
Total			22	2	3	-	1	1	3	7	2	2	1	2	20

## Community Level Initiatives

Training Course	Supporting Organisation	Total No.	Governorates			Gender Distribution	
			Basrah	Missan	Thi-Qar	Female	Male
<b>Phase I</b>							
Public Meeting on Environmental Awareness Programme	Basrah Governorate Council	1,035	Approx. 300	-	-	N/A	N/A
	Thi-Qar Governorate Council		-	-	160	N/A	N/A
	Missan Governorate Council		-	575	-	N/A	N/A
<b>Phase II-B</b>							
Environmental Awareness Programme for Women in the Marshlands (June-July 2007, 4-5 day training per community)	Univ. of Basrah	712	281	-	-	281	-
	WEO		-	220	211	431	-
<b>Phase III</b>							
Environmental Awareness Programme for Women in the Marshlands (June-August 2008, 4-5 day training per community)	WEO	400	133	134	133	400	-
Total		2,147	414	354	344	1,112	-

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## **About the UNEP Division of Technology, Industry and Economics**

The UNEP Division of Technology, Industry and Economics (DTIE) helps governments, local authorities and decision-makers in business and industry to develop and implement policies and practices focusing on sustainable development.

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- > sustainable consumption and production,
- > the efficient use of renewable energy,
- > adequate management of chemicals,
- > the integration of environmental costs in development policies.

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*This publication is a completion report for “UNEP Support for Environmental Management of the Iraqi Marshlands” project, which was one of the largest environmental projects conducted within the framework of the United Nations Development Group (UNDG) Iraq Trust Fund. The publication presents the background of the project, project activities, and major outputs and results. It also makes recommendations on additional initiatives to improve the environmental conditions for the Marshlands area as well as for the country.*

*Through this project, UNEP supported sustainable management and rehabilitation of the Iraqi Marshlands in the post-conflict and reconstruction period of 2004 to 2009, by monitoring environmental conditions, raising capacity of Iraqi decision makers, and providing drinking water, sanitation, and wetland management options on a pilot basis through the applications of Environmentally Sound Technologies (ESTs). Based on the success of this project, UNEP’s initiatives in this area are now transitioning to focus on more longer-term management programming.*

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